

No. 4 / 2014

# Mekong Institute

Research Working Paper Series 2014



## Maize Production and Marketing in Leuk Daek District, Kandal Province, Cambodia

Dorl Pheakdey



**Mekong Institute**  
Research Working Paper Series 2014

**Maize Production and Marketing  
in Leuk Daek District, Kandal Province,  
Cambodia**

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December, 2014

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This publication of Working Paper Series is part of the Mekong Institute – New Zealand Ambassador’s Scholarship (MINZAS) program. The project and the papers published under this series are part of a capacity-building program to enhance the research skills of young researchers in the GMS countries.

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# Table of Contents

<b>List of Abbreviations</b>	<b>v</b>
<b>List of Figures</b>	<b>vii</b>
<b>List of Tables</b>	<b>viii</b>
<b>Acknowledgements</b>	<b>ix</b>
<b>Abstract</b>	<b>x</b>
<b>1. Introduction</b>	<b>1</b>
1.1. Overview	1
1.2. Research Rationale	4
1.3. Objectives of Study	4
1.4. Research Questions	5
1.5. Scope and Limitation	5
<b>2. Literature Review</b>	<b>5</b>
2.1. Agricultural Sector of Study Area	5
2.2. Maize Production in Cambodia	7
2.3. Definition and Concepts of Value Chain	7
2.4. Systemic View of Value Chain	8
2.5. Value Chain Analysis	9
<b>3. Research Methodology</b>	<b>10</b>
3.1. Conceptual Frameworks	10
3.2. Site Selection	11
3.3. Sampling Method	12
3.4. Data Collection	14

3.5. Research Tools	15
3.6. Data Analysis	16
3.7. Research Design	16
<b>4. Results and Discussion</b>	<b>17</b>
4.1. Overview of Study Area	17
4.2. Maize Cropping System	20
4.3. Mapping of Maize	28
4.4. Constrains of Each Actor	43
<b>5. Conclusions and Recommendation</b>	<b>44</b>
5.1. Conclusions	44
5.2. Recommendations	45
<b>References</b>	<b>47</b>
<b>About MINZAS</b>	<b>50</b>
<b>The Mekong Institute</b>	<b>51</b>

## List of Abbreviations

ADB	:	Asian Development Bank
AEC	:	Asian Economic Community
CARDI	:	Cambodia Australia Research Development Institute
CDRI	:	Cambodia Development Research Institute
CLMV	:	Cambodia, Lao PDR, Myanmar and Vietnam
CO	:	Certificate of Origin
DAP	:	Di-Ammonium Phosphate
DOAKP	:	Department of Agriculture, Kandal Province, Cambodia
FAO	:	Food and Agriculture Organization of the United Nations
FGD	:	Focus Group Discussion
GAP	:	Good Agricultural Practices
GDA	:	General Directorate of Agriculture
GDP	:	Gross Domestic Product
GIZ	:	Deutsche Gesellschaft für Internationale Zusammenarbeit, Germany
GMS	:	Greater Mekong Sub-region
GO	:	Gross Output
GVA	:	Gross Value Added
Ha	:	Hectare
IDE	:	Integrated Development Environment
JICA	:	Japan International Cooperation Agency
KII	:	Key Informant Interview
MAFF	:	Ministry of Agriculture, Forestry and Fisheries, Cambodia

MI	:	Mekong Institute
MOC	:	Ministry of Commerce, Cambodia
NGO	:	Non-Government Organization
OPV	:	Open Pollinate Variety
PADEE	:	Project for Agriculture Development Economic and Empowerment
PDA	:	Provincial Department of Agriculture
PDOP	:	Provincial Department of Planning
RFA	:	Radio Free Asia
RUA	:	Royal University of Agriculture
SNV	:	Netherlands Development Organization
USD	:	United States Dollar

## List of Figures

Figure 1:	Maize Production Volume and Harvested Areas in Cambodia 2008-2012	3
Figure 2:	The Value Chain System (Adapted from USAID, 2006 cited in (Rounder D, 2007))	9
Figure 3:	Conceptual Framework	11
Figure 4:	Map of the Study Area	12
Figure 5:	Research Design	17
Figure 6:	Percentage of Cultivated Area of Annual Crop of Leuk Daek District, 2013	19
Figure 7:	Property Size Distribution of Landholders by Villages	20
Figure 8:	Distribution of Number of Growing Times by Villages	20
Figure 9:	Distribution of Planting Techniques by Villages (%)	21
Figure 10:	Source of Seed Used by Farmer in the Area	23
Figure 11:	Chemical Types and Effect on Maize	24
Figure 12:	Harvesting and Husk Remove	26
Figure 13:	Drying and Collecting	26
Figure 14:	The Core of Actor Involved	29
Figure 15:	Source of Credit Access for Maize	30
Figure 16:	The Models of Maize Thresher Machine	32
Figure 17:	The Process of Maize Supply to Factory	38
Figure 18:	Maize Volume Flow	40



## List of Tables

Table 1:	Agricultural Land Access in Kandal, 2004	6
Table 2:	Sample Size of Respondents	13
Table 3:	Sampling by Villages	14
Table 4:	Maize Cultivated Area in 11 Districts in Kandal Province, 2013-2014	17
Table 5:	Type of Main Job of People in Kandal Province	19
Table 6:	Share of Production Costs and Profit per Hectare	28
Table 7:	Cost and Benefit for Collector	35
Table 8:	CP Supplier Calendar a Year	37
Table 9:	Expend and Cross Income of Actors in kg of Maize	41
Table 10:	The Relationship and Linkage between the Actors	41
Table 11:	The Problem Faced in difference Actor	43

## Acknowledgements

First of all, I would like to thank you all the lecturers and staff of the Royal University of Agriculture (RUA), Cambodia, particularly the Graduate School, who taught and facilitated us to complete master class with their knowledge and experiences.

Secondly, I also wish to deeply thank Director of Mekong Institute and Former New Zealand Ambassador to Thailand, H.E Tony Lynch, who provided us the opportunity to participate in the MINZAS scholarship program.

Thirdly, I am deeply grateful to Associate Dr. Huon Thavrak (Dean of Graduate School of RUA), Ms. Jutamas Thongcharoen (Associate Program Manager of Mekong Institute), Dr. Kong Krisna (Dean of Faculty of Animal Science and Veterinary Medicine), Mr. Chay Kongkruy (Vice Dean of Faculty of Agro Industry of RUA), Mr. Tal Makara and Mr. Thorng Ra, all of whom have kindly devoted their time to me and provided me with constructive advice and comments on my research.

Fourthly, I would like to express my gratitude and sincere thanks to all MI staff, who facilitated us during the program period.

Finally, I deeply thank Director and staff of Provincial Department of Agriculture and Commerce of Kandal Province and staff, local authorities and all respondents, who coordinated, cooperated and spent their valuable time with me during my research period.

## Abstract

The research finding describes the existing maize cropping system in Leuk Daek District of Kandal Province, Cambodia. In-depth interviews were conducted with key actors: maize farmers, maize collectors and processors. It is an information mapping flow showing the maize management system. Also, constraints and problems facing maize production and its marketing were analyzed to find out its marketing system. In order to reach the goal, some research tools were employed namely in-depth interview, focus group discussion (FGD), key informant interview and cost and return analysis. In total, 110 samples including, 5 government agencies, 5 input supplies, 3 collectors, 1 processor and 96 maize farmers, were selected for interview base on the Yamane Taro function and purposive sampling in difference actors along the chain.

The finding shown that, there were many actors involved in the maize value chain, including downstream input suppliers as well as upstream collectors and processors. Leuk Daek district contributed nearly 39% of cultivated area out of Kandal province. Maize farmers tend to practice mono cropping of maize production. Only 29% of maize farmers conducted mixed crop and crop rotation practice with mungbean, sesame and rice with the water source from digging wells and Mekong River.

Farmers relied mainly on chemical shops in terms of input supplies. Seeds and chemical pesticides were directly recommended by chemical shop dealer seasonally. Approximately 80% of the farmers received information on application of pesticides and varieties of maize from the chemical shop dealer while 8% get such services from agricultural company and 12% get these from fellow farmers and provincial and district agriculture extension..

On average, maize cultivation land is 1.50 ha in dry season, but it decreases to 1.37 ha in the rainy season. Farmers can access credits for their maize cultivation from banks, micro finance institutions, chemical shops (in term of inputs), and others institutions with the percentages of 18%, 11%, 67% and 4% respectively. Most of the high income farmers access credits from the banks or micro finance institutions while the lower income farmers generally rely on chemical shops.

Farmers sell maize directly to middlemen, where payment will be done within 3-7 days later. The maize collector distributes 80% of the maize to Vietnam and 20% of which to domestic factories. The price of maize is set by the collectors with a net profit of 50% if they sell the grain to the domestic factory, CP Cambodia, and which accepts only the good quality product that meet their requirements. The lower quality will be export to Vietnam with lower price. Farmers can get a profit of approximately 294 Riels (0.074 USD) per kilogram of maize while collectors would earn 41 Riels (0.010 USD) per kilogram.

Furthermore, some challenges were attended in the production stage. They are issues related to seed quality, high prices of inputs in-kind loan with chemical shop, corn borer outbreaks, flooding, fluctuation of maize prices in the market, lack of marketing information access and the limitation of government and extension service provision.

In order to solve such challenges, some recommendations would be appeared. The effective group should be established to manage the market system and reduce cost of inputs. Also the government agency services should be improved and extended into the village levels. The services of micro providers should be improved for easier access with lower interest rate.



## **1. Introduction**

### **1.1. Overview**

Cambodia is a developing country, which depends heavily on agricultural sector. This sector continues to be the foundation of the economy. Agriculture represented 45 to 50 percent of Cambodia GDP in 1994 (ADB, 2005), and its share went down to 27.5 percent of the GDP in 2012 (MAFF, 2012). An average growth in this sector was around 4.5 percent per annum over 1998-2012 (Guimbart, 2010, MAFF, 2012). Agriculture absorbed approximately 56 percent of the total employed labor force in 2007 (World Bank, 2009). Although the sector share of the labor force dropped remarkably from 2001 to 2007, from 70 percent to 56 percent, the total population involved in this sector did not change over the same period (Suchat et al., 2013). At the same time, the workforce in industry and services increased remarkably, from 10.2 percent to 15.4 percent in industry sector and 19.5 percent to 28.7 percent in service sector (CDRI, 2011).

Maize crop is led by paddy rice and cassava in terms of cultivation area. Paddy rice alone contributes to around 50 percent of the national agricultural output. Fisheries, including freshwater, aquaculture and marine, account for approximately 25.4 percent, while livestock and poultry contribute to about 14.1 percent of the total national agricultural output (MAFF, 2012). Forestry and logging accounted for around 8 percent of total agricultural output in 2012 (FAO and CDRI, 2012). Maize is the third largest crop cultivated in Cambodia by volume after rice and cassava. This crop has become an important agricultural commodity since the country's opening to the market economy system. Over the past five years, maize cultivation and production has rapidly increased, with harvested area expanding from 163,106 ha in 2008 to 215,442 ha in 2012, while production has increased from 161,865 tons to 950,909 tons in the same period (FAOSTAT, 2014 and MAFF, 2012) (Figure 1). With limited processing facilities in Cambodia, the vast majority of production is exported to Thailand and Vietnam, mostly through informal channels. Maize cultivated area is located in the northwest and northeast provinces of Cambodia, including the banks of Mekong River and Tonle Sap Lake. Battambang's maize cultivated area represents more than 61% of the total maize cultivated area in Cambodia followed by, Battambang, Pailin, Kampong Cham and Kandal Provinces. The average maize yield per hectare is 5.4 tons/ ha in Battambang which is higher compared to the national average yields of 4.3 tons/ha (FAOSTAT, 2013).

The geographical trading advantage of Battambang and Pailin in comparison to other provinces is due to strong influences from Thailand and its Thai organized contract farming of Cambodian farmers (Jan-Peter Mund, 2011).

In the last decade, maize was identified as the major crop to generate small farm household's income and as the main agricultural commodity for exports (MAFF, 2012). Research by Setboonsang (2008) found that small farmers in developing countries have typically limited access to financial resources, knowledge, and market information. They cannot compete for higher profits due to imperfect market information, poor infrastructure, and poor facility in linking their products to market channels (Setboonsang et al., 2008). In order to promote the rapid growth of local economic and integrate economies of Cambodia, Lao PDR, Myanmar and Vietnam (CLMV) into the AEC, Mekong Institute (MI) conducted value chain studies of selected agricultural commodities in twin provinces along the GMS economic corridors. The results showed that, the major constraints of agriculture commodities are low intensive agricultural practices at the production stage as well as lack of technical knowledge in fields of post-harvest management. Other contributing factors generating unbalance economic growth in the GMS include (i) the lack of production clusters and cross-border networks, (ii) limited absorptive capacity of information access in study area, and (iii) the need for adjustment of agricultural policies and practices to a larger and more competitive regional economy and the world economy (Aung Myo Thant, 2013).

Cambodia is also facing the same problems. In recent years, the market price of maize product is fluctuated due to the unstable markets of maize products and many significant constraints along the maize value chain. For instance, in August 2012, the cob maize price in the North-West of Cambodia was 500 Riels/kg and decreased to 400 Riels/kg in August 2013, due to the reducing number of traders involved in this sector. This unstable price makes maize smallholder farmers suffer from debt of the bank since smallholder farmers usually get loan from the bank for their maize cultivation (RFA radio, 12 August, 2013). According to the report conducted by Kandal Provincial Department of Agriculture indicated that the price of maize has remarkably decreased in September 2013, a price fall from 1050-12,00 Riel/kg to 740-760 Riels/kg in the same season of 2012. Moreover, the majority of small farmers in Leuk Daek District have limited access to market information. Farmers normally make distress sales of their crops immediately after the harvest, since they need to repay their loans,

pay for their daily living expenses and meet other financial obligations, particularly field operation costs for the next crop after the harvest. As a result, farmers are often obliged to sell their crops immediately after the harvest despite low prices offered by traders. This demonstrates that almost 100% of the total market volume is sold during the first three months after the harvest in both early and late seasons to avoid risks of pest infestations, disease and quality deterioration of their crops from inappropriate post-harvest handling techniques and the lack of facilities. Furthermore, in cross border trade with Vietnam, there is significance constraints in terms of transportation and cross-border check point procedures (World Bank, 2002).

Thus, the potential development of agricultural value chains in provinces along the borders, especially in light of increasing cross-border trade with Vietnam, is substantial and promising, both from the supply and demand perspectives. By engaging all actors, especially small farmers in an improved value chain, it is expected that this would contribute to increased income, employment and poverty reduction as well as to achieving food security at the household level. Therefore, the proposed research presented here provides a background on assessment of the maize value chain and the existing maize cropping system in Kandal Province, and issues/constraints faced by different value chain actors along the chain. The research also provides potential recommendation, which would be helpful to the maize value chain by increasing benefit for all stakeholders and greatly contributing to for poverty alleviation.

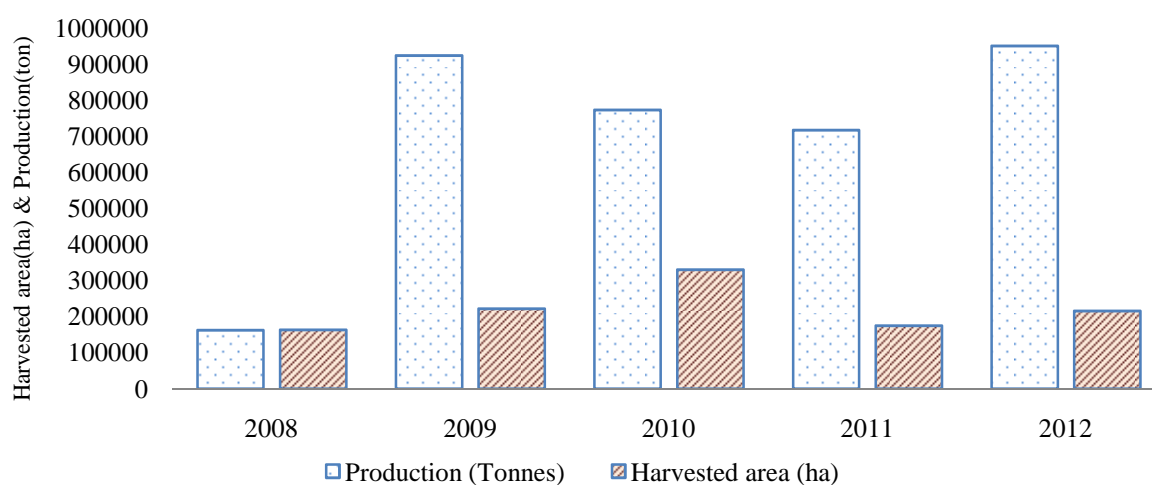


Figure 1: Maize Production Volume and Harvested Areas in Cambodia 2008-2012

Source: FAOSTAT, 2014



## **1.2. Research Rationale**

Maize culture is a major source of income and sustenance for most of small household farmers in Cambodia (Belfield, S., & Brown, C. (2010). Various maize actors are not aware of the importance of understanding the value chain of maize and how each actor can benefit from an improved chain. Farmers in Leuk Daek District of Kandal Province sell their maize at low prices without knowing the market information. In addition, price of maize are always low in the harvest season. It can be seen the disadvantage when some farmers sell their maize in wet form (sell immediately soon after harvesting) to the local and Vietnamese collectors in order to get money and pay for loan. Given this, the farmers are forcedly to receive unsatisfied price. A study conducted by Dawit (2005) explained that the flow of agricultural production from producers to consumers in Ethiopia involved a long chain of intermediaries without creating value-added; merely keep on stretching the chain. Also, the education of farmers is so limited that cannot manage the circulation of products. Other constraints are related to maize production and it's marketing mainly farmers limited knowledge of market information, excessive intermediaries, price seasonality and limited number of buyers. In spite of the significance of maize in the livelihood of many farmers and income generating in the area, maize has not been given due attention it deserves. However, maize value chain and its characteristics have not yet been studies in this location. Hence this study reveals such a severe condition taking place. This study will find out the issues and constraints along the chains and offer some recommendations to improve maize value chain especially for the maize farmers. As a result, it will contribute to improve cross border trade between Kandal Province of Cambodia and An Giang Province of Vietnam. Moreover, this research result will be a model used by policy makers, scholars or researchers are who interested in the maize production in Cambodia. The alternative recommendations will improve the maize productions in the area particularly for farmers.

## **1.3. Objectives of Study**

The overall objective of this research is to analyze maize value chain and describe the maize exiting cropping system in Leuk Daek District of Kandal Province of Cambodia. The specified objectives are (1) to describe the existing maize cropping system in Leuk Daek District of Kandal Province, (2) to map the maize value chain in Leuk Daek District of

Kandal Province - and (3) to identify the constraints of maize production and its marketing chain of maize in the above-mentioned geographical location.

#### **1.4. Research Questions**

The research questions of the study are:

1. What are the maize cropping systems in Leuk Daek District?
2. What are the main activities in the maize value chain in the area? Who are actors involved in these activities? What are their roles?
3. What are the flow of products, information and knowledge in maize value chain? What are the flow of product volumes and number of actors involved?
4. What type of relationship and linkage exist among the various chain actors? What types of business service are feeding into chain, regulation and policy framework in which sector is operating?
5. What are the key constraints and difficulties faced by value chain actors at different stages of the chain?

#### **1.5. Scope and Limitation**

The research conducted in Khpob Ateav and Peam Reang communes of Leuk Daek District, Kandal Province. The study is focused on the mapping of value chain actors such as input suppliers, maize producers, collectors, and processors. It also describes the maize cropping system in the area. The study conducted from April to May 2014. However, Vietnamese collectors and exporters were not included in this study because of time limitation.

Moreover, the research aims to map the maize value chain and identify the issues faced by different actors in Leuk Daek District in order to improve the maize value chain in the area especially for the farmers.

## **2. Literature Review**

### **2.1. Agricultural Sector of Study Area**

Kandal Province is a major agricultural producer in Cambodia, home to many horticulture and aquaculture businesses. Kandal is well suited to agriculture. Over 78% of population

engaged in agricultural sector as their main job (Department of Planning, 2011). Moreover, agriculture land is divided into two areas. One is located in West of the province. There are three districts namely Kandal Stueng, Pon Nhea Loeu and Ang Snul, all of which are mostly suitable for rice cultivation, and depend mainly on the rain. The other one is in the Eastern part of the province. It consists of 8 districts namely Saang, Koh Thom, Leuk Daek, Kein Svay, Lvea Am, Khsach Kandal, Muk Kompul and Takhmao. In this Eastern part, most of farmers cultivate rice in dry season, corn, bean, sweet potato, and various kinds of vegetables. They are also engaged in fishery. Farmers living in Western part of the province have low income compared to the farmers who live in the East (Department of Planning, 2011).

The province has 140,797 hectares devoted to agricultural production, approximately 101,500 hectares of which is for rice production, with yields above the national rice average. The main other crops are maize, sugarcane, soybean, and many varieties of vegetables and fruits (USAID, 2008). In 2010-2011, there were 24,337 ha of land used for the cultivation of some main crops. Out of this, maize cultivated area had 9,797 ha of the agriculture land area.

In 2004, about 17% of rural households in Kandal Province were landless and did not produce their own staple food crops. A further 66% possessed less than 1.0 hectare of land (World Food Programme, 2014). These small farming households will typically only produce enough food from crop agriculture to partially meet their staple food needs.

Table 1: Agricultural Land Access in Kandal, 2004

<b>Agricultural Land of Household</b>	<b>Provincial Rural Household (%)</b>	<b>National Rural Household (%)</b>
No agricultural land(landless)	17%	15%
Less than 1.0 ha(0.01-<1.0 ha)	66%	49%
From 1.0-3.0 ha	15%	30%
>=3.0 ha	2%	6%
Total	100%	100%

Source: MAFF, 2004

## **2.2. Maize Production in Cambodia**

Maize is the third important crop in Cambodia after rice and cassava in terms of cultivated area in 2012. In recent year, maize production in Cambodia has increased remarkable in terms of cultivated area and production. Between 2003 and 2013, maize cultivated area and production increased by 122,000 ha and 636,000 tons, respectively (MAFF, 2014).

Most farmers in the area are paying less attention to practice mixed cropping. They tend to practice mono cropping to their increase income by cultivating maize, rice, bean, sesame, pumpkin, and vegetables. The breeding technology is advanced in Cambodia. The open pollinate variety (OPV) and hybrid one was cultivated in some areas in Cambodia. Given this there are some maize breeding stations in Kandal Province. Most of breeding seeds were imported from Thailand, Vietnam, and the USA. However, farmers are using the breeding seeds that can be cultivated only once time and unable to keep for next generation, hybrid seed. Farmers tend to grow the best market variety and they can easily select the satisfied variety since seed companies are high competition.

In Kandal Province, maize has been cultivated since long time ago. In other words, it is a traditional crop that has improved by using imported varieties, chemical fertilizers and pesticides. In the last decade, Maize production and cultivated area have remarkably increased from 14,044 ha to 4,588 ha and production volumes from 13, 797 tones to 52,797 tons (Provincial Department of Agriculture Kandal Province, 2010).

## **2.3. Definition and Concepts of Value Chain**

The term value chain was used by Michael Porter since 1985 in his book, 'In Search of Excellence' (Dagmar Recklies, 2001). The term is quite intuitive as it is refers to a full range of activities that are required to bring a product (or a service) from conception through different phases of production to delivery to final consumers and disposal after use (Kaplinsky 1999; Kaplinsky and Morris 2001).

Further, a value chain exists when all of the actors in the chain operate in a way that maximizes the generation of value along the chain (M4P, December 2008).

Other definitions of a value chain include a chain of activities that a firm operating in a specific industry performs in order to deliver a valuable product or service to the market (Wikipedia, 2014). At the same time, GTZ noted that a value chain is a sequence of related business activities (functions) from provision of specific inputs for a particular product to primary production, transportation and marketing, up to the final sale of a particular product to consumer (GTZ Valuelinks, 2008). It also includes a set of operators performing different functions, producers, processors, traders and distributors of a particular product, linked by a series of business transactions through which the product passes from primary producers to end consumers (Ranjit Kumar et al, 2012). Kumar continued that thus, value chain actors, responsible for transmission of materials, information and/or services, share an interest in the end-market which affects them both collectively and simultaneously.

The definition of a value chain can be divided into, narrow and broad senses. In the narrow sense, a value chain includes a range of activities performed within a firm to produce a certain output. This might include the conception to the design stages, the process of acquisition of input, production, marketing, and distribution activities, and the performance of after-sale service. However, the broad approach of defining a value chain looks at the complex range of activities implemented by various actors (primary producers, processors, traders, and service providers) to bring raw materials through a chain to the sale of the final product (Van Den Berg Michael, 2008).

The value chain concept has proven particularly useful for the identification and formulation of projects as well as in the development of strategies for improving the agricultural and rural development. According to (Gebremedhin, 2009) in the agricultural value chain, there are four major basic concepts: value chain, stages of production, vertical coordination, and business development services. The value chain concept could be conveniently divided into production which is mostly the farmers and support services, processing which is a combination of parboiling and milling, and marketing which is mostly bulk through the open air markets (Tinsley R.D, 2012).

#### **2.4. Systemic View of Value Chain**

The systemic view consists of three important levels within the value chain network and allows discovering potentials and bottlenecks within these levels and in the dynamic

interactions between them. Thereby traditional value chain analysis approaches should be enriched by other concepts and methodologies such as sub-sector analysis, enabling business environment, cluster development, and local economic development approaches.

- Value chain actors: The chain of actors who directly deal with the products, i.e. produce, process, trade, and own them.
- Value chain supporters: The services provided by various actors who never directly deal with the product, but whose services add value to the product.
- Value chain influencers: The regulatory framework, policies, infrastructures, etc. (Roduner D, 2007b)

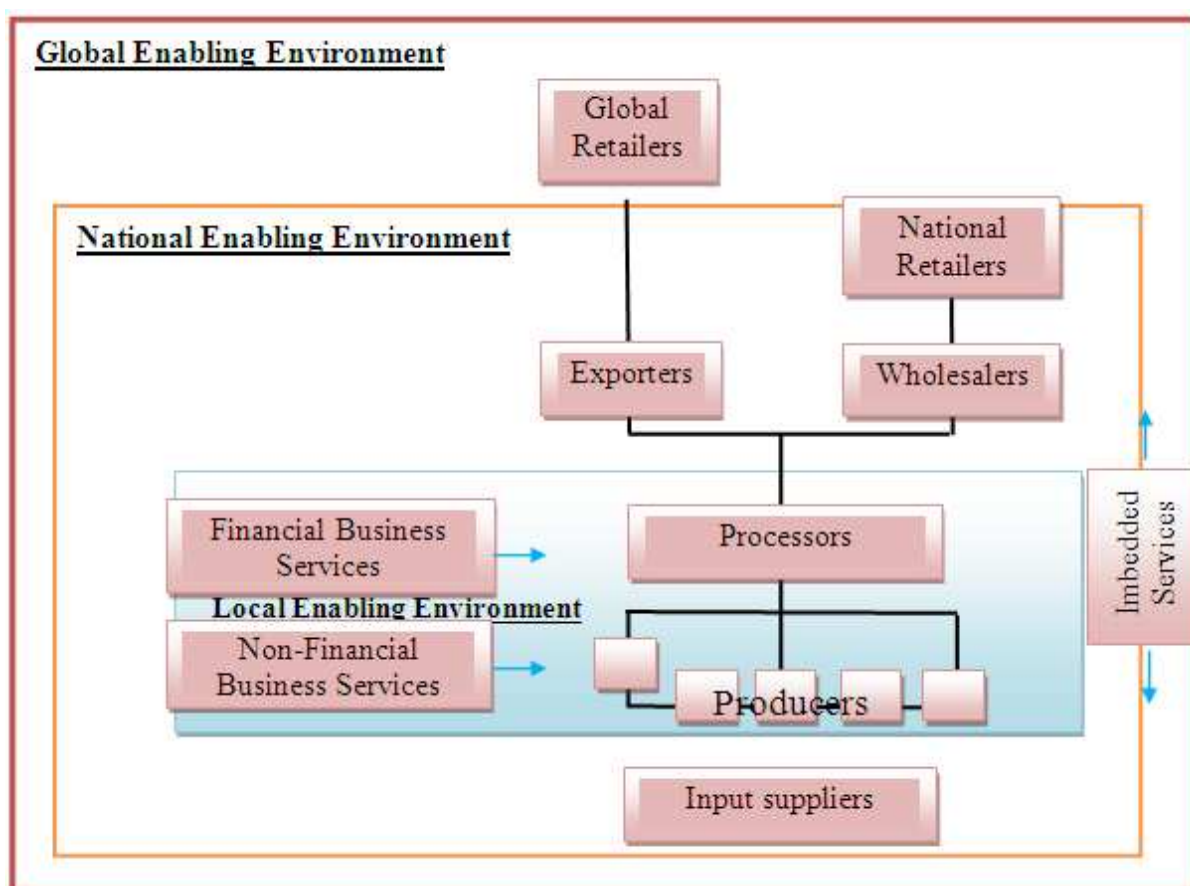


Figure 2: The Value Chain System (Adapted from USAID, 2006 cited in (Rounder D, 2007))

## 2.5. Value Chain Analysis

A major benefit of value-chain analysis is through the identification of the nature and extent of barriers to entry along the chain. As a result, such an approach is amenable to explain

many of the distributional outcomes that occur in the course of globalization as well as the evolution of such relationships over time (Kaplinsky and Morris 2001). Value chain analysis has been applied to the understanding of commodity chains and export strategies in a number of developing countries (Humphrey et al. 1998).

Value chain analysis starts with the selection of a value chain as the key entry point and proposed is poverty improvement and achieving pro poor outcomes (M4P, 2008). Moreover, there are four particularly important aspects of value chain analysis of agriculture. Firstly, the value chain analysis systematically maps the actors participating in the production, distribution, marketing and sales of a particular product. This mapping assesses the characteristics of actors, profit and cost structures, flows of goods throughout the chain employment characteristics, and the destination and volumes of domestic and foreign sales (Kaplinsky and Morris 2001). Secondly, value chain analysis can play a key role in identifying the distribution of benefits of actors in the chain. It consists of the analysis of margins and profits within the chain. It is also to determine who benefits from participation in the chain and which actors could benefit from increased support or organization. Thirdly, value chain analysis can be used to examine the role of upgrading within the chain. This upgrading can involve improvements in quality and product design or diversification in the product lined served, letting producers to gain higher value. The upgrading process analysis includes an assessment of the profitability of actors within the value chain as well as information on limitations that currently exist. Lastly, the value chain analysis highlights the role of governance in the value chain that can be internal or external (M4P, 2008).

### **3. Research Methodology**

#### **3.1. Conceptual Frameworks**

A conceptual frame work has been designed to identify the maize value chain in the area. The first concept is to map the key value chain actors, as well as their functions and activities involved in each stage of the chain. It is used to show the flow of transactions from sourcing of raw materials and inputs, to production, processing, marketing and final sale. The maps can also illustrate costs, value addition at each stage, secondary services important to each stage, critical constraints, and the relative clout of players along a value chain. Then issues

and constraints along value chain stage are also identified. The last concept is to propose intervention to improve the maize value chain in the area.

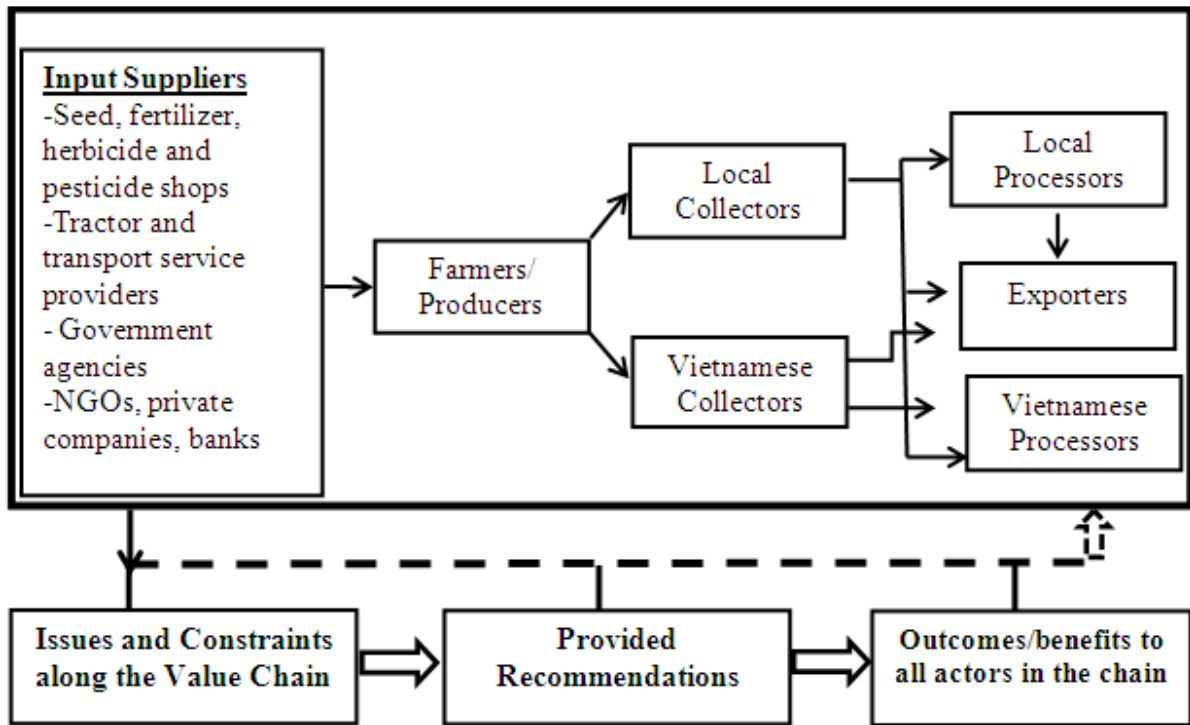


Figure 3: Conceptual Framework

### 3.2. Site Selection

Kandal Province was selected as a site for the research because it is the province with the most potential to produce maize in Southern Cambodia, bordering Vietnam. Leuk Daek District is the target district for the study because it is the biggest area to produce maize within the province in term of cultivated area. Also two out of seven communes of Leuk Daek District were selected for the study. The process of the research is to investigate the maize value chain along the production system on the Cambodian side. Six villages from the two communes were selected, namely Phumi Thmei, Peam Reang Leu, Pheam Reang Graom, Boeng Lue, Boeng Kandal, and Boeng Graom villages of Peam Reang and Khpov Ateav communes. The selection of these sites was followed by a wide range of maize cultivated area of these two communes. Moreover, depending on the times available, we decided to choose the middle commune of maize production to represent other bordering communes within Leuk Daek District.



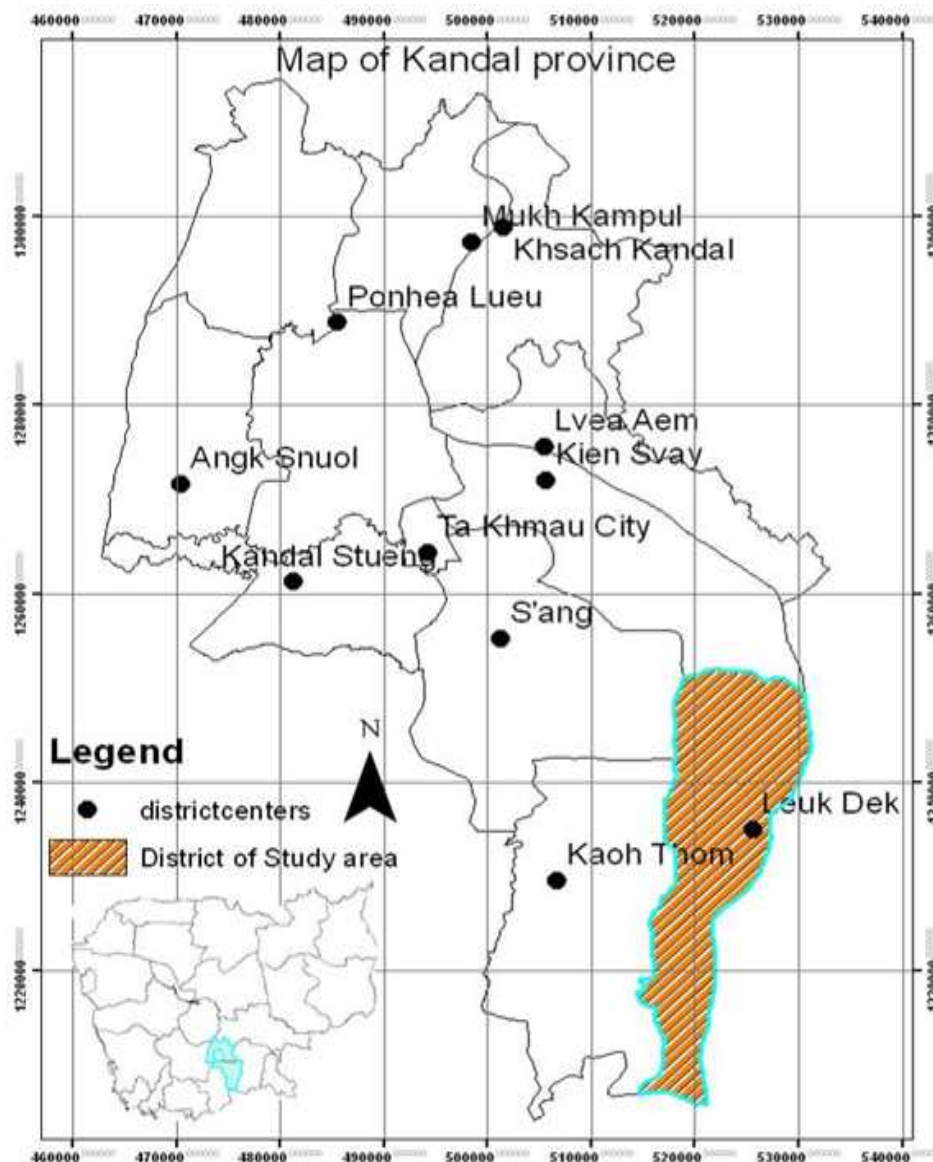


Figure 4: Map of the Study Area

### 3.3. Sampling Method

#### 3.3.1. Sample Size

The sample of the study consists of value chain actors mainly maize producers, collectors, semi-processors and exporters together with supporters including government agencies (Provincial Department of Agriculture and Commerce, Kandal Province, Division of Agricultural District, Commune Chiefs), agricultural input providers, tractor and transport service provider, and bank and micro-finance institutions as listed in Table 2.

Table 2: Sample Size of Respondents

N	Interviewees	Number of Sample
1	Department of Agriculture and Commerce, Division of Agriculture District, Commune Chiefs	5
2	Input Suppliers, Fertilizer Pesticide Seller, Transportation Service Provider, and Banking Institutions	5
3	Collectors	3
4	Processor	1
5	Maize Farmers	96
6	<b>Total Sample</b>	<b>110</b>

### 3.3.2. Sampling Method

#### A. Sampling Method for the Two Communes:

The sampling calculation formula of Yamane Taro (1967) was used to calculate the samples size in this study.

$$n = \frac{N}{1 + Ne^2}$$

Where n : Number of samples selected

N : Total number of households in two communes

e : Rate of error= 10 %

$$n = \frac{2552}{1 + 2552(0.10)^2} = \frac{2552}{26.52} = 96$$

#### B. Sampling method for each village:

The sampling calculation formula of Yamane Taro (1973) was used to calculate samples size

$$ni = \frac{n \times Ni}{N}$$

Where ni : Number of samples selected for each village

n : Total number of samples selected

Ni : Total number of households in each village

N : Total numbers of households in two communes

Table 3: Sampling by Villages

Province	District	Communes	Villages	Number of households in Each Village	Number of Maize Farmers in Each Village	Number of Sample	Total Sample (%)		
Kandal	LeukDaek	Peam Reang	Phumi Thmei	724	651	24	25.00 %		
			Peam Reang Leu	486	437	16	16.50 %		
			Peam Reang Graom	398	358	14	14.20 %		
		Khpob Ateav	Boeng Leu	382	344	13	13.40 %		
			Boeng Kandal	456	410	16	16.50 %		
			Beung Graom	391	352	13	14.40 %		
		Total	1 district	2 communes	6 villages	2837	2552	96	100 %

Source: Report of Leuk Daek District, 2013

### 3.4. Data Collection

Data collection was divided into two categories, secondary and primary data of the two communes in Leuk Daek District, Kandal Province.

#### 3.4.1. Primary Data

Value chain maps and identifies maize production and marketing system in Leuk Daek District. The map can help to identify the constraint happening along the chain. In order to reach this, a few methods were employed to identify the existing maize production and marketing systems in the area. The following tools will be used base on indicated below.

- **In Depth Interview:** individual interview was also used in the research. The interviews were held with input suppliers, maize farmers, collectors, processors;

consists of qualitative and quantitative information to understand the farmer's choice, constraint and problem of field management, marketing of their produce, etc.

- **Focus Group Discussion (FGD):** 5 participants were invited for the FGD to identify problem and constraint faced by each chain actor particularly maize farmers and the barriers to exit from the marketing.
- **Observation:** it was conducted by the author to observe maize-related activities of in the study area.
- **Cost Benefit Analysis:** cost and benefit analysis questions were asked after the in-depth interview finished. Therefore, the farmers can answer questions related to the requirements of labor and its costs, inputs use, the fertilizer rate and price, the yields obtained and selling prices of the crop (Thant 2013). It is necessary to understand economic benefits that farmer believed more worthwhile for their choice of crops based on their need, production factors available to them and how to manage their farms.

### **3.4.2. Secondary Data**

It is the existing data in the study area which are related to the research.

- Ministry of Agriculture, Forestry and Fisheries (MAFF)
- Provincial Department of Agriculture, Kandal Province
- Provincial Department of Commerce, Kandal Province
- Department of Water Resource and Meteorology in Kandal Province
- Library of Rural University of Agriculture (RUA)
- Internet, Teal software
- Journal and research papers etc.

### **3.5. Research Tools**

The study were used several methods to describe the existing maize cropping system and map the maize value chain in Leuk Daek District, Kandal Province. Some tools will be used in the study as follow:

- In depth interview
- Focus group discussion

- Key informant interview
- Cost and Return analysis

### 3.6. Data Analysis

All data from survey was divided into two categories, qualitative and quantitative data. Quality and quantitative data from in-depth interview were used to analyze rely on the research objectives. Some functions, frequency, descriptive, compare mean, min, max, mean, Count, Recode, Compute, Visual binning (category land size, Cross tab(percentage of some data by village), Anova (comparing type of fertilizer) and multiple respond (job type it percentage), were used to analysis the data.

Cost-benefit will also analyze in Excel and SPSS to see the economic performance of crops. Several functions will be used for economic assessment of maize in the area to evaluate the important of maize cropping and to understand the productivity of maize.

- Gross output (GO):  $GO = \text{Production} \times \text{Unit price}$
- Intermediate Inputs (II): include all variable costs in inputs (fertilizer, pesticide, labor, seed, transportation etc.)
- Gross Value Added (GVA):  $GVA = GO - II$
- Land productivity: GVA/ha
- Labor productivity: GVA/workman days
- Gross Value Added per ton (maize farmer):  $GVA = \frac{GGVA \text{ of all frrmers}(US\$)}{\text{Total Production}(ton)}$
- Gross Value Added per ton (collector):  $GVA/ton = GO - II / \text{total production (tons)}$

### 3.7. Research Design

This study will be conducted to find out the issues and constraint along the maize value chain. The maize value chain consists of input suppliers, maize farmers, collectors and processor. The process of research is showed in fig. 5 below:

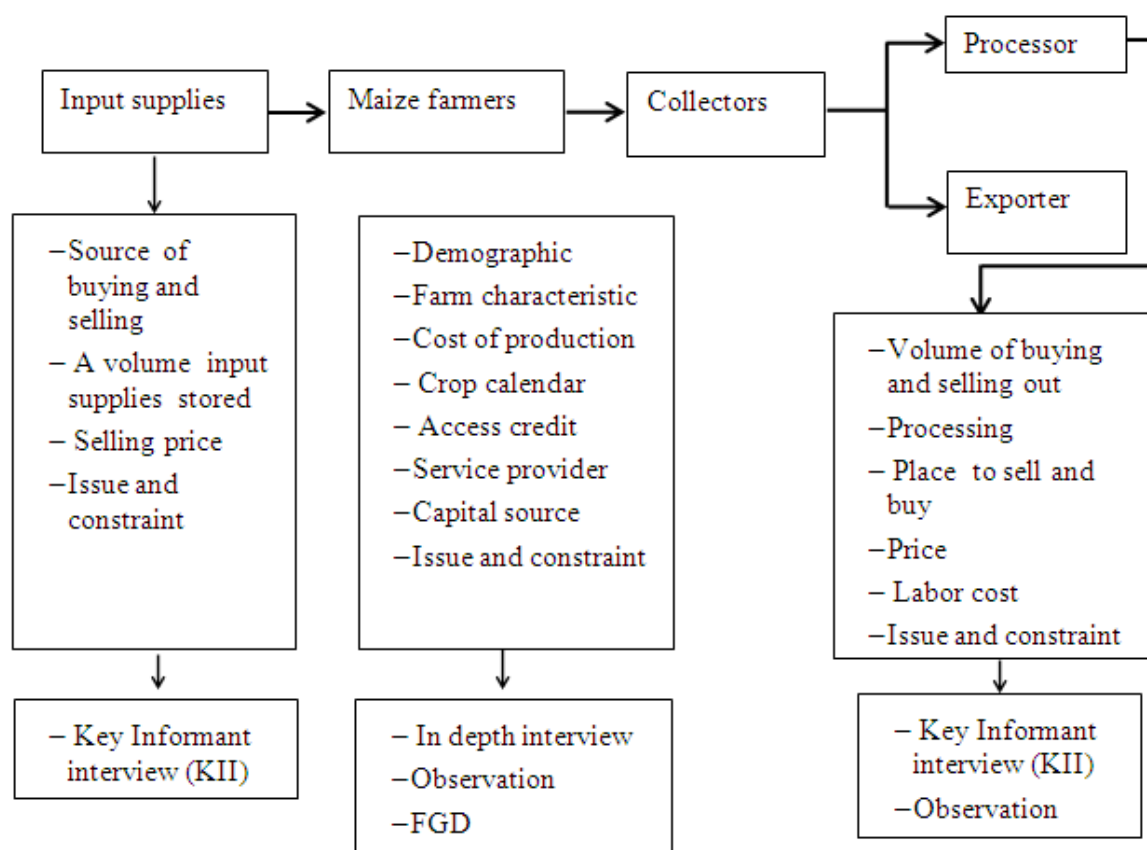


Figure 5: Research Design

## 4. Results and Discussion

### 4.1. Overview of Study Area

Leuk Daek and Koh Thom districts are two biggest out of eleven districts to produce maize within Kandal Province, Cambodia. They are the large maize production in the province in term of cultivated area. In 2013 to 2014, maize cultivated area was 8,361 ha and 7,507 ha, respectively.

Table 4: Maize Cultivated Area in 11 Districts in Kandal Province, 2013-2014

N	District Name	Maize Cultivated Area (ha)	Production (tone)
1	Leuk Daek	8,361	35,878
2	Koh Thom	7,507	38,118
3	Saang	2,288	14,170

<b>N</b>	<b>District Name</b>	<b>Maize Cultivated Area (ha)</b>	<b>Production (tone)</b>
<b>4</b>	Lvea Em	1,617	4,061
<b>5</b>	Kean Svay	1,314	3,095
<b>6</b>	Khsach Kandal	286	1030
<b>7</b>	Muk Kompul	219	876
<b>8</b>	Takhmov	86	228
<b>9</b>	Kanda Stueng	0	0
<b>10</b>	Ang Snoul	0	0
<b>11</b>	Phonh Nhea Loeu	0	0
	<b>Total</b>	<b>21,678</b>	<b>97,456</b>

Source: PDA-Kandal, 2014

In addition, in the area a formal community was established. There are 20 cooperatives within the province (24 December 2013, PDA). Among those, three cooperatives existed already in the area, namely Preak Dach Mean Chey cooperative, Peam Rang Rong Roeung cooperative and Khpov Ateav cooperative. Preak Dach Mean Chey established a saving group and specialized on operating maize thresher machine.

The Peam Rang Rong Roeung cooperative established a saving group as well and attempts to increase agricultural input by efficient fertilizer usage. In 2011, 162 of members of Khpov Ateav cooperative created a saving group for fresh water consumption.

Beside this, Kandal is working with some development partners. Currently the province has implemented the PADEE project running for 5 years while VVOB project have just gone. Therefore, other partners namely GIZ, World vision, Caritas, JICA, FAO, World bank, Bumong, Agri Cam, Carbi, SNV and IDE which cooperated with Department of Agriculture.

#### **4.1.1. Land Use and Major Annual Crop**

The total land size in the district comprises 37,888 ha, of which 40 % is used for agriculture and other remaining percentage is left for buildings and living area. The agricultural land 15,283 ha, 54.53% maize, 41.55% rice field and the other agricultural land is for growing vegetable, cassava and sweet potato, mungbean, sugar cane and sesame.

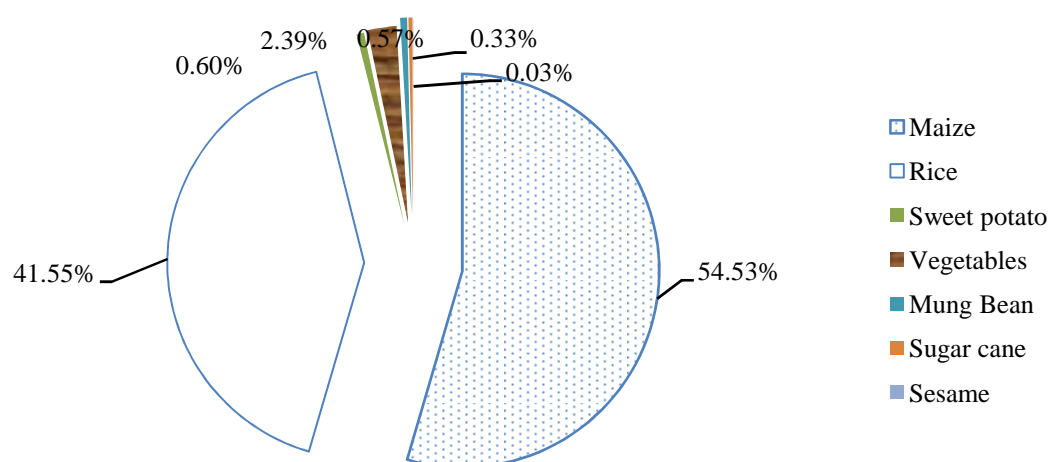


Figure 6: Percentage of Cultivated Area of Annual Crop of Leuk Daek District, 2013

#### 4.1.2. Socio-Economic Feature of Leuk Daek District

Total population in Leuk Daek district is 59,353 people with 12,378 households in on area of 378.88 km<sup>2</sup> (PDA, 2009). Over 78% of the total population of the province is farmers, while nearly 10% of them depend mainly on service provider job and over 10% relies on multi and artist job (PDOP, 2013).

Table 5: Type of Main Job of People in Kandal Province

Job Type	Percentage ( 2008)	Percentage (2009)	Percentage (2010)
Household depend mainly on agriculture	80.51	80.79	78.03
Household depend mainly on art	1.16	1.13	1.08
Household depend mainly on service	10.2	9.28	9.66
Household depend mainly on multi job	8.13	8.8	11.23

In addition, the result of interview showed that annual income of respondent is average 348 USD/household. The source of income varies from different jobs. They are crop cultivation (maize, rice, and other crops), animal raising, construction worker and other marginal works.



Moreover, most farmers they hold the maize land less than two ha. According to in depth interview with farmer, farmers have own maize cultivated land less than 1 ha, 1-2 ha, over 2 ha with 41%, 39% and 20 % respectively.

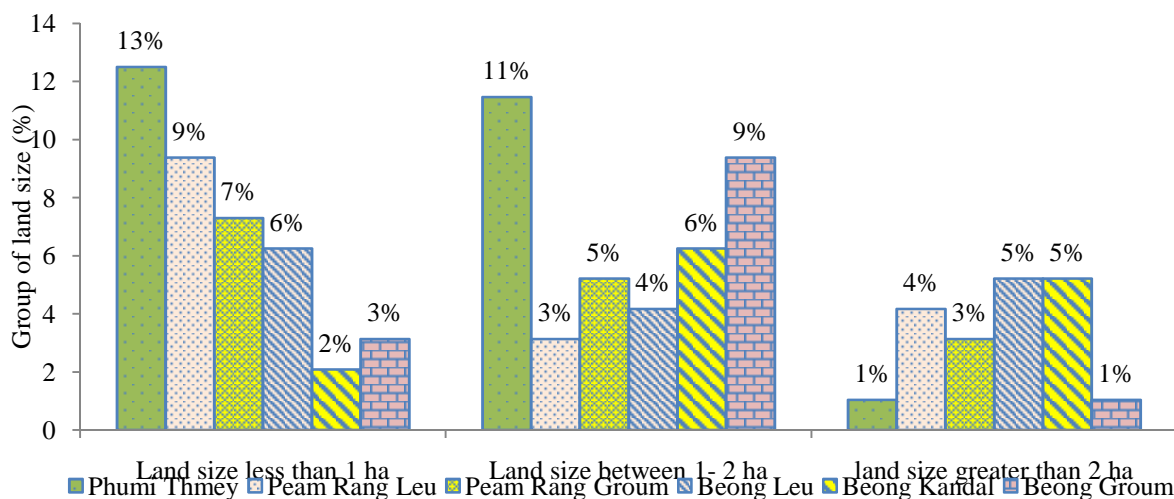


Figure 7: Property Size Distribution of Landholders by Villages

## 4.2. Maize Cropping System

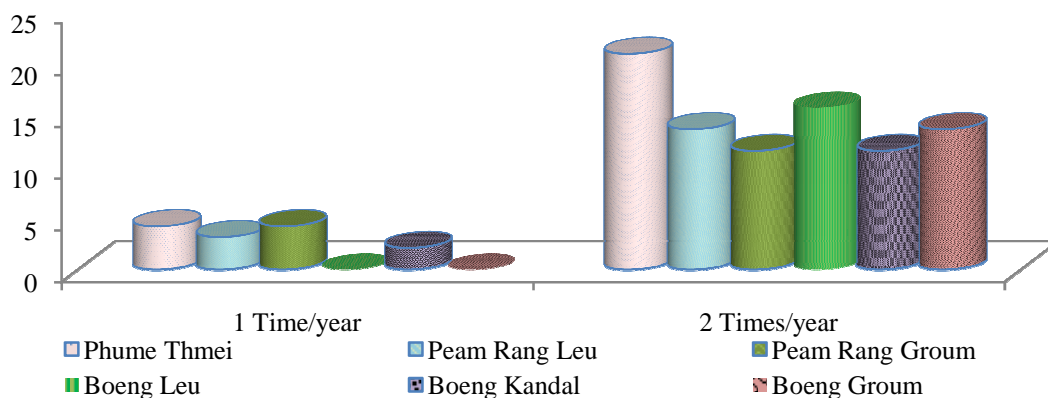


Figure 8: Distribution of Number of Growing Times by Villages

The main growing crops in the district are maize and rice which has 7,240 ha and 6,330 ha, respectively. Most farmers can grow their maize twice a year while some farmers can only cultivate their crop one time a year. It depends on farm location area. The study area was categorized into two characteristics, high and low level lands. The higher level land is cultivated by annual crop while the lower is used for paddy rice. According to in-depth

interviews, over 86% of maize farmer cultivated twice times a year and other 14% could cultivate only once a year.

However, only 28 farmers out of 96 (29%) practiced crop rotation and mixed crops with their maize. Mostly they grow mungbean in dry season because growing in rainy it is no security due to diseases outbreak. Some of them grow rice in dry season and few farmer plant maize inter row of mango. Beside growing maize, 84% of maize farmer raise animal such as cow 4, pig 9, buffalo 4 in average. Account for 29% of them cultivates other crop such as rice, sesame, mango, morning glory and vegetables while the other farmers are a fish man, worker in agriculture and small business man.

In addition, cultivated area of farmers accounts for 2.32 ha in average. Among this amount, farmer holds maize land in average 1.49 ha and 1.37 ha/household in dry and rainy season, respectively.

Maize production in the area has increased remarkably. In 2009-2013, the maize volume has double increased from 17,062 tons to 35,878 tons. The average yield has also significant increased from 2.90 ton/ha in 2009 to 4.48 ton/ha in 2013 (PDA-Kandal).

#### 4.2.1. Planting Method

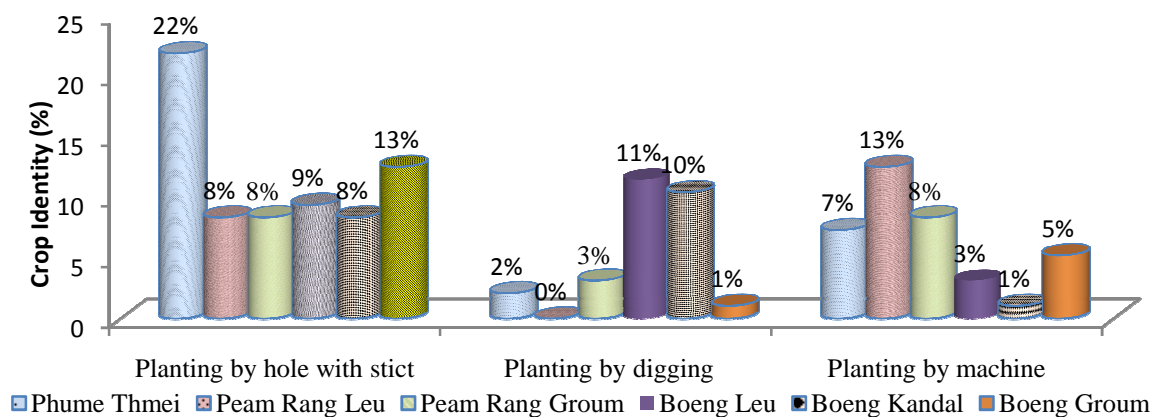


Figure 9: Distribution of Planting Techniques by Villages (%)

Different planting techniques were employed in the area depending on season and field location. Farmers tend to grow maize by using a stick to make a hole in dry season while digging and applying machinery were employed in rainy season. The survey showed that

69% of farmers planted their maize by using stick to make hole. Also 28% and 37% of respondent grew their maize by digging and applying machinery respectively.

#### **4.2.2. Agricultural Input Use**

##### **A. Seed**

Farmers have experience in planting maize for 20 years in average since they use local variety which it is Open Pollinated Variety (OPV). They began to change hybrid variety for around ten years. Now all farmers in the area practice with hybrid variety that import from Thai, Vietnam, and USA. We also produce hybrid and OPV maize variety in Cambodia. Sar Chey and Loeung Mongkul variety were produced by CARDI (Cambodia Agricultural Research and Development Institute) since 2006. In recent year, Bontey Daek Crop Experiment Station under department of horticulture of MAFF and donated by ICF (International Corn Foundation) of Korean was released some new maize varieties for testing on farmer farm. The varieties are sweet corn (Normal Hybrid, 2K12C Bt, and Hybrid 20009×20002), White Sticky Corn (O.PV w/b, 47×35 and Hybrid 35×47) and Feed Corn (KC45, and Normal Hybrid). However, these kinds of local breeding varieties were not popular for their cultivation. Farmers tend to practice a good hybrid maize variety that imported from foreign country.

Moreover, maize variety usage seem to be changed depend on its productivity to meet market requirement. At the beginning, farmers tend to cultivate Vietnam seed like 10, then they prefer to engage with CP seed, 888, 989, QQQ, AAA, 301, 801, new 888 and 201, but now they tend to use Pacific and Pioneer Seed Company instead. By the way, farmer need to change new seed produced within the current seed company practice. Otherwise, the production will lose if they could not catch up with the new changing seed. According to in depth interview, farmer spent the seed 28 kg/ha in average (minimum 15kg/ha and maximum 60kg/ha). Among these, account for 49% of farmer cultivated by using Pacific seed (999,339) while the other 24% engage in Pioneer seed (60, 67, 73, 96, and 99), the other 23% use Vietnam seed (Syngenta 10, 6326, 8867, 5599, 1968, and 6888), and only 4% of farmer use CP seed (888, 301 and 63) for their maize cultivation. The most popular seed use in the area are 999, 339, 6326 and 76 seed. However, grower also faces problem with seed quality in their production. Over 52% of farmer has the seed problem. Some seeds are expired, spoiled,

broken, less tolerant, and not pure. As the result, the production is decrease. Farmers need to be flexible to respond for the new seed within the season or a year. They need to adapt for new variety of seed. If they still cultivate the same seed more than one year (even it is good seed), they will get low yield compared to previous year or compare to other new good variety of seed. Some farmers said “if I still grow the same seed in the same land, the fruit of maize may become smaller and smaller and the quality of seed is also difference if compare to before”.

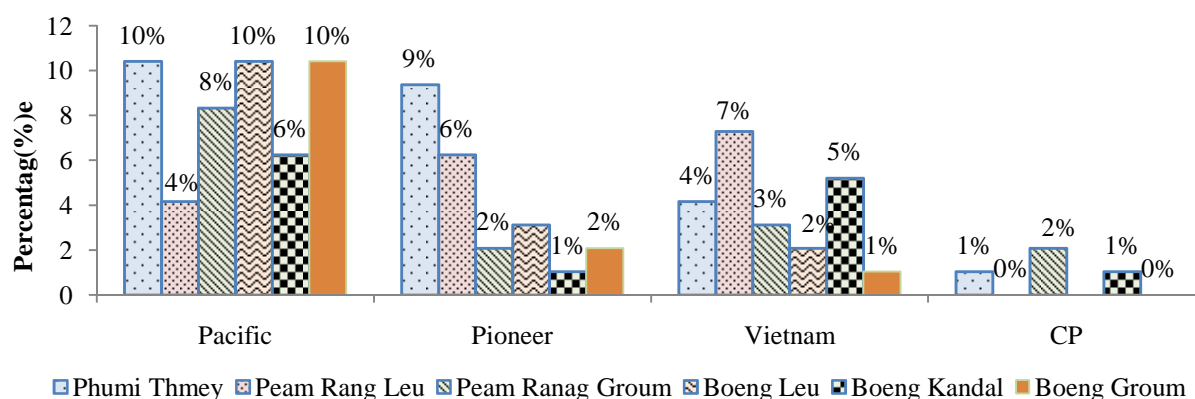


Figure 10: Source of Seed Used by Farmer in the Area

## B. Fertilizer

All of farmers use chemical fertilizer for their maize cultivation. However, some farmers who use ash or cow dung to cover the maize seed while planting.

A few kinds of fertilizer have been employed in the production. There are Urea (46-0-0), DAP (18-46-0), 20-20-15+TE, and liquid fertilizer. Generally, farmers apply fertilizer 3-4 times in a cycle. Some farmers they apply a single Urea fertilizer while some of them mix Urea with DAP or Urea with 20-20-15+TE or mix three of them together in a second or third application. First application ranges from 20-30 days of age with a single Urea. After 40-50 days, second application will be done. After flowering (55-65 days), the application was employed. The times of application depends on the irrigation times. Normally, farmer applies fertilizer after irrigation with their family labor.

In addition, single Urea (30%), farmer apply 348kg/ha in average of Urea fertilizer in a cycle. 57% of farmers combine Urea and DAP with the average quantity of 334 kg/ha and 96kg/ha. Other formula, 7% of famers mix Urea with 20-20-15+TE. They apply 290 kg/ha and 130

kg/ha of Urea and 20-20-15+TE. There are only 6% of famers who mix three kinds of fertilizer together. In one hectare of the land they apply Urea 254kg, DAP 86kg and 20-20-15+TE 79 kg.

### C. Chemical

There is account for 99% of famer in the area applies chemical pesticide for their maize production. In a cycle of production, farmers spray insecticide 3 times and herbicides 2 times in average. Some famers also spray fungicide and other chemical to enhance crop development. There are a few kind of herbicides have been used in the area. Paraquat herbicide was used for post emergence at the age of 45 days after planting. Glyphosate also used in pre emergence. Then farmer usually apply Atrazine herbicide no longer than four weeks after planting. Beside this, many kinds of insecticides was employed in the maize production. Insecticides usage is difference from each village. It depends on farmer tendency and the available insecticides in chemical shop. The most insecticide sprays of farmer are Chlopyrifos, Phenthoate, Chlorantraniliprole, Cypermithrin, Thaimethoxam, Emamectin Benzoate, Cyerrun and Abametin. However, there are only 60% of farmers who use safety materials. Most of common safety materials are mask or towel, boots and glass to protect them from direct attack of chemical.



Figure 11: Chemical Types and Effect on Maize

#### 4.2.3. Labor Use in Production

All of famers in the area hire labor in local. There is lack of labor in their production. Most hiring labor works on planting, harvesting and maize husk removal stage. A few larger land

household farmers hire labor in almost all stage of production. Farmers who have land size less than 0.5 ha tend to use their family labor for their maize cultivation. Farmers who has active member over 4 people mostly work by their own labor except planting and harvesting stage in rainy season. The number of hire labor depends on type of work and season.

#### **4.2.4. Access to Credit**

According to the study, there is over 91% of maize farmer accessed credit from various sources for their maize production. In this percentage, 57% of maize farmer they access credit in term of agricultural inputs for a cycle of maize, 3-4 months. In a cycle of maize product, retailer get interest of fertilizer 12,000-40,000 Riels/bag (50 kg/bag), seed 20,000-60,000 Riels/case (20kg/case), chemical 2000-7,000 Riels/bottle, and fuel 10,000-30,000 Riels/30liters. There is no any formal contract, sign or finger between retail and farmer. The only farmers live in the village who the shopper knew that can be gotten agricultural inputs. There is 31% of farmer get loan from bank and microfinance with interest rate range from 1.7-3%/month depended on the quantity of loan. The other 3% they access money from saving group, their relatives and money lender in village. In conclusion, chemical shop dealer play more important role for maize production. The shop owners not only provide agricultural inputs service, but also provide loan in term of product and technical support.

#### **4.2.5. Harvesting**

Harvesting time depends on each variety and soil condition. In general, harvesting starts from 110 days to 120days after planting. However, some new variety needs less than 90 days. The harvesting is operated by human and it needs 5 to 7 people for harvesting one ha/day. But in this year, there is a harvesting material which combines with tractor available in the study area. After or during harvesting, transportation tractor or cart comes to transport maize to their house immediately within a day especially in rainy season. They use basket to collect maize pile then load by human onto card or tractor transportation.

There are many kinds of transportation style and volumes. The prices of transportation are also depending on these and the distance of crop field (detail in 4.3 above). Farmers spend on labor for harvesting about 6% in average among of all expend in a cycle of their maize production. Maize was kept for 2-3 days before conduct husk remove. After remove husk,



maize can be threshed. Some farmers they thresh their maize in form of husk with new thresher machine by covering maize with plastic for 2-3 day depend on the mature of maize.



Figure 12: Harvesting and Husk Remove

#### 4.2.6. Drying

There are only 13% of farmers who dry grain before sell while other 44% sell their grain in wet condition. Beside this, 43% of them sell their maize production in both dry and wet condition depending on season (weather), labor force, volume and quality of maize grain, market price of maize and buying criteria of broker. Moreover, farmers dry their maize after threshing. They use plastic mat to dry the grain in front their house or on the road for 3-4 days depending on the sunlight. During drying, the human must pay attention to recover grain in every 1-2 hours/time in order to dry the grain fast and well with moisture of 14%. After three days of drying, maize were cleaned, packed into bag and weighted by collector preparing to transport to factory.



Figure 13: Drying and Collecting

#### **4.2.7. Marketing**

All interviewed farmers they sell their maize at home in both dry and wet condition. Some farmers who have enough members in household they prefer to sell their product in dry condition to add the value. Moreover, after harvesting and transportation to their home, collectors come to give the price at their house. If farmer agree the given price, collector set the date to thresh their product and provide the package bag. Before sell their product, famers also get information about price by asking other farmer and compare to the price given by collector. Accounting to in depth interview, in dry season, farmer sold their grain with the price of 724 Riels/kg and 964 Riels/kg in wet and dry form, respectively. For the rainy season, wet form of grain was 740 Riels/kg and 972 Riels/kg of dry form. The price of grain in rainy season is quite high if we compare to dry season.

There are two majors market of maize in the area. Usually, the some good maize was sold to collector for feed factory especially CP factory in dry form. Some colorless and broken grains were sold to Vietnam in form of wet condition especially in rainy season. There are no accurate criteria for buying the maize for Vietnam buyer, but the price is difference depending on the quality of the product. For CP factory criteria, the quality of maize was divided into three categories. Moreover, farmers get the information about price of maize from collector only.

Farmer can produce grain of maize 7,486 kg/ha in average. They can sell with the price of 810 Riels/kg (0.20 USD). Moreover, producer gets profit 2,198,100 Riels (550 USD), while they spend 3,861,500 Riels (965 USD) in production costs per hectare. Most of expenditure engages in fertilizer, seed, chemical and fuel with the percentage of 21%, 13%, 13% and 12%, respectively. It seems to be high for such expenditures compared to other payment. Actually, the price of these materials is not so expensive since some of farmers tend to use illegal inputs with a cheap price. However, the price of such inputs was included interest rate due to farmer get it in kind of loan with almost double compared to the original price that farmer pay when get the inputs.



Table 6: Share of Production Costs and Profit per Hectare

Item	Unit	Value	Expenditure Percentage (%)
Rend Land	Riels/ha	413,810	10.72 %
Land Preparation	Riels/ha	240,450	6.23 %
Seed	Riels/ha	508,691	13.17 %
Chemicals	Riels/ha	488,656	12.65 %
Fertilizers	Riels/ha	815,798	21.13 %
Fuel	Riels/ha	452,368	11.71 %
Planting Labor	Riels/ha	112,396	2.91 %
Weeding Labor	Riels/ha	77,972	2.02 %
Spraying Labor	Riels/ha	59,510	1.54 %
Applying Fertilizer Labor	Riels/ha	97,679	2.53 %
Irrigation Labor	Riels/ha	92,222	2.39 %
Harvesting Labor	Riels/ha	126,769	3.28 %
Husk Removal Labor	Riels/ha	82,761	2.14 %
Thresher	Riels/ha	95,980	2.49 %
Transportation	Riels/ha	136,628	3.54 %
Other Expenditure	Riels/ha	59,861	1.55 %
<b>Total Expenditure</b>	<b>Riels/ha</b>	<b>3,861,551</b>	<b>100%</b>
<b>Average Yield</b>	<b>Kg/ha</b>	<b>7,486</b>	
<b>Average Maize Price</b>	<b>Riels/kg</b>	<b>810</b>	
<b>Cross Income</b>	<b>Riels/ha</b>	<b>6,059,734</b>	
<b>Profit</b>	<b>Riels/ha</b>	<b>2,198,183</b>	

### 4.3. Mapping of Maize

#### 4.3.1. Core Actor Involve

The core actor involved in maize value chain in the area consists of input provisions, production, collection and processing as shown in figure 22 in detail with their specific activities.

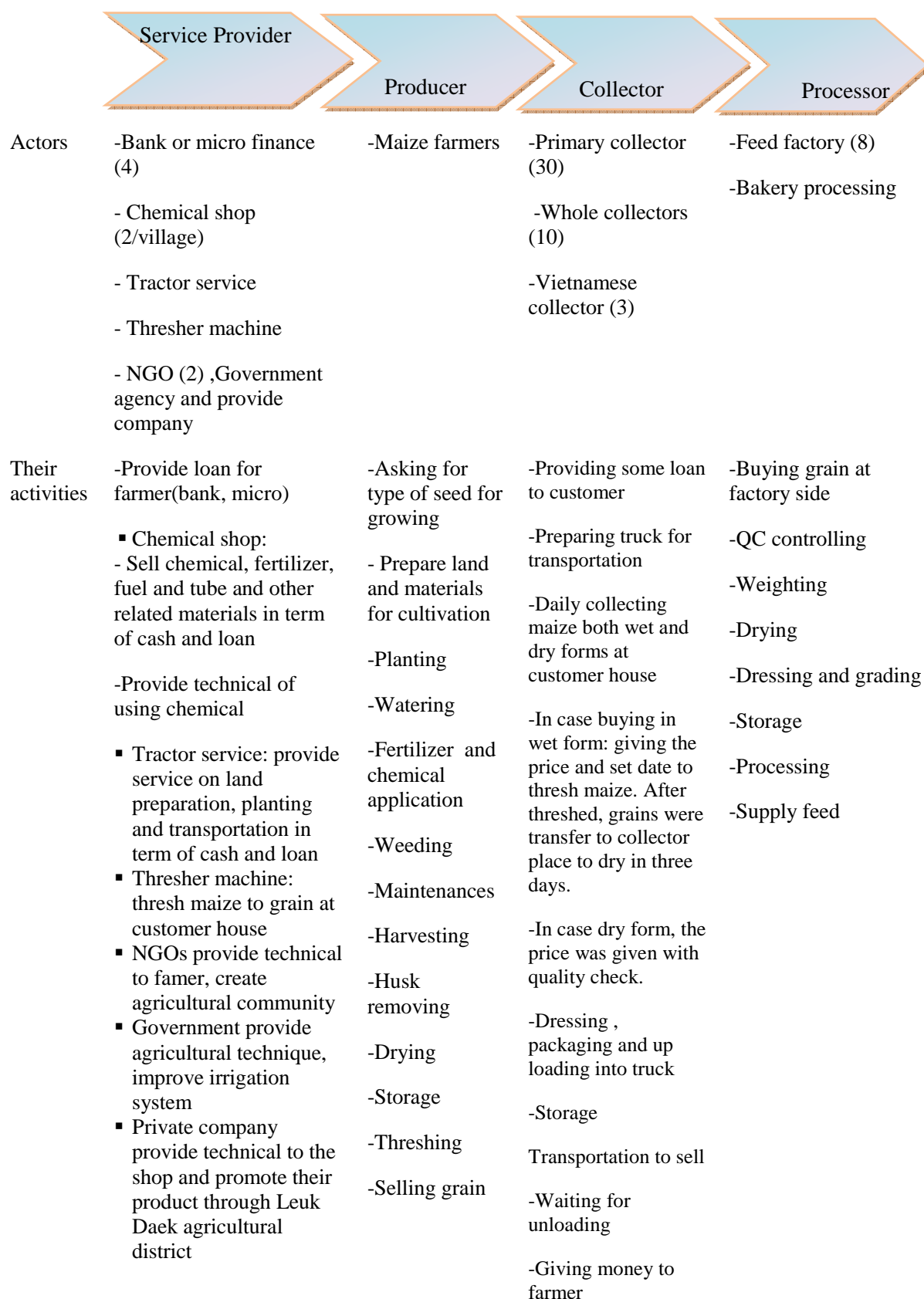


Figure 14: The Core of Actor Involved

### 4.3.1.1. Service Providers

Bank, chemical shops, tractor provider (plow, planting and transportation), and thresher machine are the main input providers.

- **Bank**

There are Aceda bank, Prasak, AMK, Amret, and Vision fund microfinance were established in the area and provide their loan service to maize production. There is over 91% of maize farmers borrowed money for their maize production. It was calculated that 34% of farmers can access loan from bank and microfinance with monthly interest rate 1.7-3% depended on the quantity of loan. In order to loan, credit officer come to check household status, properties, and estimate the current market price of these properties. After checking, farmer can get the amount of loan according to the price of these and farmer need. There are two criteria to loan credit from bank or microfinance. The first option is farmers need to keep their own land title with bank from which they want to borrow. Also, they can get money from bank when they have group of at least 3 people. High living standard farmers more prefer to access credit from micro finance while the poor farmer rarely to do so because they do not have monthly income to pay for monthly interest. So they tend to access credit from chemical shop or render who can provide loan them without monthly interest.

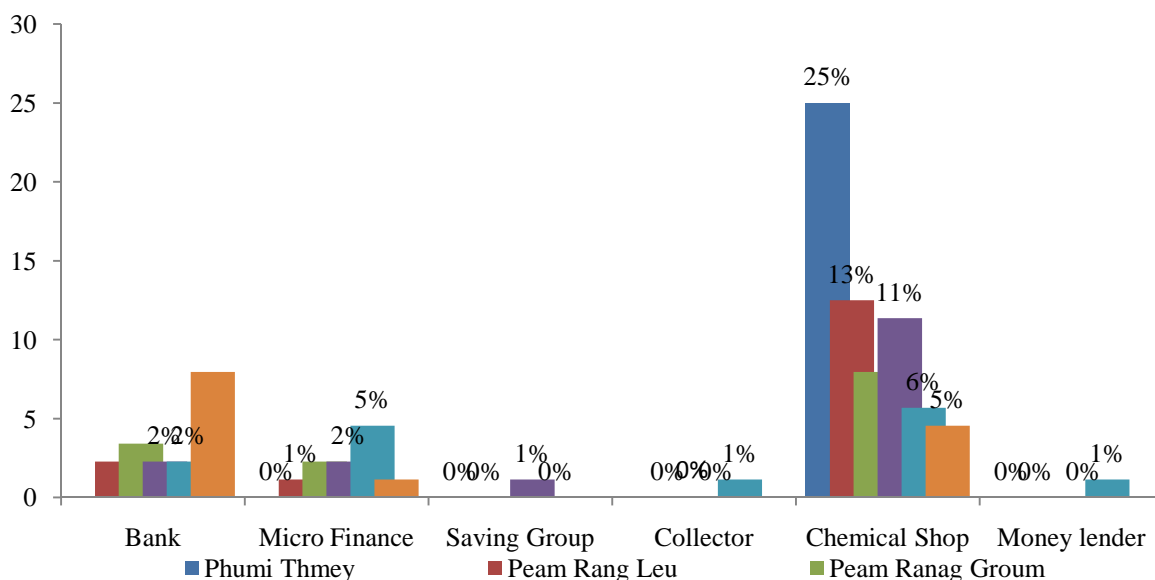


Figure 15: Source of Credit Access for Maize

### ▪ **Chemical Shop**

Sellers sell many agricultural inputs in their shop. They provide chemical fertilizers (Urea, DAP, 20-20-15+TE, 15-15-15), insecticides, herbicides, fungicides and other chemicals, sprayer, tube and other agricultural materials service. Most agricultural inputs import directly from nearby Vietnam border especially the commune that border with Vietnam such as Kaam Somnor and Sandar commune. In recent year, most of agricultural inputs imported by chemical company and sell to shop retailer in district, commune and village. There are many agricultural companies that provide the agricultural product in the area. CP provides seed service namely 888, 989, QQQ, AAA, 301, 801, new 888 and 201 while Pacific (imported by Nokorthum) provides seed 999 and 339, Pioneer consist of 60, 87, 96 and 99 seed, Vietnam Company (Syngenta) provides 6326, 8869, 5599, 1968 and 10 seed. For chemical company, it consists of AgrotechVita, Dupont, Nokorthum, An Gaing, Syngenta and Mabro. The other input, fertilizer, was provided by Five Star Cambodia (20-20-15+TE), PETROVIETNAM, and Agrotec Vita company. Total chemical retailer shop in the district is 40 sellers, 92.5% has license trader (PDA-Kandal 2011). Chemical shop retailers play the important rule in maize production. They not only provide their agricultural products, but also provide loan and technical service in agricultural works. According to the result of in-depth interview, nearly 65% of maize farmer access agricultural inputs in debt condition for a cycle of maize cultivation, 3-4 month. In a cycle of maize cultivation, retailers get interest of fertilizer 12000-40000 Riels/bag, seed 20000-60000 Riels/case (20kg), chemical pesticides 2000-7000 Riels/bottle, and fuel 10000-30000 Riels/30liters. There is no any formal contract, sign or finger between retail and farmer. The only farmer who lives within the village and shopper knew that can be got agricultural input in term of dept.

### ▪ **Tractor Service**

The service plays the rule in land preparation and harvesting stage, plowing and transportation. In this year, the planting machine was used that connect behind tractor. Farmers plow their land from 1 to 2 times and make row in the field of planting. However, some farmers cultivate maize without plowing mostly in dry season after flooding down. Plowing costs around 200,000 Riel/ha. Seeding by planting machine costs 300,000 Riels/ha. For transportation, there are many different sizes of cages. Small size scale of transporter can weigh up to 500 kg/times. A medium transport can store up to 1500 kg while a bigger

transport has a capacity up to 4000 kg/times. In addition, the fee charge for transportation from farm to house also depends on the size and distance of transportation. Small transportation costs about 10,000-20,000 Riels/time. A medium size costs 20,000-30,000 Riels/time while a bigger transportation costs vary from 40000 Riels up to 60000 Riels/time. Some maize cultivators provide the money after completed work, but some of them pay after harvesting their crop with interest around 40,000 Riels/ha.

#### ▪ **Thresher Machine**

There are three types of thresher machine that operated in this area. For first style, it is very common use in last 5 years in the area. It requires two or three people to sit on it and then move cob maize into machinehole. Currently this type is not popular in the area because the operation process is slow. It can produce cob to grain 8-10 ton/8 hours. For a second thresher, it works faster than the first machine and need only one person to load cop maize to put onto machine. The capacity can produce grain 15- 20 ton/8 hours. The fee for renting this machine is from 10,000-15,000 Riels/ton. However it depends on maize selling condition, wet or dry. The other type was call thresher machine. It can process to thresh without removing bark of maize out. It was just present in recent year but it is very popular in the area. Even though, some farmers still use the old style one. It costs 15,000-20,000 Riels/ton depends on maize selling condition. The capacity of this type of thresher can be threshed the maize up to 40 tons/day.



Figure 16: The Models of Maize Thresher Machine

#### **4.3.1.2. Maize Farmers**

Maize is the main crop to generate household's income the area. Farmer has experience more 20 years in planting maize. They hold the maize land size of over 1 ha/household in average.

86% of farmer cultivate twice a year while the other 14% cultivate once a year. Hybrid seed was imported by companies from Thailand, Vietnam and USA for cultivation. They use 28 kg of seed in average for one hectare of land. Three types of fertilizer were used 3 to 4 time/cycle in order to improve maize yield, 46-0-0, 18-46-0 and 20-20-15+TE. Most of maize producer use chemical pesticides to protect their crop at 2 to 3 times/cycle. Both hire and household labor were engaged in their maize cultivation. Most of hire labor are involved in planting, harvesting and husk removing activities. After planting 110 days in average, harvesting times will be done. 5 to 7 labors can be harvested in a hectare of maize land. After 2-3 days, maize husk will be removed then the grain depends on the mature of maize, volume of maize and available collector for buying. Most of maize farmer prefer to their grain in wet form depending on season. Vietnam and local a factory are the only two entrances in order to absorb their grain with deference price. In average, farmer can get profit 859 USD/ha in a cycle of their cultivation. However, some major constraints were occurred in the production stage. They are seed quality, pest outbreak and flooding, lack of labor and capital and the fluctuation of the price.

(All information of maize farmer was shown detail in 4.2)

#### **4.3.1.3. Maize Collector**

Collector refers to buyer who buys agricultural commodities from farmer and sells to factory within country and/or export to sell in Vietnam without certificate of origin (CO) or any export license. There are two types of collector in the area, primary collector and whole collector. Primary collector buys and collects the commodity directly from farmer for whole collector with the profit of about 5 USD/ton. There are about 30 primary collectors in the district. Furthermore, the whole collectors buy maize from farmer and collector from primary collector to sell at factory in the country and/or transport to Vietnam by truck and boat. There are about 10 big collectors in the district. In addition, collector has experience more than 10 years in their filed. They think that this type of job is easy to earn money and they follow their relative work style. The collector education level is secondary school up to university. At the beginning, collector starts their business with capital of nearly 5000 UDS in average. Therefore, a collector has over 180 customers in average who supply the maize grain. Some farmers sell their maize in wet form while the others sell in dry form to collector. If maize in wet condition, collector must dry for two days with a full sunlight. If the quality of grain is

good, the only 20% of total weight was lost during drying while a quite good grain decreases 25-30% of total weight.

Moreover, some collectors they work on maize commodity only while the other collectors engage more in rice, sesame and bean commodity, but it is not much volume as a maize production. After finished business in September to March at the district, they move to buy maize in different province namely Prey Veng, Kompot, Kompong Cham, Pailin and Battambang Province. Buyer who runs business with maize product as main job can get profit range from 10000 to 20000 USD/year.

- **Labor Use**

All of labor source come from the local area. Most of labor in the cultivation is man, the only drying progress that woman was involved. Labor works on loading, drying, weighing, cleaning and packaging process. Collector hires labor day by day in the season and pay labor fee in term of contract of volume. According to in depth interview, the fee for labor is 45000-50000 Riels/ton (11.25-12.5 USD) from drying to loading onto truck. There are 6-10 people was employed in a collector to involve with package bag, loading and unloading from buying location, drying, cleaning, packaging, weighting and loading onto truck to factory or export. If collector buys grain in dry condition, they will pay for cleaning grain and truck loading in account for 25000 Riels/ton (6.25 USD/ton). Collector pays for truck driver with the price of 60000-70000 Riles/times (15-17.5 USD). In addition, woman usually engages in drying work while man works on loading, packaging and grain cleaning job.

- **Maize Buying Capacity**

The buying volume depends on each collector and seasonal crop. Small collectors especially communes near border gate buy grain and transport by motor bike to sell by themselves at border gate with volume of 1 ton/time. Most collectors decrease the order in rainy season because it is difficult to dry grain by conventional technique. In general, Collectors start to buy grain in early March to early June in dry season. Then late July to mid-September, collectors will start to buy the products again in rainy season.

One collector can buy from 12 up to 20 tons/day depend on season and volume of maize demand. There are about 1,700 tons of maize in average was bought by a collector per year. In April and May, a collector can buy from 30 to 40 tons/day, two trucks per day.

▪ **Maize Marketing**

There are two majors market for maize, local factory within the country and export to Vietnam. The buying criterion is also difference between them. There is no requirement standard for Vietnam buyer, but the price of grain is difference and change day by day or change by volume of contract of boat. Normally, collector sells grain with moisture to Vietnam at the border gate or at Tan Chau district of An Gain province in Vietnam if they transport by boat. For factory, there are about 7 factories. CP is the biggest factory to absorb maize grain in term of volume if we compare to other factories. Collector buys the wet grain 730 Riels (0.183 USD)/kg and buy the dry grain 1000 Riels (0.25 USD)/kg from farmer. They sell grain with the price 1000 Riels (0.25USD)/kg up to 1150 Riels (0.288USD)/kg depending on price fluctuation. The price of the grain is cheaper than last year in the same period of time. The price downed 100-200 Riels/kg if compare to last year. Collector can buy up to 1200 Riels (0.30 USD)/kg from farmer and sells to buyer with the price of 1350 Riels (0.338 USD)/kg.

▪ **Cost and Benefit**

After getting payment by receipt, collectors sell it as they can get cash immediately. Most of them always get paid this way rather than payment by bank because it takes too long for dealing with bank process. However, they lost .1% of wage to the receipt buyer.

Table 7: Cost and Benefit for Collector

Items	Expenditure (Riels/kg)
Dry Maize	1,000
Labor	35
Truck	35
Receipt Cost	12
Fuel	9



Items	Expenditure (Riels/kg)
Bag and Plastic	8
Driver	3
Road Payment	3
Stock Material	0.02
Cleaning Machine	0.00017
<b>All Expenditure</b>	<b>1,104</b>
<b>Sales Price</b>	<b>1,145</b>
<b>Profit</b>	<b>41</b>

#### ▪ Constraints

There are some challenges were employed in maize collecting stage of collector. Timing of cash receives after selling is the one of issue. Collector must wait for a week to get the cash after sell to factory while farmer need money in agent after they sell their maize. In order to get money quick to respond for farmer need, some collectors access loan from the bank, Aceda and Amret, or from money lender with the interest rate of 1.4%/month, 1.6%/month and 0.1%/3day, respectively, due to they are lack of capital. Some collectors they sell their recipe that got from factory to sell to money lender to get money on the day with the interest rate 10-15 Riels/kg. Therefore, collectors are lack of drying machine to dry grain. There is only one collector who has drying machine in the district. Most of collectors dry their grain under sunlight conventionally. It is the main cause to effect on grain quality, particularly in rainy season. The most difficult period ranges from July to September due to heavy rain come. As the result, the grain has low quality which not meet factory requirement. Moreover, labor force is also a main challenge happened with collector. Some collectors decide to decrease the buying volume due to lack of labor force. There is also unofficial charge along the transportation and borer gate. There is no official check point at the border gate.

#### 4.3.1.4. Processor

Processor plays the important role in marketing system in determining the higher price compared the selling at the border gate to Vietnam. At least 7 factories buy grain of maize for the animal feed process in Cambodia. Four of them are the biggest companies: CP Cambodia, Green feed, FCF and Agri Master. They are three in Phnom Penh, two in Kompong Spue

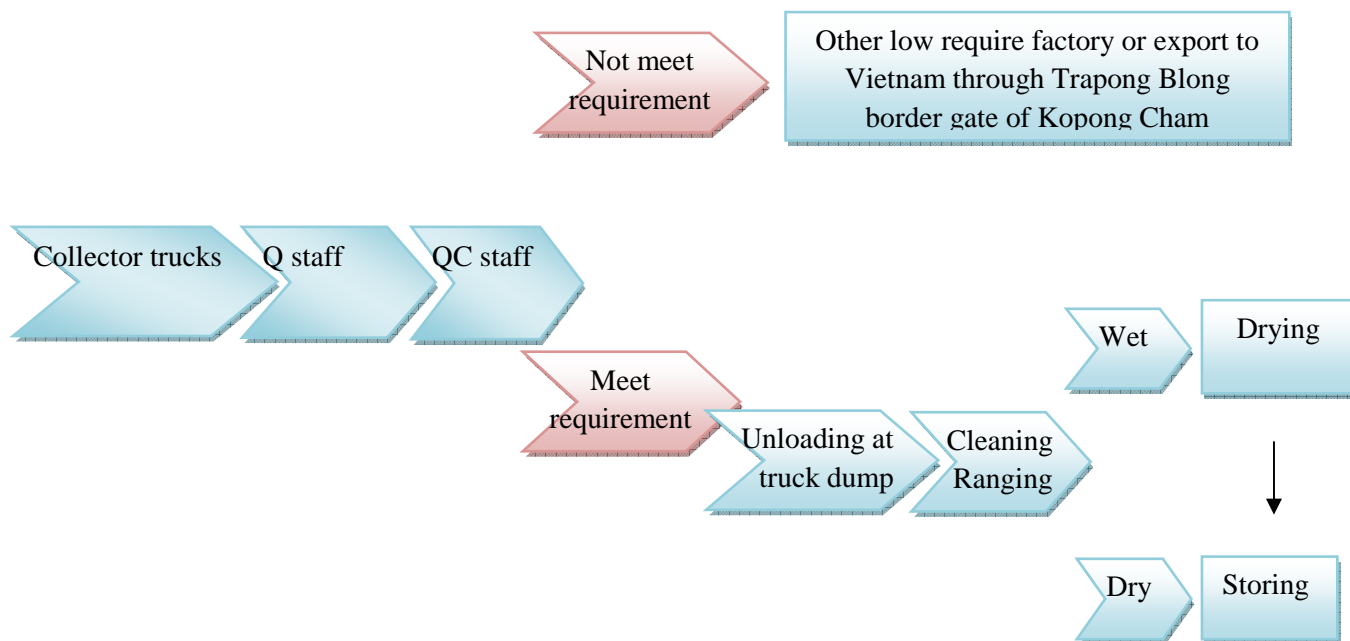
province, one in Kompong Cham and other one factory locate in Kandal province. However, only CP Cambodia factory was selected for interviewing due to time is too limited and it is very difficult to deal with them. CP is the biggest factory with the land size of 9 ha that has bought much amount of maize grain in Cambodia. This company offers the higher price with the dry grain, at least 14% moisture, the collectors said. However, high demand of quality is much needed; the only high quality is accepted.

According to the information from marketing manager in CP Company out of 24, only 6 provinces are main supplier. They are Kandal, Kompong Cham, Battambang, Pailin, Pursat and Kompot provinces. Kandal province contributes around 15% to CP.

Table 8: CP Supplier Calendar a Year

Months	1	2	3	4	5	6	7	8	9	10	11	12
Provinces												
Kandal		_____					_____					
Kompong Cham	_____					_____						
Battambang						_____						
Pailin						_____						
Pursat						_____						
Kompot								_____				

The five concrete criteria have been set to monitor the product in quality laboratory. 1) the rate of Alphatoxin content in maize grain is less than 200 ppb, 2) color of maize grain is a good color, dark yellow and red color 3) uniform grain size, 4) the grain must be clean enough (without contaminate with soil or dirty things), 5) moisture content is less than 14%. The standard of grain was divided into 5 categories, number 1, number 2 number 3, number 4 and number 5. The number 4 and number 5 can't be accepted. However, Cambodian maize grain has never met the number 1. All suppliers have to have the product that meet the quality requirement otherwise QC department will reject then supplier can sell their maize to other factories that have lower standard. The last option is export to Vietnam with the low price.



Trucks of supplier are waiting in front for label from security guard(Q staff)	Q staff provides label for entrance	Q staff collect sample 30% and bring to laboratory to test the quality and appearances	Weighed on the scene and move forward for unloading from truck.	- Purchase department issue the invoice - Trucks move to truck dump place to be unloaded -Trucks move to reweight the truck weight - Purchase department issues the bills providing invoice to pay money after seven days via Acleda bank (supplier pay for transfer fee).	- Cleaned and ranked through this process. Grain was divided into different classes	-Stocking in container with volume of 4000 tons/container in warehouse - Storing for 6 months with the good condition and pesticides control
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Figure 17: The Process of Maize Supply to Factory

▪ **Labor Use**

All staff is full time job. There are total 200 officers working in CP. About 50% of labors source were from local area nearby the factory side while the other 50% of labor comes from different province namely Takeo and Kompong Spue provinces.

- **Processing Capacity**

The demand of maize need depends on price of raw inputs, maize and cassava competition, and season. The price of cassava up, so the requirement volume of maize will increased. Over 40% of raw inputs of feed come from maize. In general, CP buys 100 tons daily, but demand increases in August to September up to 800 tons/day. Annually, CP absorbs maize 120,000 tons and produces feed about 250,000 tons per year.

- **Constraints**

There is no any serious challenge occur in processing stage due to CP has ability and experience to manage the risk and human resource well since 1998 (factory established). However, in last few years CP faced the problem with lack of raw material for processing due to natural disaster (flood) in Cambodia. Factory need to import maize and other raw material from nearby countries, Thailand and Vietnam, with higher price than local price. Competitive of growing crop is also the challenge for the processor. This year farmer tends to grow cassava since there is good price comparing to maize. The changing make farmer tend to decrease the maize cultivation area. As the result, the supply of maize is going to decrease. Moreover, there are feeds were exported in informal way throw border without any registry license. By this way, the price of these feed is cheaper than local feed and could not compete with imported feed.

#### **4.3.2. Product Flow**

Farmers sell maize directly to collector then it circulates to Vietnam about 80% and local factories about 20%. Vietnam buyer normally bought maize in wet and low-quality grains since it is the prefer of farmer to do so. It is informal business as there is no regulation or rule. The Vietnam collectors come and collect product in 1-2 days then return their home country with the products. It is known that the product is dried immediately after arriving Vietnam side. Also, the product is sold to second buyer as outside-country exporters. CP was received products from local collectors that buy from farmer and primary collector. Also, other

factories such Green Feed, FCF and Agri Master are the buyer of maize farmers equal to 10 percent. The local collector shares its product to local factories 64% and Vietnam 36%.

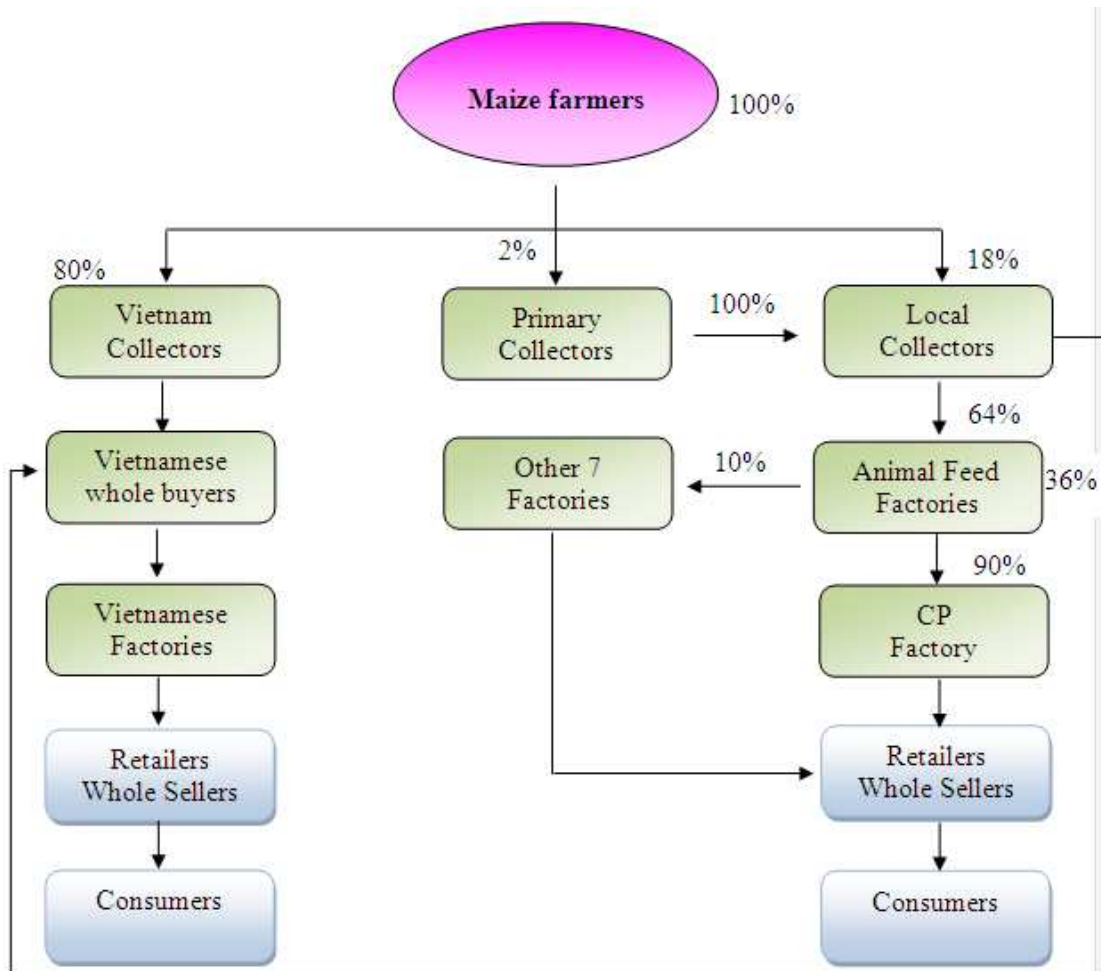


Figure 18: Maize Volume Flow

### 4.3.3. Expenditure and Profit of Actor

Producer and collector actor were considered to calculate the expenditure, revenue and cross income while the processor was not analyzed due to lack of data. However, in a kilogram of grain maize, farmer spends 516 Riels, revenue 810 Riels and cross income 294 Riels while the collector spends 1104 Riels, revenue 1145 Riels and cross income only 41 Riels. According to these data, it looks farmer get more profit than collector between 294 Riels and 41 Riels/kg of grain maize.

In contrast, farmer may get less profit than collector due to farmer meet many risks at production stage and produce less amount of maize while collector can buy grain much more almost a year with a little risk.

Table 9: Expend and Cross Income of Actors in kg of Maize

Actors	Expend (Riels/kg)	Selling Price (Riel/kg)	Profit (Riels/kg)
Farmer	516	810	294
Collector	1,104	1,145	41
Processor	n/a	n/a	n/a

#### 4.3.4 Relationship and Linkages

There is relationship between the different actors within the chain. Farmer has relationship with input provider, collector and processor. At production stage, before farmer decides to select type of seed to grow, farmer usually asks information about the type of seed and chemical from other farmer in the area and chemical shop dealer that promoted by company. They get the information about technical how to use chemical from the shop. Most famers also get agricultural inputs, seed, chemical and fertilizer in kind of loan from the chemical shop dealer and they will payback when harvesting in four months. Moreover, some rich farmer they access credit from bank or microfinance by paying interest monthly for their production. Famers also receive agricultural training a few times a year from seed company, NGO (world vision) and extension. In addition, collector is the only actor to inform the price and buy the grain from famer. The quality standard need of processor or exporter was also transferred by collectors. Collectors come to producer's house to check the quality, set the price and date to thresh. By the way, they also provide some money in advance to producer to book the product.

Table 10: The Relationship and Linkage between the Actors

	Farmer	Collector	Processor
Farmer	- Asking each other about seed, chemical and price of grain	- Asking price of grain - Asking for quality requirements	- No relationship/linkage

<b>Collector</b>	- Collect maize	- Compete with each other	- Supply grains
	Inform market price		
	Quality check	- Sometime they agree to	
	Inform quality need	buy grain at low price	
<b>Processor</b>	-No relationship/linkage	- Quality check	- No relationship/linkage
		- Category the grain quality	
		- Processing	
		- Paying money to collector via bank	
<b>Service Providers</b>	- Provide loan and inputs in kind of loan	- Provide the loan (banks, micro credits)	- Provide loan (Bank/micro credit)
	- Provide technical knowledge, improve infrastructures		

#### 4.3.5. Rule and Regulations

There is no any registration license at department of commerce to become a collector. Also there is no any complicate in document operation at border check point. Most of commodities are cross border in informal way. Beside this, there is no requirement standard of grains to sell to Vietnam side through collector. Vietnam buyer offers to buy grain in wet form and do not strict with the quality requirement. A good quality grains are more expensive than a low quality standard. Hence, the price of the product fluctuates day by day or within the day. However, the local processors are strict with the quality standard particularly CP processor. Also the price of grain announce on information board once a week. There is no contract between collector, exporter and processor in term of volume. The processor does not limit either buying volume or number of suppliers. The only supplier who passed QC check point can be sold their grains. The processor consider on the rate of Alphatoxin less than 200 ppb, color of maize grain, uniform grain size, the grand must be clean enough and moisture content is less than 14%. The grains were divided into 4 difference categories.

#### 4.4. Constrains of Each Actor

There were some different problem faced occurs in each actor along the chain. The detail of constraint was shown in table 11.

Table 11: The Problem Faced in difference Actor

Actors	Constraints
<b>Farmer</b>	<p>There are many constraints which occurred on maize production namely seed quality, pest outbreak, flooding disaster, lack of labor, lack of capital, price of agricultural input, high of interest rate and the fluctuation of maize price. However, only a few problems that most serious and happened in their production. Most of producer, 42%, faces the serious problem with price fluctuate of maize. Furthermore, over 70% of respondents were lack of market information access in their location. Also, the limitation of government service providing the technical advice and marketing of crop is the one of main challenges for their maize crop</p>
<b>Collector</b>	<p>There are some challenges were employed in maize collecting stage of collector. Timing of cash receives after selling is the one of issue. Collector must wait for a week to get the cash after sell to factory while farmer need money in agent after they sell their maize. In order to get money quick to respond for farmer need, some collectors access loan from the bank, Acleda and Amret, or from money lender with the interest rate of 1.4%/month, 1.6%/month and 0.1%/3day, respectively, due to they are lack of capital. Some collectors they sell their recipe that got from factory to sell to money lender to get money on the day with the interest rate 10-15 Riels/kg. Therefore, collectors are lack of drying machine to dry grain. There is only one collector who has drying machine in the district. Most of collectors dry their grain under sunlight conventionally. It is the main cause to effect on grain quality, particularly in rainy season. As the result, the grain has low quality which not meet factory requirement. Moreover, labor force is also a main challenge happened with collector. Some collectors decide to decrease the buying volume due to lack of labor force. There is also unofficial charge along the</p>



Actors	Constraints
<p><b>Processor</b></p>	<p>transportation and border gate. There is no official check point at the border gate.</p> <p>There is no any serious challenge occur in processing stage due to CP has ability and experience to manage the risk and human resource well since 1998 (factory established). However, in last few years CP faced the problem with lack of raw material for processing due to natural disaster (flood) in Cambodian. Factory need to import maize and other raw material from nearby countries with higher price than local price. Competitive of growing crop is also the challenge for the processor. This year farmer tends to grow cassava since there is good price comparing to maize. The changing make farmer tend to decrease the maize cultivation. As the result, the supply of maize is going to decrease. Moreover, there are feeds were exported in informal way throw border without any registry license. By this way, the price of these feed is cheaper than local feed and could not compete with imported feed.</p>

## 5. Conclusions and Recommendation

### 5.1. Conclusions

The research finding makes out the exiting maize cropping system in the area. The actors: farmer, collector and processor were conducted in-depth interview. It is an information flow showing a system of maize management, mapping. Also, constrains and problems faced of maize production and its marketing were analyzed to find out the market system.

In put suppliers that farmer usually use rely on chemical shops. This mean that farmer don't get the products directly from company but the middlemen. Seed and chemical pesticide were directly recommended to culture seasonally. It is 80% farmer receives information of using pesticide, and variety from the seller while 4% get from company and 12% get from farmer. Maize production is the core and very important for living standard in this area. It is very natural for using maize products for selling, animal feed (bark), and burning fuel.

Farmers sell directly to middlemen and payment will be done around 3-7 days later. Then the middlemen distribute 79% to Vietnam, 05% in local farmer, 20% in-country factories. The

price is set by the collectors with net profit 50% if they sell to the CP as it is the first option and only the quality product can be sold. The last option will be exported to Vietnam with the lower price.

The Maize cultivation land is 1.50 ha (Mean) in dry season it decreases to 1.37 ha (mean) in rainy season. Farmer can access to the main credits such as bank, micro finance, chemical shop and others with the percentage of 18%, 11%, 67% and 4% respectively. Mostly the high income farmers access to bank or micro finance while the lower one go to chemical shop with higher interest.

There were many actors involved within the maize value chain, downstream input suppliers and upstream collector, processor. Leuk Daek district contributed nearly 39% of cultivated area out of Kandal province. Maize farmers tend to practice mono cropping of maize production. The only 29% of maize farmers that conducted mixed crop and crop rotation practice with mungbean, sesame and rice with the water source from digging well and Mekong River through bridge.

Furthermore, some challenges were attended in production stage. They are seed quality, high price of inputs in-kind loan with chemical shop, borer outbreak, flooding, the fluctuation of maize price, lack of market information access and the limitation of government and extension service providing.

## **5.2. Recommendations**

Based on the findings, the following are recommended:

1. Effective group should be established to manage marketing system for both inputs and outputs, which will be benefit farmers by receiving more appropriate prices from increasing of bargaining power, and reducing the cost of inputs from collective buying inputs.
2. The extension agency services should be improved in each village. This sector would provide technical knowledge such pest control, chemical application, variety and marketing.
3. Flow of market information need to be improved widely rather than coming from collectors/middlemen only

4. Improve service of micro-credit providers to be easier to access with lower interest rate.
5. Government should encourage the private sector/ investors to invest in drying facilities and harvester machine.
6. Improve early warning system for farmers to be able to avoid or minimize the lost from flood.

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MINZAS program is a partnership program of Mekong Institute and New Zealand Embassy in Bangkok. The objective of this program is to enhance research capacity of young GMS researchers by providing a structured learning and field research application program for 36 master's degree students from provincial universities in Cambodia, Lao PDR, Myanmar and Thailand.

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The MINZAS Program is designed for 3 cycles; each cycle lasts for one year with 4 phases:

- Phase One: Training on Research Methodology
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MI's learning programs services caters to the capacity building needs of current and future GMS leaders and policy makers on issues around rural development, trade and investment facilitation, human migration, with good governance and regional cooperation as cross cutting themes.

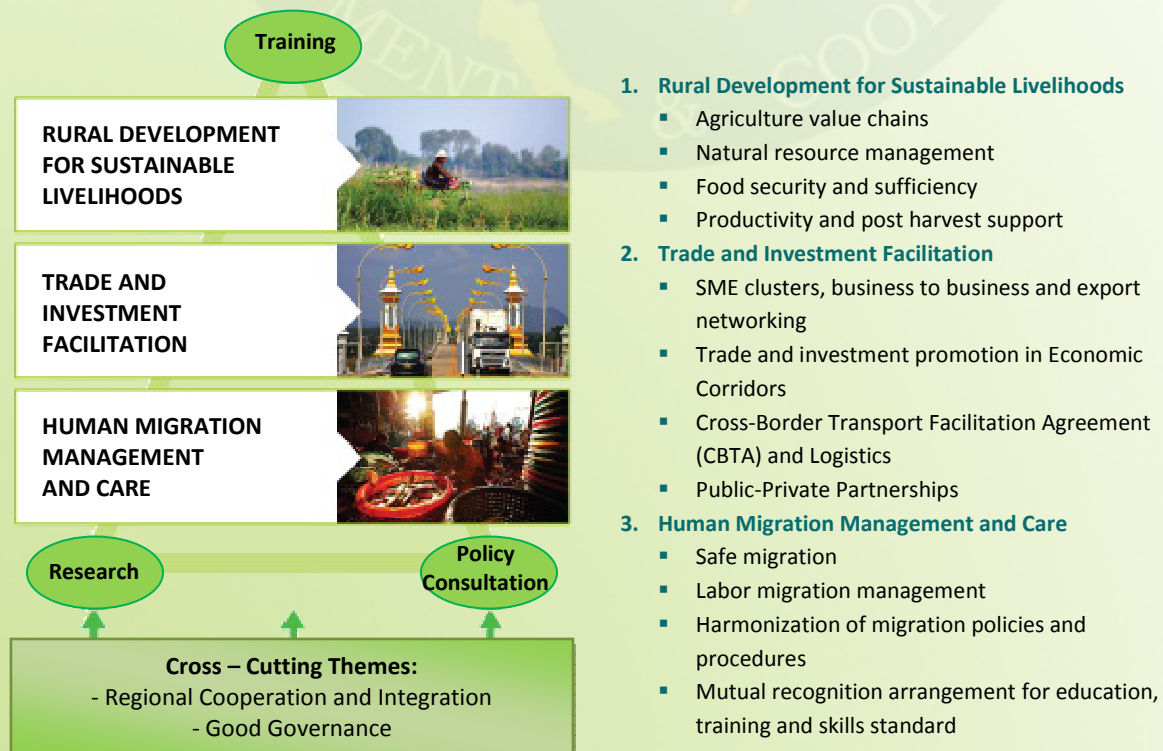
## Vision

Capable and committed human resources working together for a more integrated, prosperous, and harmonious GMS.

## Mission

Capacity development for regional cooperation and integration.

### MI Program Thematic Areas



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# Mekong Institute

Research Working Paper Series 2014



**NEW ZEALAND**  
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This publication of Working Paper Series is part of the Mekong Institute – New Zealand Ambassador’s Scholarship (MINZAS) program. A collaboration project between New Zealand Embassy in Bangkok and Mekong Institute aims to bring forth the research development within the Greater Mekong Subregion (GMS) through educational provision that will be given to 36 master’s degree students from Cambodia, Lao PDR, Myanmar and Thailand (2012 - 2014).