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Master's Thesis

The Impact of Microcredit on Rainfed Lowland Rice Production in the Northwest of Cambodia

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Assignment

Declaration

I hereby declare that this thesis entitled “The Impact of Microcredit on Rainfed Lowland Rice Production in the Northwest of Cambodia” is my own work and all the sources have been quoted and acknowledged by means of complete references.

In Prague on 24 April 2017

Touch KHIEV

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Abstract

The absence of capital and access to credit is one of the key financial challenges for Cambodian rice farmers who mainly depend on rainfed lowland rice production as their source of livelihood. In the context of developing countries, sources of credit have clearly been identified as a tool to contribute significantly for improving agricultural production. The main objective of the study was to evaluate the impact of microcredit on rainfed lowland rice production in Battambang province, Cambodia. A sample size of 120 farmers out of which 60 farmers each were borrowers and non-borrowers of credit based on purposive sampling method. Afterward, the snowballing method was employed during the interviews through structured questionnaire, while focus group discussion was also conducted. The gross margin analysis was applied to compare the average gross margin of rice farmers, while t-test was used to investigate the impact of microcredit on rice production. The study showed that microfinance institutions were the common source of credit for rice farmers in the region, while the next source was moneylender. Most of the rice farmers used credit for agricultural production purpose, and the rest of the credit often used for debt-servicing and household consumption during the offseason or fallow period. Women were the main actor within the households with respect to the loan initiative proposal for working capital and loan keeping. Furthermore, women played a major role in jointly making decision together with their spouse for using agricultural credit. Finding revealed that credit borrowers obtained higher gross margin and hence were more profitable (136.34 US$/ha) than non-borrowers (87.67 US$/ha). The t-test result showed that there was a significant difference in input usage and output among the borrowers and non-borrowers. This is partly because rice farmers who had access to credit have high ability to purchase farm inputs and improve their rice productivity. In addition, borrowers' recorded higher yield than their counterparts due to the intensive use of farm inputs. The study recommends that there is a need to be improved the credit system and should be made accessible to smallholder farming in order to increase output and income.

Keywords: Microcredit, Microfinance, Rice production, Battambang, Cambodia.

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List of the Abbreviations

ADB	Asian Development Bank
CARDI	Cambodian Agricultural Research and Development Institute
CDRI	Cambodia Development Resources Institute
CMA	Cambodia Microfinance Association
CSES	Cambodia Socio-Economics Survey
FAO	Food and Agriculture Organization of United Nations
GDP	Gross Domestic Product
GRiSP	Global Rice Science Partnership
MAFF	Ministry of Agriculture, Forestry, and Fisheries
MFIs	Microfinance Institutions
MRC	Mekong River Commission
NGOs MFI	Non-Governmental Organization Microfinance Institutions
NBC	National Bank of Cambodia
RGC	Royal Government of Cambodia
US$	United States Dollar

1 Introduction

Rice production is the backbone of agricultural sector growth in Cambodia. Cambodian cultivated areas are dominated by rainfed lowland rice which accounts for 82% that concentrated on around Tonle Sap Lake, Mekong River, and Bassac River (Sarom, 2007; GRiSP, 2013). The cultivation of early rice in rainfed lowland areas is the most common practice of Cambodian rice farmers in wet season. Rice is a crucial source of stable food to ensure food security for Cambodian people (Dalgliesh et al., 2016; Poulton et al., 2016). Royal Government of Cambodia (RGC) has paid particular attention to rice sector as a strategic commodity for strengthening the economic growth (RGC, 2014). Consequently, Cambodia had paddy surplus of about four and a half million ton in 2015 and exported rice milled to international market approximately half million ton in 2015 (MAFF, 2016). Factors associated with the increased rice production such as changed rice seeds from late to short and medium varieties; increase irrigated coverage and the expansion of cultivated areas (Theng and Koy, 2011). Nonetheless, there are some major constraints on rice production in rainfed lowland rice areas such as soil problem, water unavailability, pest, diseases, and limitation of irrigation, fertilizers, and a variety of new seeds adopted (ADB, 2012; Soeun, 2010; Sarom, 2007; Bell and Seng, 2004). Likewise, the lack of adequate and appropriate credit is also one of the keys financially challenges for the rice production in Cambodia (ADB, 2012). Cambodian rice farmers, who lack short-term working capital for rice production, are more likely to take microcredit from microfinance institutions or moneylenders. Because of credit sources may allow farmers to invest in supplementary irrigation, purchasing more agricultural inputs and improve farming technologies (Chea et al., 2004; Hasan et al., 2013; Girabi and Mwakaje, 2013). Therefore, microcredit is the primary external source of fund for rural households to invest in agricultural activities. Currently, there are many researchers pay attention to focus on the impact of microcredit on agricultural production, yet there is still not so many scholars to critically study the impact of microcredit on rice production in Cambodia. This study is designed to conduct the impact of microcredit on rainfed lowland rice production in Cambodia.

2 Literature Review

2.1 Agricultural Sector in Cambodia

The agricultural sector in Cambodia is not only the primary source of low-income households but also the backbone of the country's economy that contributed to GDP about 28.86 % in 2015 (MAFF, 2016). Moreover, it remains the largest share for labor force which accounts for 45.3%, compared to industry and services sector which were only 24.3% and 30.4% respectively in 2014 (MAFF, 2015). There are four main subsectors such as crop production, livestock, forestry, and fisheries. The composition of agricultural sector contributed by crop production was around 60%, while fisheries, livestock, and forestry contributed around 22%, 11%, and 7%, respectively (see figure 1). Likewise, the contribution of crop production to GDP was about 15.8% in 2015. It is therefore noticed that crop production still has a significant proportion of subsectors in agriculture either cultivation areas or production of the country (An and Culas, 2013).

Rice is the dominant crop among other crops including cassava, maize, mungbean, and soya bean for Cambodian rural livelihoods, and especially it is a strategic commodity for strengthening the economic growth, poverty alleviation, and food security (Yu and Diao, 2011). Consequently, Cambodia had paddy surplus of about three and a half million ton in 2009 which rose to more than four and a half million ton in 2015 (MAFF, 2016). This was due to the rice production associated with the expansion of cultivated areas (Theng and Koy, 2011). Due to this, the Cambodian government has adopted policy document on the promotion of paddy rice production and exportation of milled rice since 2010, to transform Cambodia into a "*rice basket*" and a major milled rice exporting country.

Despite the fact that Cambodia could have attained paddy surplus consecutively and self-sufficient in rice production, the productivity is still low because of its rice-based farming systems mainly subsistence oriented and heavily relies on rainfall pattern (ACI and CamConsult, 2006; An and Culas, 2013; Kleinhenz et al., 2013). Furthermore, Cambodian

farming systems widely associate with insufficient irrigation facilities and exceptionally low input, and this is due to their financial constraint (Mak, 2001; Frenken, 2012).

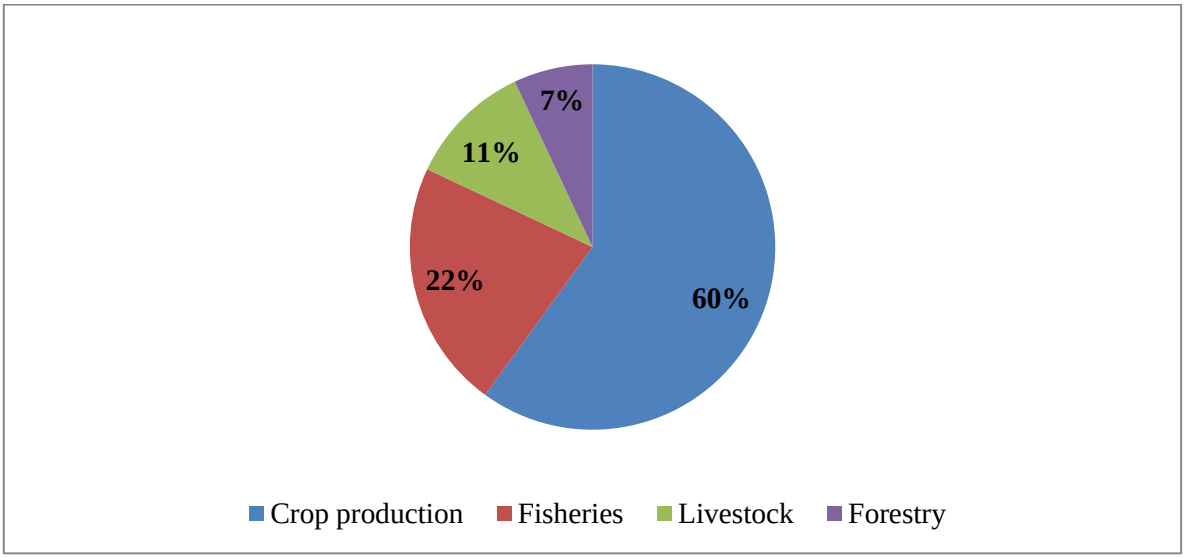

Figure 1: Composition of subsector in agriculture, 2015

Source: Ministry of Agriculture, Forestry, and Fisheries (MAFF, 2016)

2.2 Rice Ecosystems in Cambodia

Cambodia has tropical monsoon climates which have two distinct seasons namely the dry season and the rainy season (Frenken, 2012). The ecological zone for growing rice cropping has been allocated into four different zones such as (1) rainfed lowland rice zone, (2) rainfed upland rice zone, (3) deep water or floating rice zone and (4) irrigated dry season rice (Sarom et al., 2001; Sarom, 2007; ADB, 2012; GRiSP, 2013). The rainfed lowland rice of Cambodia represents 82% of the total annual rice cropping areas which is cultivated in all provinces, and it is concentrated on the flat plains areas around the Tonle Sap Lake, Mekong River, and Tonle Bassac River. Therefore, it is a major category of rice production in the country which has contributed significantly to boost the growth of Cambodian economy. The rainfed upland rice is cultivated in a small proportion approximately 2% of the total annual rice cropping (GRiSP, 2013; Frenken, 2012).

However, it has the potential for growing non-rice crops such as cassava, maize, mungbean, sesame, peanut and so forth (Belfield et al., 2013). Specifically, the rainfed upland rice zone is mainly found in the hill regions of northern and north-eastern of Cambodia (Sarom et al., 2001). The deep-water or floating rice area is grown around the slope of Tonle Sap Lake and other smaller lakes and stream where maximum water depth can reach from 3 to 4 meters (Sarom et al., 2001; GRiSP, 2013). The deep-water or floating rice zone where rice can be grown after the floodwater recedes or flow from the rice fields through tributaries into the lake and river. It is now mainly cultivated for water receding rice or recession rice and occupies approximately 4 % of the national rice land (Chea, 2014). The irrigated dry season rice zone, which entirely or partially irrigated, represents about 12% of the total cultivated areas (Frenken, 2012). The productivity of dry season rice is higher than wet-season rice thanks to the fact that its productivity associated with better water control, higher solar radiation during crop growth, and the development and cultivation of fertilizer-responsive modern varieties (Nesbitt, 1997).

2.3 Rainfed Lowland Rice Zone

The rainfed lowland rice ecosystems were divided into five sub-ecosystems such as (1) Rainfed shallow and favorable, (2) Rainfed shallow and drought-prone; (3) Rainfed shallow, drought and submergence-prone; (4) Rainfed shallow and submergence-prone; and (5) Rainfed medium deep and waterlogged (Khush, 1984; Mackill et al., 1996). According to Javier (1997) stated that the rainfed lowlands of Cambodia heavily rely on local rainfall pattern and runoff of water supply. Wade et al. (1999) confirmed that rainfall pattern is a major determinant of rice yield in rainfed lowland rice and other factors such as topography and soil fertility which can also contribute to affect grain yield and choice of cultivation of rural people.

2.3.1 Rice Growth Duration

In Cambodia, rice can be cultivated in both dry and wet season. In rainy season rice heavily relies on rainfall pattern, whereas dry season rice depends on full or partial supplementary irrigation (Sarom, 2007). The paddy varieties in Cambodia have classified into three such as short-term rice, medium-term rice, and long-term rice (Kula et al., 2015). The growing period of short term rice is about 100 days; mostly farmers grow two times per year. The first growing is cultivated in June and harvested in August or September, and the plantation of the second growing will be in September and harvested in November. The duration of growing medium-term rice is about 120 to 140 days. Farmers can start planting in the middle of July and harvesting during November. For long-term rice, the period of its production is about 160 days; farmers start planting in July and harvesting in November.

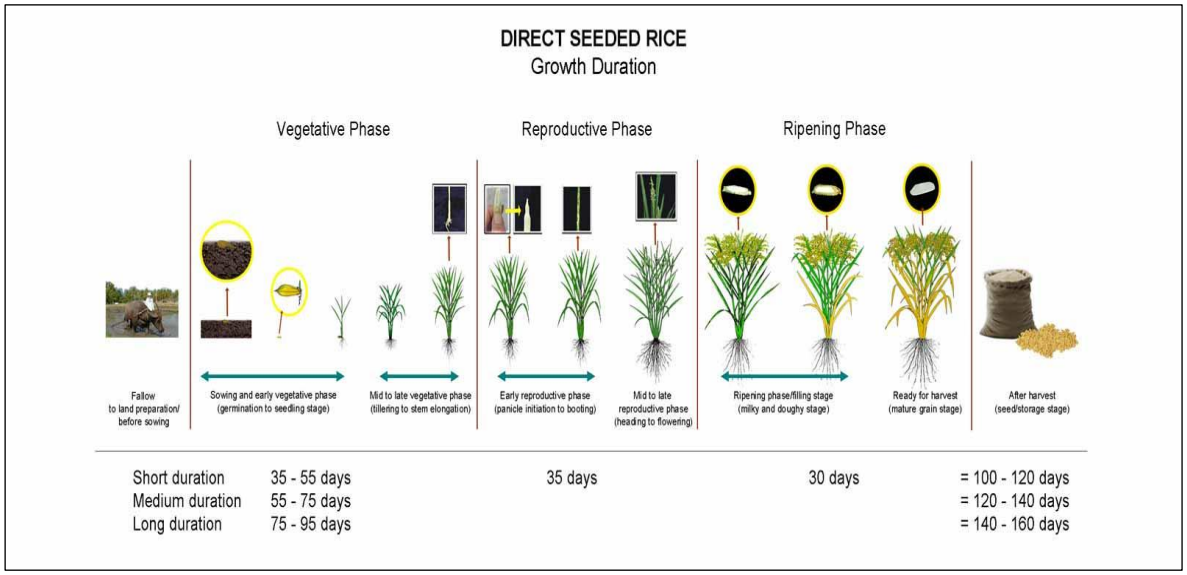

Figure 2: Crop calendar for growing rice

Sources: Rice Knowledge Bank, 2017.

2.3.2 Rice Production

The rice production is a vital source of stable food and the food security of Cambodian people (ADB, 2012; Poulton et al., 2016; Dalgliesh et al., 2016). Rice production has the highest proportion in total cultivation area approximately 3.05 million hectares, while the total rice production in 2015 was around 9.3 million tons (MAFF, 2016). Even though the agricultural sector has dramatically decreased into Cambodia's economy, the average yield of the national rice crop histrionically increases from year to year (see Table 1). The increase rice yield could contribute to many factors including favorable weather condition, technology improvement, fertilizers, seeds, soil improvement techniques, and especially the adequate and appropriate agriculture credit (CDRI, 2011; ADB, 2012). For comparison, Cambodia's rice yield remains below the level of rice yield in Thailand and Vietnam (Yu and Diao, 2011). According to World Bank (2015) rice yield in Cambodia was around 2-4 tons per ha, compared to better growing areas of the neighboring countries such as Thailand and Vietnam were around 5.7 t/ha and 6-7 t/ha, respectively. The intensity of inputs utilized can lead to higher returns to production (ADB, 2014).

A recent study, Rio et al. (2013) reported that gross margin per hectare with labor cost of rice production in Cambodia was to be 137.90 US$, while the variable cost of production was 549.6 US$/ha. They further confirmed that the higher yield of rice in the region was approximately 2.71 t/ha owing to the strategic of using new seeds and best timing for cultivation. According to Theng et al. (2013) who studied the comparison with treatment groups and control groups of rice farmers in four provinces namely Pursat, Battambang, Siem Reap, and Kompong Thom under Cambodia HARVEST program. They indicated that the rice farmers in the treatment group produce higher yield (2.5 ton/ha) than rice farmers in the control group (2.4 ton/ha) in 2012. World Bank (2015) conducted a survey to compare the gross margin of rice in wet season between modern farmers and traditional farmers based on the basic criteria such as used improved seeds, fertilizers and chemicals, mechanization, and irrigation. The results found that gross margin per hectare of modern farmers were higher (399 US$/ha) than traditional farmers (178 US$/ha). However, modern farmers had higher expenditure on fertilizers (99 US$/ha) and lower expenditures on labor

forces (130 US$/ha), compared to traditional farmers were expense on fertilizers costs approximately (5 US$/ha) and 259 US$/ha for labor forces. Thomas et al. (2013) indicated that applying more nitrogen fertilizers can increase the rice yield in the wet season. According to An and Culas (2013), the greater rice yield of indirect seeded cultivation is due to appropriately fertilizer application. However, rice producers in Cambodia had higher expenditure on harvesting and threshing activities, fertilizers, seeds, pesticides, herbicide, while the price of paddy rice at farm gate was low (MRC, 2014). The farm gate price of paddy rice in Cambodia was about 240 US$/ton for wet paddy, low compared to neighboring countries like Thailand's 376 US$/ton (World Bank, 2016) and Vietnam's 287.1 US$/ton in 2015 (FAOSTAT, 2017). The higher price of paddy rice at the farm gate has encouraged rice farmers to produce more rice and expand their production (Sophal, 2008). In Myanmar, Nan Wutyi et al. (2013) calculated the gross margin on rainfed lowland rice production by the comparisons of three groups of farmer such as small-scale farmer, medium and large farmers. Results showed that gross margin of small farmers were higher (106.23 US$/ha) than medium (100.55 US$/ha) and large farmers (75 US$/ha). The study also revealed that most rice farmers were characterized by expenditure on labor which highly contributed to total variable cost in the study areas. Vietnam has potential on the agricultural sector and its rice yield is higher price compared to neighboring countries like Cambodia, Laos, Myanmar, and even in Thailand. In addition, the gross margin per ha of paddy rice production in the Mekong Delta in 2012 were also more profitable which accounts for 17.26 (mill. VND) ≈ 761 US$, higher than Cambodia in 2012 were 245 US$/ha and Myanmar were about 114 US$/ha (World Bank, 2016). In Thailand, Kaitpathomchai (2008) calculated the economic efficiency of rice production by comparison between rainfed rice and irrigated rice. Results show that the gross margin of rice production of rainfed rice was 6,676.04 THB/kg (194.35 US$), which was relatively lower than irrigated rice 9,227.59 THB/kg (269 US$).

Table 1: Rice Production, 2011 – 2015

Description	2011	2012	2013	2014	2015
Cultivated Area (ha)	2,968,529	3,007,545	3,052,420	3,055,507	3,051,412
Harvested Area (ha)	2,766,617	2,980,297	2,968,967	3,028,836	3,025,630
Yield (Ton/ha)	3.173	3.117	3.163	3.079	3.085
Production (Ton)	8,779,365	9,290,940	9,389,961	9,324,416	9,335,284
Rice Surplus (Million Ton)	2,780,328	3,031,017	3,090,452	3,013,783	2,975,809
Paddy Surplus (Million Ton)	4,344,263	4,735,964	4,828,832	4,709,036	4,649,702

Source: Ministry of Agriculture, Forestry, and Fisheries (MAFF, 2016)

2.3.3 The Constraints of Rainfed Lowland Rice Production

The majority of cultivated areas of cropping systems, more than 80%, are dominated by rainfed lowland rice areas that concentrated on around Tonle Sap Lake, Mekong River, and Bassac River (Sarom, 2007). Wang et al. (2012) provides evidence that the leading producer of rice in rainfed lowland areas finds in particular provinces such as Battambang, Pursat, Kompong Thom, Prey Veng, Takeo and Kampot province. There are some researchers found the major constraint of rice production in rainfed lowland in Cambodia. According to Zeigler and Puckridge (1995) cited by Wade et al. (1999) asserts that the primary constraint to the productivity of rainfed lowland rice areas is the soil chemical imbalance, soil problem, uncertainty in water availability, socio-economic reason, and the use of limitation of fertilizer. Similarly, Bell and Seng (2004) on the study of rainfed lowland rice-growing soils of Cambodia, Laos, and North-east Thailand revealed that the limitation of rice yield in the early wet season and dry season rice thanks to the fact that the loss of soil-water saturation and soil fertility. Thus, soil problem and rainfall variability are the key issues that associated with low productivity in Rainfed lowland (Soeun, 2010). Sarom (2007) mentioned that the low productivity not only caused by soil problem, water unavailability, and limitation of fertilizer but also pests and disease, and a variety of seed. According to Javier (1997), the low yield of rice firmly link to sources of credit because credit facilities hinder the hiring of labor and purchase of farm inputs. Likewise, among the constraints to rice production in Cambodia, the lack of access to inputs and credit is also the

main obstacles for Cambodian farmers. Because of credit source may allow farmers to invest in supplementary irrigation; for example, buying a pump, installing a tube-well, and buying fertilizer inputs (Chea et al., 2004). Thus, it is clear to mention that Cambodian rice farmers confront with many problems such as the lack of purified seed; lack of access to commercial credit; high-interest rate; limitations of irrigation; and high costs of energy, fertilizer; pesticides and herbicide (ADB, 2012).

2.4 The Concept of Microcredit

The terms of "microcredit" and "microfinance" have often misconceived, and some scholars have used interchangeably. Distinguishing between microcredit and microfinance definition is imperative. The Food and Agricultural Organization (2000) of the United Nations has tried to describe the term of microcredit as a small loan which is intended to benefit low-income household and marginalized group of the borrower by offering collateral free loan through microfinance institution and non-organizations (NGO) that can help them move out of poverty. Likewise, Carpenter (1996) has defined the microcredit in the context of developing countries such Asia, Africa, and Latin America that microcredit is a small loan of credit which is underneath 25,000 US dollar in credit or financing. According to Nobel Laureate Professor Muhammad Yunus, who a founder of Grameen Bank and a global leader in the fighting against poverty, has used the term microcredit mean to agricultural credit, rural credit, cooperative credit, consumer credit, credit from the savings and loan associations, from credit unions, from money lenders. He also suggests classifying microcredit as traditional informal microcredit including moneylender, friends and relatives, and Traders, and agricultural credit through specialized bank as well as another type of NGO microcredit. By contrast, Microfinance is the provision of a wide range of financial services including loans, deposits, payment services, money transfer, and insurance to poor and low-income households and especially self-employed, to enable them to boost their income levels and improve their living standards (ADB, 2000). Additionally, microfinance services are provided by (1) formal institutions such as microfinance institution (MFI), rural bank; (2) semiformal institutions such as non-government organization; and (3) informal microfinance provider such as moneylender, rotating saving

and credit association. To simply put, microcredit is single service of microfinance that refers to a small loan, while microfinance is a broad range of financial services such as deposit, saving, insurance, and loan.

In this study, the microcredit is the main concept used for the impact on rice production thanks to the fact that microcredit means to agricultural credit and rural credit. Specifically, microcredit program has designed for poor households who unable to access financial service and to increase poverty alleviation and fix credit market imperfections (Bauer et al., 2012). Microcredit program has been designed in a way to reach the poor who have left out the formal financial systems and provided a small amount of money to the poor, so as to generate self-employment in income-earning activities (Khandker, 1998).

Table 2: Characteristic features of microcredit

Lending	Borrowers
Small Loan Sizes	Poor
Little or no collateral required	Predominantly female
Little or no collateral required	Predominantly female
Non-credit services offered	Low education levels
Regular loan payment	Geographical remoteness
Peer group liability	Few assets
Donor-funded	Agriculture-related occupations

Source: FAO, 2000

2.5 Microcredit in Rural Cambodia

Like in many developing countries, rural credits markets in Cambodia are divided into two forms of credit sources such as formal and informal. According to Pide (2012) has defined informal sources refer to a loan taken from relatives, friends, neighbors, and private moneylenders, while formal sources refer to credit taken from banks, microfinance institutions, and microfinance NGOs. Practically, Cambodian farmers often use both

sources of credit for their household strategies. According to National Institute Statistics (2015) reported that majority of agricultural households, who live along with Tonle Sap Lake Zone, relies on a source of credit from MFIs approximately 31 %, while the next sources of credit were from moneylenders which account for 21 %. Similarly, borrowers in Peru, usually access to various sources such as informal loan (85%) and formal loan (95%) to mainly invest in agricultural production (Guirkinger, 2008). In Nigeria, the most popular sources for agricultural production were from informal sources such as co-operative society (84.7%), friends and relatives (63.5%) that were closely followed by traditional saving association (60%), while (33%) were from moneylenders (Adebayo and Adeola, 2008). The credit has been used not only for livelihood investment but also for weathering socks such as crop failure and health treatment as well as addressing consumption shortages due to income fluctuated (Pide, 2012). Bylander (2015) also reports a similar experience from Siem Reap province, Cambodia where her study found that about 27.5 % of loan size used for agricultural activities, while loan used for consumption were around 14% and about 18 % for service existing debt.

In Cambodia, there are two forms of borrowing from formal institutions consisting of personal lending and group lending scheme. First, group lending scheme is required to create a group approximately from 3 to 5 members and based on the principle of joint liability through peer pressure (Khoi et al., 2013). According to Ghatak and Guinnane (1999), the joint group liability is necessary for either credit provider or borrowers thanks to alleviating the problem such as moral hazard, costly audit and enforcement from the poor borrower who unable to payback, and also help the borrowers who lack collateral. Second, personal lending scheme widely practices in rural credit market in Cambodia where formal credit institutions provide for who have more collateral or have the ability to payback (CDRI, 2012; Bylander, 2014). Interestingly, the nature of informal lenders charges interest rates are higher than the formal providers. For example, interest rates on moneylender usually charge around 10 % per month, while interest rate charged by formal credit institutions hover around 2 to 4 % per month (Bylander, 2014). According to report of the national data of Cambodia socio-economics survey (CSES) reported that the average

monthly interest rate charged by moneylenders (5.5%) were higher than NGOs microfinance (2.6%), and microfinance institutions (2.6%) in 2014.

Both formal and informal credit providers are actively involved in rural credit market of developing countries (Khandker and Faruqee, 2003). In general, poor farmers confront a reality about of accessing to formal credit, in particular, commercial bank or microfinance institutions because of the lack of collateral (Khoi et al., 2013; Khandker and Faruqee, 2003). Similarly, formal credit institutions in developing countries frequently finance only a small portion of small farm finance flow (Von Pischke, 1974). Due to this, poor farmers are more likely to borrower money from informal sources. Thus, it can be concluded that the coexistence of both formal and informal credits system plays a significant role in rural household economics.

2.5.1 Moneylender, Relatives, and Friends

Notwithstanding many microfinance institutions (MFIs) and NGOs microfinance is widespread for actively providing a loan to the rural poor, the conventional and traditional informal credit systems such as moneylenders, relatives, and friends, are still commonly practiced and continue to be considered as main sources of rural credit in many developing countries. The feature of moneylender can describe as a small loan, unsecured, short in the majority, flexible for payment, free collateral and high-interest rate (Mallick, 2012; Bylander, 2014; Kislat, 2015). The interest rates charged by moneylenders may exceed 75 % per year, and in some period credit is unavailable at any price (Hoff and Stiglitz, 1990), while Siamwalla et al. (1990) have observed that the high-interest rates attribute by many to the monopoly power of the village moneylender. Nonetheless, Sinha and Martin (1998) report that about 87 % of rural households in northern Bangladesh, most of them were used the loan from moneylender for primarily purpose such as consumption and loan repayment. Several studies indicated that those informal loans are mostly used to smooth consumption strategy and pay back previous debt, while formal loan primarily uses for agricultural production (Khandker and Faruqee, 2003; Barslund and Tarp, 2008; Yadav et al., 1992; Zeller, 1994). This is because of rural poor may occasionally confronting with short

consumption crises and other basic-needs (Zeller et al. 1997). Thus, it is important to mention that credit from moneylender still plays a major role in the provision of consumption and still continue to enjoy great popularity in developing countries (Kislat, 2015; Yadav et al., 1992). On the other hand, borrowers assort to moneylender because of formal credit has probably failed in loan disbursements such as an inadequate supply seasonal loan, and the short-term of repayment schedules after borrowing (Mallick, 2012). In India, Rao and Priyadarshini (2013) found the relationship between rural credit and microfinance instead of informal sources of rural credit. However, they further added that the informal sources of credit remain a strong presence in the rural credit market.

2.5.2 Rural Credit Operator as NGOs

The nature of NGOs microfinance mainly leans on donor money and other kinds of subsidized funding. For example, international firms or international non-governmental organizations in which strongly provide either technical or financial support for building and credit for revolving fund (Mersland and Urgeghe, 2013); likewise allowed to delivering a single service as a credit to group farmers in rural areas (D'Espallier Bert et al. 2017). However, NGOs microfinance in Cambodia, as well known as rural credit operator, was typically established by international NGOs or group of rich people, so as to operate or provide a small loan to the poor people. The National Bank of Cambodia reported that there are currently about 170 NGOs, as rural credit operator, supplying credits in the countryside of Cambodia. Therefore, NGOs microfinance can be a key player in the field of microcredit which actively providing a loan to the poor people who unable to borrow from the bank or microfinance institution. The interest rates charged by NGOs microfinance around 2-4% per month regardless of the negotiation between lender and borrower, so as a result of the interest rate per annum about 24% to 48% charge to borrowers (CDRI, 2012). Even though the interest rate charged by microfinance NGOs is slightly higher than microfinance institutions (MFIs) and Banks, It is still considered the important source of rural credit.

2.5.3 Microfinance Institutions

The term of microfinance was quickly spread through international NGOs to Cambodia after the Paris Peace Accords in 1991, with the aim of formally given credit to the rural poor household (NBC, 2007). Over the year, the financial service was incorporated by international NGOs and Local NGOs to provide actively and directly credit to people all over the country. At the time, the Cambodian Government has clearly acknowledged microfinance as actively development tool to fight poverty alleviation and to upgrade the people's living standard so as to greatly contribute to developing the national economy. Likewise, Ledgerwood et al. (2013) have asserted that microfinance is the main sources of low-income household who mainly associate with agriculture to increase their income, food security, and create more job opportunity.

Today, Cambodia's microfinance sector has grown rapidly over the past decade. The continuing of success several years of Cambodian microfinance institution mainly causes by stable economic growth which accounts for GDP growth around 7 per cents (Tahir and Tahrim, 2015). The wide range of rural finance services in Cambodia is microfinance institution (MFIs) which have officially obtained a license from national bank of Cambodia approximately 49 institutions with 2 million borrowers and more than 1 million depositors (NBC, 2016). It is clear that a microfinance sector is an essential tool for helping people living in rural areas to access credit with reasonable interest rates and to fund their investments in agriculture.

Table 3: Total loans outstanding and borrowers of Cambodian MFIs

Outstanding Loan	2011	2012	2013	2014	2015
Amount in million USD	644.64	892.66	1325.20	2028.56	2293.00
Number of borrowers	1,151,339	1,316,265	1,565,526	1,779,171	1,789,283

Sources: National Bank of Cambodia, 2016

2.6 Role of Gender in Microcredit

Microcredit program designed for targeting low-income women now becomes a powerful tool for alleviating poverty in developing the world (Hashemi et al., 1996; Khandker, 2003; Pitt et al., 2006). Many of microcredit programs are specifically targeted for women probably because of women are more likely to be credit-rationed if compared to men (Fletschner, 2009), while Agier and Szafarz (2013) stated that men are richer than women in developing countries. Thus, it is important to highlight that the provisions of credit to women are wholly or partially reflected in credit-constrained, vulnerable group of women and have an inequality of decision making in the households. Goetz and Gupta (1996) assert that the proportions of women's loan are directly used and controlled by men and in some case by their male relatives, while women borrowers are a key player for paying back the loan. Similarly, White (1991) states that the higher amounts of money borrowed by women mainly invested for men's productive activities; for example, farming operations, and business purpose because men can undertake higher productivity activities. Indeed, Kabeer (2001) confirmed that the loan taken out by women; of course, they are more likely to share their loans with the men in the households.

Nevertheless, there are some reasons to point out the impact of microcredit could provide a positives impact and do empowerment women. According to Pitt and Khandker (1998) and Pitt et al. (2003) provide evidence that credit provided to women were more likely to influence than credit provided to men concerning specific indicators such as household expenditure, labor supply, assets, health status, and access to schooling. Likewise, D'espallier et al. (2011) confirmed that most of MFI's clients are female because they have good credit performance including had no problem repayment, good at credit risk, and fewer write-offs. On the other hand, women's participation in credits programs has a positive impact and could gain decision-making power in the household either practical or strategic gender needs (Fofana et al., 2015). Of course, provided credit to women not only could enable them to negotiate gender barrier but also build up their ability, improve their relatives position and more active involved in their community (Hashemi et al., 1996). They also further suggest that when women use the money for farming activities such as

poultry or livestock, women's financial control over-funded enterprises tends to be greater. Kato and Kratzer (2013) used quantitative and qualitative data to compare the women client of microfinance institutions (MFIs) and women non-client in three regions of Tanzania. Results showed that women access to credit enable them to gain the ability and right to make strategic plan in the household. They further revealed that women members of MFIs play important role in decision-making within the household and actively involved in the community. Similarly, Chandaroth and Liv (2011) also found that women client of MFIs are more active in their community than women non-clients. Moreover, they can bargain their position and right as well as the necessary decision making within the household greater than women non-members. This is clear that microcredits do employment the women.

2.7 Empirical studies on impact of microcredit on agricultural production

Many studies have been interestingly drawn out and believed that better access to credit, can help the rural poor household to improve agriculture production and living standard. They have conducted the research on the impact of microcredit in the different continent of the world. Due to the fact that sources of credits are significantly needed so as to meet production requirement such as purchasing fertilizers, improved seeds, supplementary irrigation, and especially machinery and so forth (Miller, 2011; Tran et al., 2014). However, there are still some researchers found the negative impact of microcredit on agricultural production.

2.7.1 The impact of microcredit on agricultural input and output

Duy (2012) examined the contribution of credit to rice production levels and production efficiency of Vietnamese farmers in the Mekong Delta. Results of this study showed that access to credit has a positive impact on rice production and production efficiency. He concluded that formal credit had a larger impact than informal credit on rice production. However, both formal and informal credits are still main sources of fund for many rural

households in Vietnam. Thus, access to credit has identified as a key factor for improving rice production.

Hasan et al. (2013) evaluated the effect of microcredit on agricultural output in rural Bangladesh. The results showed that microcredit has statistically significant impact on rice production of microcredit receiving. Moreover, microcredit could increase farm output approximately 15% when compared to non-beneficiary farmers in the study areas. According to Zuberi (1989) asserted that increase in agricultural output because of associated with the change in the amount of improved seeds and fertilizers expenditure. Therefore, microcredit was the main factor in determining the amount of seeds and fertilizers (Malik et al., 1991).

Das et al. (2009) used panel data at the district level to evaluate the impact of agricultural credit of agricultural production on various crops in India. Results showed that direct agricultural credit into farming activities have a positive impact on agricultural output. Their finding also suggested that the indirect agricultural credit also has an impact on output, but with a year lag. They concluded that agricultural credit still plays a major role in supporting and improving agricultural production in India. In Ghana, Nuhu et al. (2014) also evaluated the impact of microcredit on crop production of rice, maize, and groundnut. The results found that an increase of microcredit by 1 Ghanaian Cedi would increase crop production by 0.314 bags. They concluded that microcredit has a positive influence on crop production in Ghana.

Kyi and Oppen (1999) used stochastic frontier production function and technical efficiency estimation of irrigated rice in Myanmar. Their finding indicated that increase seeds use in rice production would have a significant role in increasing total output. An additional finding was that building human resources and extension knowledge are required to improve rice productivity. Similarly, Shah et al., (2008) found that the impact of microcredit on crop production of borrowers has significantly increased in yield of particular crops such as maize, wheat, potatoes, and apple. They further confirmed that this

is due to part of the utilization of credit for the right purpose which was only applied to crop production.

Wicaksono (2014) studied the impact of agricultural credit on rice productivity Indonesia by using the provincial panel data from 2001 till 2009 in 27 provinces. The regression analysis shows that credit has a positive impact on rice productivity. Indeed, rice productivity increase 1.2 per hectare was associated with increased 10 % of the agricultural credit. Moreover, educating farmers can be considered the main factor associated the increase in rice productivity.

Girabi and Mwakaje (2013) also investigated the impact of microfinance on agricultural productivity on selected crop sunflower and maize by comparison between credit beneficiaries and non-beneficiaries in Tanzania. Results revealed that rice farmers who had access to credit had higher agricultural productivity than rice farmers who do not. This is because rice farmers with credits are more likely to buy more farm inputs and improve farming technologies. Nonetheless, the results furthermore suggested that lack of information on credit, inadequate credit supply, and interest rates are a negative effect on small-scale farmers' access credits. According to Akinbode (2013) also found that credit user recorded greater yield and higher profit than that non-credit user which results to have stable food and food security. The study also suggested that age, education, gender and extension services were associated with access to credit for rice production.

In contrast to the results mentioned above, Khandker et al. (2016) using household panel data covering the period from 1991 to 2011 in Bangladesh found that there is no evidence of microcredit's impact on crop agriculture mainly because of household credit rationing in which lower contributed to access more inputs and technologies so as to improve agricultural productivity. The author further added that microcredit could only benefit to small farmers who associated with livestock activities thanks to the fact that require less landowning than cropping activities. Therefore, credit constrained is still the biggest problem for a small farmer to increase income across both agriculture activities and non-agriculture activities. Furthermore, small farmers who have less agricultural land have not

been well served by the formal credit institution, and those farmers are more likely to be credit constraints (Andrews, 2006; Tran et al., 2014). Khan et al. (2013) using the simple t-test analysis on the effect of agricultural credit on farm productivity as a case study in Lakki Marwat, KPK-Pakistan. The results showed that agricultural credit had no significantly impact on crop production and income of borrower farmers. Their results further revealed that only 12 % of borrowers had utilized credit for the right purpose, while 82 % of them have used credit for a mixed purpose such as agriculture use, household consumption, and so forth.

2.7.2 The impact of microcredit on farm income

Microcredit is widely acknowledged to be one of the important sources of low-income earners in many developing countries which enable them to increase their incomes (Miller, 2013). Serval studies have been showed that access to credit has a positive impact on household income (Teng et al., 2011; Sopheana et al., 2012; Wadud, 2013). Wadud (2013) compared the average income of control group and non-control group to find the impact of microcredit. Propensity score matching shows that microcredit not only a positive impact on agricultural production but also impact on farm income. This will significantly contribute to sustaining food security. He concluded that the average income of microcredit receiving was higher than that of non-receiving farm approximately 10%. It is a clear positive relationship between microcredit and farmer incomes. Teng et al. (2011) studied the impact of microcredit on household economics in Cambodia. Results indicated that credit users have better income and living standard than before. They further mentioned that due to income and households' asset growth such as motorbikes, Television, bicycle, telephone and agricultural equipment. Furthermore, microcredit could create more job opportunities, women empowerment, and improve living standard. Likewise, Sopheana et al. (2012) also indicated that microfinance significantly contributed to increasing farm income and household consumption. Therefore, access to credit could improve economic activities, especially improve farming technologies. However, the study suggested that some credit users have sold their land to repay the interest rate thanks to the fact that using inappropriate credit way.

3 Aims of the Thesis

The main objective of the study is to examine the impact of microcredit on rice production in Battambang province, Cambodia. Specifically, the study seeks to answer the following objectives:

1. To identify the sources of credit for rice farmers in the region,
2. To determine the main actor of the credit management within the rice farm families,
3. To evaluate the impact of microcredit on rice production in Aek Phnom District.

3.1 Research Question

Sources of credit play a major role in agriculture activities which can improve farming technologies and increased input use of rice farmers. The research questions have designed for finding the answer related to the impact of microcredit on rice production in Aek Phnom district, Battambang province as following:

1. What types of sources of the loan are available in the local area? Where do rice farmers obtain a loan from?
2. Who is the main actor for borrowing loan from external sources, controlling, and making the decision within the households?
3. What is the impact of microcredit on rice production?

3.2 Research Hypothesis

1. Null Hypothesis H_o: There is no significant impact of microcredit on rice output between borrowers and non-borrowers.

4 Materials and Methods

4.1 Research Design

The main goal of the research study was to examine the impact of microcredit on rice production which significantly contributes to improving local livelihoods economics in Aek Phnom district, Battambang province. The specific objectives have been specifically designed to obtain necessary assessment information from various respondents including microfinance institutions, moneylenders, and especially rice farmers who take a loan for their agriculture purpose. Based on this, purposively sampling method was applied to select study site and sample size, while snowball sampling was conducted during the interview. Focus group discussion was also conducted. Sources of data collection include primary and secondary data were used. Data analysis was done using Microsoft Excel version 2010 and SPSS (The Statistical Package for Social Sciences) version 20. Gross margin analysis and t-test statistic were applied to see the difference between two groups of rice farmers namely borrowers and non-borrowers.

4.2 Study Area

Aek Phnom district of Battambang province in the northwest of Cambodia, was purposively selected for the study area to identify the agroecological zone of rice and common characteristic of households who engage in agriculture activities and access to credit. Geographically, Aek Phnom district borders with Siem Reap province to the north and east, Sangkae district to the south, Krong Battambang to the southwest, and Thmar koul district to the west. The total land area is about 63,500 ha, while agricultural land is approximately 13,700 ha (Try et al., 2015). The average annual rainfall in the area ranges from about 695 mm to 1,300 mm. Based on the Provincial Department of Planning (2015), the district has a population of approximately 82,602 of which 50.63% were female and 50.27% were male in 2015. There are about 17,908 households whose economic activities dominated by subsistence rice production, followed by fishing and small trade. According to agrological zones of Battambang province, the Aek Phnom district critically deserves for

the research topic because of its location in rainfed lowland rice croping systems that partially surrounds the Tonle Sap Lake which has the potential for growing rice. The major crops that are cultivated in the district include bean, peanut, watermelon, maize, sugarcane, jute, and vegetable. Three villages of one commune in Aek Phnom district namely Rohal Soung, Reach Donkeo, and Preak Trop were specifically selected. Based on availability of water and occurrence of the seasonal flood, farmer in each village can grow rice two times per year. The first planting season starts in May and harvest in August or September. The second planting usually starts in the middle of October, and harvest in February.

Interestingly, Aek Phnom district has an adamant presence of either microfinance institution (MFIs) or rural credit operator as NGOs, and moneylender. It was noteworthy that the seasonal credit demands are during pre-planting and harvesting of the rice and chamkar season. Besides, credit is used by rice farmers not only for the agricultural purpose, but also for household consumption expenditure, and especially debt repayment during the off-season or fallow period.

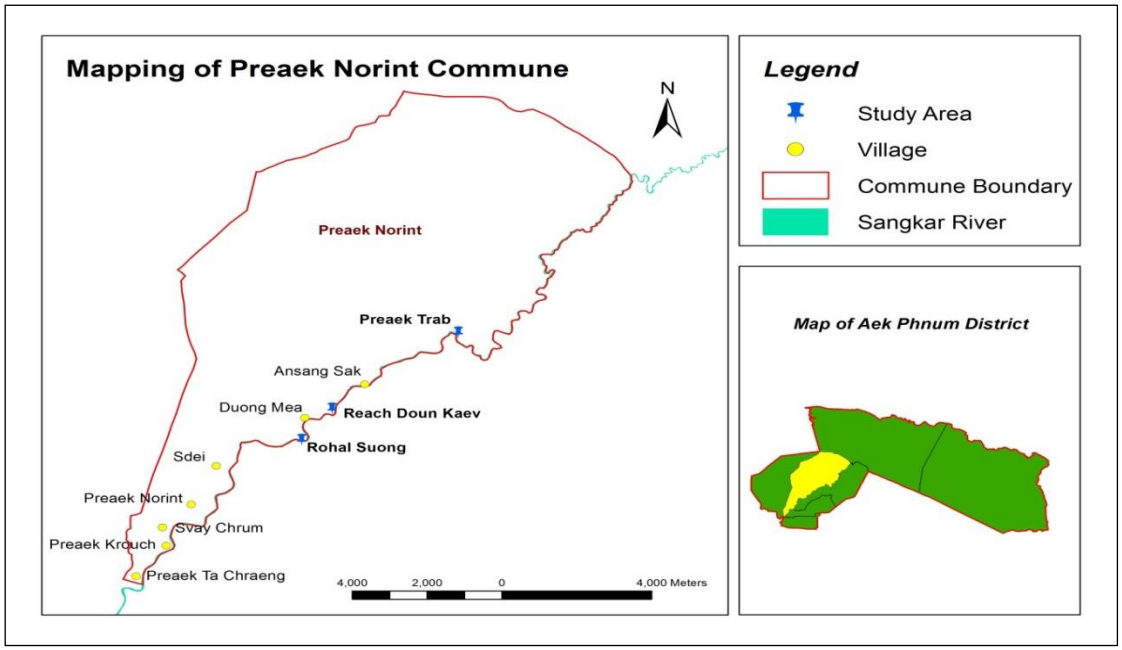

Figure 3: Map of Preaek Norint Commune

Source: author

4.3 Data Collection Technique

The data collected was used both primary and secondary source for the study. The primary data collected from rice farmer producers from the beginning of July till mid-August 2016. The study was employed both quantitative and qualitative tools to collect primary data through the administration of the structured questionnaire. The questions mainly cover on rice production, agricultural input (fertilizer, seeds, herbicide, machinery, and so on), agricultural output, and the cost of production. The demographic characteristics of households such as education, age, gender, and farm land size were included. Furthermore, access to credit and other borrowing activities, loan amount, interest rate, sources of loan repayment were asked.

Focus Group Discussion was also used to observe and find out in-depth information such as perception, behaviors, and farming experience. Moreover, 10 households from three villages were invited to participate in a group discussion that mainly focuses on agricultural practices activities, microcredit systems in the locality, the role of gender in microcredit, the impact of microcredit on rice production, and source of repayment.

Secondary data is an integral part of this research study in which scientific article and journals mainly derive from scopus, a web of science, google scholar, science direct to discuss and compare the result of this research. Furthermore, other sources from various documents such as working paper, government's policy document, an annual report of the relevant institutions were also used.

4.4 Sampling Techniques

To estimate the impact of microcredit on rice production, the author carefully selected the sample size with respect to similar farming characteristics, road infrastructure, and climatic condition. The number of population of farmers in the district was about 23,844 of which 76.2% have primary employment in agriculture (Provincial Department of Planning, 2015). In the most conservative approach, the sample size is estimated based on RAOSOFT

sample size calculator with the confidence level 95%, the margin of error is 10%, and the minimum recommended sample size is 96. Since the study establishes the comparison between two groups, sixty borrowers and sixty non-borrowers were selected for the study using purposive sampling method. The idea behind this was to select a homogeneous representative sample size and fair comparisons between borrowers and non-borrowers. In addition, the study targeted both groups of rice farmers who have agricultural lands less than or equal to 5 hectares. Afterward, the snowball sampling method was also employed during the interview with respondents. This sampling technique is suitable for data collection from respondents unknown to the researcher hence, asking an interviewee for a possible next respondent with similar characteristics to be interviewed.

4.5 Data Analysis and Presentation

4.5.1 Descriptive Statistics

In order to have a basic feature of the study results, simple data analysis including frequency, percentages, mean, standard deviation, and multiple responses tools were used to summarize information on demographic and socio-economic characteristics of the respondents.

4.5.2 Gross margin analysis

The gross margin analysis method was applied to measure the difference between the value of production and variable expenses of borrowers and non-borrowers. Gross margin could be expressed per different unit of household resource, very commonly per land or labor force. This allows comparisons in one unit of land (ha), which gives an economic-technical reason for the rice production. According to Semerci et al. (2014), gross margin is the value obtained from the value of production minus total variable cost. This study takes into account of total variable costs include improved seed, fertilizer, herbicide, pesticide, sacks, gasoline, hired tractor, hired threshing machinery, and labor costs. Gross margin in Cambodia can be considered remuneration to labor cost (World Bank, 2015). The gross margin analysis followed the equation used by Senkondo et al. (2004).

TVP = Q x P ……..……...…….. (1)

GM = TVP – TVC ……...…….. (2)

Where, TVP = Total Value of Production

Q = Quantity, P = Price

GM = Gross Margin

TVC = Total Variable Cost

4.5.3 Test of difference of two mean

In order to test the hypothesis, the t-test for independent sample was used to determine whether there are significant differences between the means of two groups. Therefore, t-test analysis was appropriate method to test difference between the means of borrowers and non-borrowers with respect to agricultural production (Girabi and Mwakaje, 2013). The t-test equation was followed by Walpole et al, (1993).

$$T = \frac{(X_1 - X_2)}{\sqrt{\left(\frac{S_1^2}{n_1}\right) + \left(\frac{S_2^2}{n_2}\right)}} \quad \text{……..……} \quad (3)$$

Where, $X_1 =$ mean value for borrowers

$X_2 =$ mean value for non borrowers

$n_1 = Sample\ size\ of\ borrowers$

$n_2 = sample\ size\ of\ borrowers$

$S_1^2\ and\ S_2^2 = Sub\ sample\ variance$

Decision rule,

If p-value ≤ α= 0.05, we reject null hypothesis (H_o)

If p-value > α = 0.05, we fail to reject null hypothesis (H_o)

5 Results

5.1 Demographic and socio-economic characteristics

Figure 1 showed the differences between men and women of the borrowers who access to credit for rice production and non-borrowers who do not access to credit. The results indicated that women represented the majority of both groups which accounts for 67% for borrowers and 57% for non-borrowers.

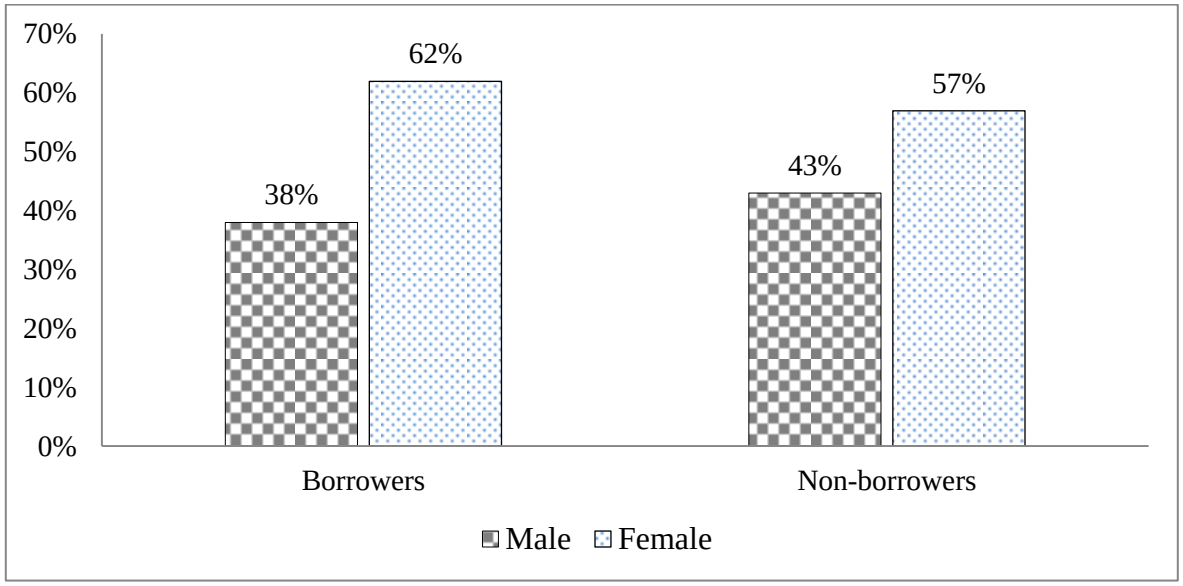

Figure 4: Gender of respondents

Additionally, the study also compared the household characteristics of borrowers and non-borrowers (Table 4). Results showed that borrower's households, in average, have higher farming experience, household size and which surprisingly low year of schooling 4.77 (±3.00) and age of household head 45.08 (±11.79) compared to their counterparts 5.57 (±3.51) and 49.05 (±12.62). Majority of the respondents dispose of the farm size equal to 5 ha or lower. In average, borrowers had a farm size of 2.61 ha (±0.86), compare to 2.52 (± 0.84) among non-borrowers.

Table 4: Socio-economic characteristics of rice farmers

Socio-economics characteristic of respondents	Borrowers (n=60)		Non-borrowers (n=60)		P-Value
	Mean	SD	Mean	SD	
Age of household head	45.08	11.79	49.05	12.62	0.078*
Year of schooling	4.77	3.00	5.57	3.51	0.183 ns
Farming experience	26.50	11.64	23.73	11.83	0.199 ns
Household size	5.13	1.30	5.02	1.69	0.673 ns
Farm size	2.61	0.86	2.52	0.84	0.502 ns

Note: * means significant level at 10%; ns = non-significant

5.2 Characteristics of typical microcredit

Firstly, we documented the sources used by rice farmers to obtain credit. Based on our results, rice farmers used different sources of credit. Majority (66.67%) of them borrowed from microfinance institutions (MFIs) and followed by moneylenders which account for 18.39%, NGOs microfinance (11.49%), and only very few from relatives and friends (3%).

Table 5: Source of loans

Source of credit	Frequency	Percentage (%)
Relatives and Friend	3	3.45
Moneylender	16	18.39
NGOs microfinance	10	11.49
MFIs	57	65.52

Secondly, we highlighted the difference between the average interest rate and maturity charged and fixed by credit providers. The high-interest rate and short maturity of the loans was one of challenges outlined by rice farmers. Table 6 revealed that the average interest rates charged by moneylenders were high around 5.64% per month, compared to NGOs-MFI and MFIs were 3% and 2.41 %, respectively. Furthermore, the maturity of the loan

provided by MFIs was longer (21.26 months) than NGOs-MFI (13.5 months), moneylenders (5.19 months), and approximately 4.25 months for relatives and friends.

Table 6: Interest rate and maturity of credit providers

Loan sources	Interest rate per month (%)	Maturity (Month)
Relatives and Friends	0.00	4.25
Moneylender	5.64	5.19
NGOs-MFI	3.00	13.5
MFIs	2.41	21.26

Furthermore, we noted that most rice farmers used the loan for multiple purposes, but the majority of them used the loan for rice production. The results showed that almost 40% of respondents primarily used the loan for farming activities, while about 36% used for coping with household consumption. Likewise, rice farmers also used the loan for repayment for another loan which accounts for 11%.

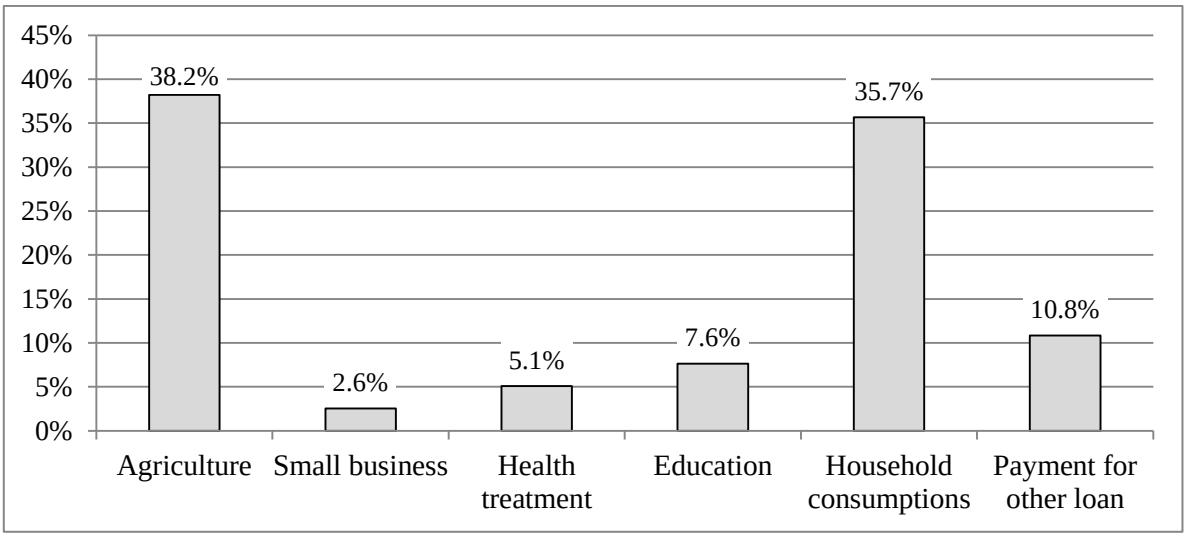

Figure 5: Purposes of using loan

In addition, we also presented the loan size used for agriculture production. As can be seen in Table 7, it is indicated that more than two-thirds of rice farmers (67%) borrowed for farming purposes less than 500 US$, while another 21% asked for the credit between 500 and 1,000 US$, and only 10% of rice farmers required higher credits.

Table 7: Loan size used for agriculture purpose

Size of loan ($)	Frequency	Percentages (%)
Less than 500	40	66.67
500 – 1,000	13	21.66
1,001 – 1,500	4	6.67
Above 1,500	3	5.00

Note: Exchange rate 1$= 4,030 Riel; based on the National bank of Cambodia in 2016

5.3 Role of gender in microcredit

This section presented the role of gender within the household to access credit. As depicted in figure 6, it showed that women play a crucial role in initiating loan proposal for working capital which accounts for 47%. In 37% of cases, there was a discussion with their spouse, while very small percentages of men had decided alone for accessing credit.

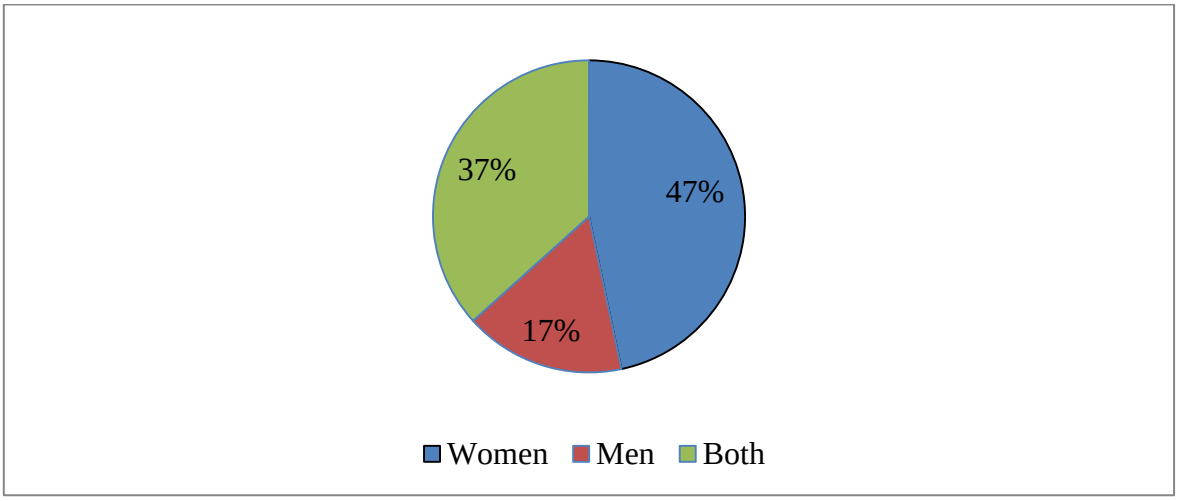

Figure 6: Initiating loan proposal for working capital

Figure 7 clearly shows the main actor of rice farmers within the household who keeps the loan and who makes a decision on using the loan. The results indicated that majority (77%) of the respondents were women who responsibly keeping the loan, while only very small for men (15%) of them were loan keepers. Furthermore, results showed that majority (70%) of respondents were decided jointly with their spouse rather than decided one-sidedly on using the loan for agriculture activities. The percentage in making decision one-sidedly is very small for women (20%) and men (10%).

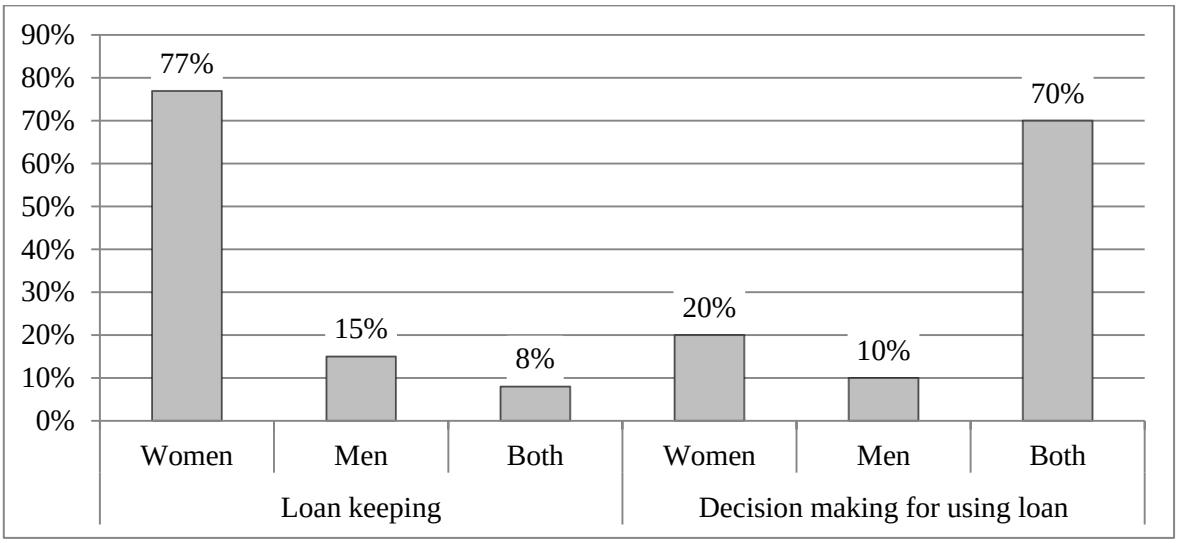

Figure 7: Loan keeping and decision making for using loan

5.4 The impact of microcredit on rice production

5.4.1 Process analysis and gross margins

Table 8 shows the comparison of gross margin per hectare for rice production of borrowers and non-borrowers. As presented, the results shows that borrowers reached higher gross margin in average 136.34 US$/ha (±153.37) compared to non-borrowers 87.67 US$/ha (±193.85). T-test statistic confirms that there were statistically significant differences between gross margin for borrowers and non-borrowers. However, the total variable cost for borrowers 388.83 US$/ha (±80.01) were also relatively higher than non-borrowers 328.61 US$/ha (±106.04). Furthermore, the results indicated that the rice yield 2.5 t/h (±615.35) and farm gate price 0.21 US$/kg (±0.04) for borrowers were higher than their

counterparts 2.1 t/h (±704.38) and 0.19 US$/kg (±0.03), respectively. The T-test statistic confirms that differences observed in the categories of rice yield and farm gate price are statistically significant. Generally, there were significant different for all variables except farm size 2.61 ha (±0.86) for borrowers and 2.52 ha (±0.84) for non-borrowers.

Table 8: Comparison of gross margin per hectare for rice production of respondents

Values and cost	Borrowers (n=60)		Non-borrowers (n=60)		p-value
	Mean	SD	Mean	SD	
Farm size (ha)	2.61	0.86	2.52	0.84	0.502 ns
Total Harvest (kg)	6,545.00	2,800.99	5,463.33	2,890.48	0.040***
Yield (kg/ha)	2,507.66	615.35	2,167.98	704.38	0.007***
Farm gate Price (US$/kg)	0.21	0.04	0.19	0.03	0.001***
Production Value (US$)	525.17	149.75	416.28	153.29	0.000***
Variable cost (US$)	388.83	80.01	328.61	106.04	0.004***
Gross Margin (US$)	136.34	153.37	87.67	193.85	0.028**

Note: **, *** and ns signs mean significant level at 5%, significant level at 1%, and ns is non-significant; 1 US$ = 4,030 Riel.

5.4.2 Comparison of level of input usage in rice production

In this section, the comparison of the inputs usage in rice production of borrowers and non-borrowers are presented. The results found that there are statistically significant differences between borrower and non-borrowers with respect to major input usage of seeds ($p<0.05$) and fertilizer ($p<0.01$). Borrowers used the high amount of seeds 217.95 kg/ha (±29.94) and fertilizers 208.23 kg/ha (±21.25) compared to their counterparts 122.07 kg/ha (±16.51) and 97.44 kg/ha (±37.41) respectively. Furthermore results indicated that there are slightly significant differences per hectare in term of herbicide usage ($p<0.1$), gasoline ($p<0.1$) and hired tractors ($p<0.1$) between borrowers and non-borrowers. However, there was no significant different between two groups in labor cost, threshing machinery, and pesticide.

Table 9: T-test results for comparing the level of inputs usage per hectare of respondents

Variable	Borrower (n=60)		Non-borrower (n=60)		P-value
	Mean	SD	Mean	SD	
Seeds (kg)	217.95	29.94	208.23	21.25	0.043**
Fertilizers (kg)	122.07	16.51	97.44	37.41	0.000***
Pesticide ($)	6.17	3.05	7.12	3.90	0.140 ns
Herbicide ($)	15.99	8.26	12.88	9.92	0.065*
Tractor ($)	37.01	25.35	30.80	9.82	0.081*
Harvester ($)	73.19	19.95	66.74	54.34	0.390 ns
Family labor ($)	59.15	31.10	56.16	30.24	0.595 ns
Hired labor ($)	25.80	13.00	21.96	19.83	0.213 ns

Note: *, **, *** and ns signs mean significant level at 10%, significant level at 5%, significant level at 1% and ns is non-significant; 1 US$ = 4,030 Riel.

5.4.3 The impact of microcredit on rice production

The hypothesis results using the t-test are presented to figure out the impact of microcredit on rice production. Our null hypothesis stated that there is no significant impact of microcredit on rice output between borrowers and non-borrowers. To test the hypothesis that the borrowers and non-borrowers were associated with statistically significant different mean on agricultural output, an independent samples t-test was used. As depicted in Table 10 shows that there were statistically significant differences ($p<0.05$) in aggregate rice production between borrowers 2,507.66 kg/ha (± 615.35) and non-borrowers 2,167.98 kg/ha (±704.39). Thus, the null hypothesis was rejected.

Table 10: Hypothesis results using the t-test

Variable	Borrowers (n=60)		Non-borrowers (n=60)		P-Value	Decision
	Mean	SD	Mean	SD		
Total rice production	2,507.66	615.35	2,167.98	704.39	0.007***	Reject Null

Note: *** mean significant level at 1%; Exchange rate 1 US$ = 4,030 Riel

6 Discussion

Our study reveals that microfinance institutions (MFIs) were the most common source of credit for rice farmers in the study area, and followed by moneylenders to cover their farm expenditure and household consumption, which is similar to the report published by National Institute of Statistic (2015). In Pakistan, most of the rice farmers also borrowed from formal sources in particular commercial bank which was used for production purposes such as seeds, fertilizers, and pesticides (Saleem, 2011). This provides a clear basis for the statement that the existence of the formal institutions in the region may reflect on growing presence of microfinance institutions and improvement of the credit market in rural areas which can lead rice farmers easily access to obtain loan. Furthermore, low-interest rate and long duration of repayment were the main critical component of accessing to formal credit. However, in the context of Nigeria, the most sources of credits for agricultural production was from informal sources such as cooperative societies, relatives and friends, traditional saving association, and moneylenders (Adebayo and Adeola, 2008). Rao and Priyadarshini (2013) confirmed that sometimes informal sources are working better than financial institutions. Because of the inadequate supply seasonal loan by formal institutions, borrowers are more likely to borrow from informal sources (Mallick, 2012). Thus, credits from informal sources still continue to enjoy great popularity in developing countries (Yadav et al., 1992; Kislat, 2015).

Nevertheless, rice farmers who had access to informal sources were charged higher interest rate than the formal loan sources. The study found that moneylender charged average interest rate were relatively higher than MFIs and NGOs microfinance at the rate of 5.64 % per month. This result is consistent with the national data from the Cambodia Socio-Economic Survey (2014) reported that the interest rates charged by moneylender were high compared to formal sources at the rate 5.5 % per month in 2014. However, CDRI (2012) indicated that the interest rates set by moneylenders were remarkably declined by 11.14 % in 2001 to 6.65 % in 2011. In some case, market-based moneylenders charged interest rate around 3 %, which was similar to the interest rate given by formal providers such as MFIs

or NGOs microfinance (Bylander, 2014). This is probably because of borrowers have a good relationship with lenders or borrowers have a good reputation in the villages or good credit.

Credit accessed by rural farmers used for multiple purposes. The study also found that credit is not only needed for agricultural production, but also for household consumption, education, health treatment, pay off previous or existing debts, especially during the offseason period. This finding was consistent with Bylander (2015) who conducted in Siem Reap province of Cambodia. According to White (1991) stated that rural people often used the loan for various purposes, not just the one stated when they borrowed money for. Likewise, Pide (2012) mentioned that rural household used credit not only for livelihood investment but also for weathering socks such as crop failure and health treatment as well as addressing consumption shortages due to income fluctuated. Several studies affirmed that rural people primarily used formal loan for agricultural production, while informal loan in particular moneylenders used for smoothing household consumption strategy and service existing debt (Yadav et al., 1992; Sinha and Martine, 1998; Zerler, 1994; Khandker and Faruqee, 2003; Barslund and Tarp, 2008). It is noteworthy that rice farmers, who used loan for different purposes, are more likely to be confronted with indebtedness and increase the risk of default. This subsequently could have an effect on rice production, which leads to lower agricultural productivity due to the fact that less contributed to agricultural purpose.

The study also revealed that women play a crucial role within the household both initiative loan proposal for working capital and loan keeping. Furthermore, we found that there is a very small number of men and women were decision making one-sidedly on using agricultural credit. This means that women and men have joined in decision making together, effectively. It is clear to mention that even though numbers of women were small in making decision alone, they can bargain their voice to jointly make some important household decision with their spouse. Kato and Kratzer, (2013) also reports a similar experience from Tanzania, where their study found microcredit could enable the women to develop a greater voice within the household. Women had right and gain decision making with the households either practical or strategic gender needs when they took loan from

external sources (Fofana et al., 2015). Providing loan to women not only could enable them to negotiate gender barriers but also build up their ability, and more involved in their community (Hasemi et al., 1996; Chandaroth and Liv, 2011; Teng et al., 2011).

The sources of credit closely link to improve the high yield of rice production due to credit facilities could influence on agricultural inputs (Javier, 1997). Similarly, Miller, (2011) and Tran et al. (2014) asserted that the sources of loans are significantly needed so as to meet production requirement such as improved seeds, fertilizers, and supplementary irrigation and especially machinery. As presented in the results, the rice yields of borrowers were higher than non-borrowers, which account for 2.50 ton/ha and 2.17 ton/ha, respectively. These results were similar to the finding conducted by Theng et al. (2013) who found that the rice yields of treatment groups were higher than that control groups. This study suggested that the greater yields of rice in the study area were strongly associated with the increased chemical fertilizer and improved higher-yielding seeds usage. By comparison, these results remain below the national average rice yield in 2015 (MAFF, 2016). Furthermore, Cambodia's rice yield is relatively low compared to neighboring countries such as Vietnam and Thailand (Yu and Diao, 2011; World Bank, 2015).

The study also indicated that gross margin in average per hectare for borrowers (136.34 US$) are higher than non-borrowers (87.67 US$). This may be due to the reason that rice farmers with credit were able to start their cultivation earlier than rice farmers without credit because they had financial assistance to operate their farming activities such as hired tractor and buy a new variety of seeds. Hence, they could harvest earlier and might sell their rice at a higher price which is 0.21 US$/kg for the borrower and 0.19 US$/kg for non-borrowers. This finding was proved by World Bank (2015) that, modern farmers generated higher gross margin than that farmer who less access to modern agricultural technologies. In addition, the average gross margin per hectare for both groups was relatively similar to Myanmar (Nan Wutyi et al., 2013); however, it was quite far less compared to gross margin value in Vietnam (World Bank, 2016) and Thailand (Kiatpathomchai, 2008). This was due to the relative low of farm gate price (200 US$/ton), high variable cost (388.83 US$/ha) and lack of irrigation systems in the study area. This is consistent with the reporting of

MRC (2014) that, rice producers in the rainfed lowland of Battambang province had the higher cost of hiring tractor, harvesting and threshing, fertilizers, and seeds used, while the price of paddy at farm gate was relative low (FAOSTAT, 2017).

The study also compares the level of using farm input for rice production. The result shows that there were statistically significant differences between borrowers and non-borrowers with respect to major inputs usages such as seeds, fertilizers, and herbicides. The study implies that rice farmers who had access credit have high ability to adequately finance purchase farm inputs and improve their rice productivity. These results are similar to the finding of previous studies in various regions such as in Indonesia (Wicksono, 2014), Pakistan (Shah et al., 2008), Nigeria (Akidbode, 2013), and Tanzania (Girabi and Mwakaje, 2013). According to Carte (1989) reported that microcredit has a positive relationship with agricultural productivity. Von barun et al. (1993) showed that the rice farmers with using credit are more likely to have higher input expenditures than those who without using credit. Likewise, Kyi and open (1999) reported that significantly increased farm inputs in rice production would lead to dramatically increase agricultural output.

In line with this, the study found that microcredit has statistically significant impact on rice production. The results are consistent with prior research with the view that access credit by farmers have positive and statistically significant impact on rice production, which could positively influence on income in the countries such as India (Das et al., 2009), Vietnam (Duy, 2012), Bangladesh (Hasan et al., 2013), and Ghana (Nuhu et al., 2014). According to Zuberi (1989) concluded that increase in agricultural output due to the change of amount of seed and fertilizer expenditure. Malik et al. (1991) confirmed that agricultural credit plays a significant role in the determination of agricultural input such as seeds and fertilizers. Conversely, this result is contrary with that of Khan et al., (2013) which found that there is no evidence significantly impact of microcredit on crop production and income of credit beneficiaries. The credit constraint and insufficient agricultural credit are the main factors in which lower contributed to access more farm inputs and improve farming technologies.

6.1 Limitations of the research

This study mainly focused on early season rice production since rice farmers in the region can grow rice two times per years in the wet season rice such as early season rice and water receding rice. Thus, the study does not provide an extensive analysis of the impact of microcredit on rice production in the wet season as a whole.

The major limitation of the survey is that it was hard to find non-borrowing respondents since most of the rice farmers in the study area had access to credit. In addition, some rice farmers work in the city as construction workers from the morning until evening. Therefore, enumerators used evening time to meet some of the respondents in their home for interviewing them. The other limitation is that some rice farmers hesitated to provide deep information related to credit used.

6.2 Suggestion for further research

There are several suggestions for further research study. First, we suggest studying on credit constraint for small-scale rice farmers who are unable to borrow from formal institutions for rice production. Second, most rice farmers borrowed money from various sources. Therefore, it would be appropriate to pay attention to analyzing the situation of indebtedness and the sources of repayment of rice farmers. Third, study the role of access to credit in rice production efficiency of rural households in the Tonle Sap Lake, Cambodia. The idea behind is to investigate whether formal credit sources more effective than informal sources or not.

6.3 Recommendation

Based on the results, it was observed that even though there are a number of MFIs operating in the study area, rice farmers still need informal sources such as moneylenders to supplement formal sources of credit to invest in agricultural production. Thus, the rural credit system still needs to be improved to help small-scale rice farming household who lack collateral to access formal institutions with the low-interest rate. Therefore, the existing MFIs and NGOs microfinances need to be supported and encouraged by the Cambodian Government through the National Bank of Cambodia to ensure their sustainability and a broad range of services they offer to poor rural folks who lack financial assistance. Moreover, MFIs should pay attention not only to medium and large-scale farmers but also to the small-scale rice farmers who most often than not lack the capital to invest in farming activities. Providing loan to small-scale rice farmers is important to enable them to improve their agricultural activities and increase income, especially significantly contributed to reducing poverty. Therefore, MFIs should design a special product for farmers who mainly use for agricultural purpose and provide consultation to farmers to use credit efficiently and with the proper purpose. This would avoid the risk of default and indebtedness between MFIs and borrowers. More importantly, this study also recommends to the farmers since most of them used credit for multiple purposes. Hence, the farmers should have a certain production plan before accessing credit to avoid the indebtedness, lose property, and land ownership. The study found that loan has a positive impact on rice production, yet the market price of paddy rice always fluctuates. The Government through the Ministry of Agriculture, Forestry, and Fisheries should take into consideration the farm gate price and agricultural inputs to encourage rice farmers to expand their agricultural production and enhance the agricultural productivity. The rice producers (borrowers) in the study had profitable and recorded higher yield of rice at 2.5 t/ha, however, the production costs such as seeds, fertilizers, threshing machinery and hired labors were relatively high. So, provincial of agriculture department should continually provide training or workshop to farmers on how to apply chemical fertilizers and seeds with respect to nationally recommended rate.

7 Conclusion

The objective of the study was to compare borrowers and non-borrowers in the Aek Phnom district, Battambang province of Cambodia with a view that the impact of microcredit on rice production with respect to input usage and output. The most of rice farmers obtained loan through microfinance institutions (MFIs) which are the most popular sources of credit in the region, and followed by the moneylenders. This result suggests that the long duration of repayment and low interest rate charged by MFIs to borrowers were the main factor to encourage rice farmers to access credit for productive activities rather than assort to moneylenders. Furthermore, most of the rice farmers used credit for agricultural production purpose, and followed by household consumption and pay off debt. It is well documented that Cambodian rice farmers used the loan for multiple purposes because the rest of the agricultural credit often used for debt-servicing and household consumption during the offseason or fallow period. Moreover, women were the main actor within the households with respect to the loan initiative proposal for working capital and loan keeping. Indeed, women also play a major role in making decision together with their spouse for using agricultural loan. This is clear that women were able to gain their right or position within the household to make some an important household decision, effectively. The study also compared the profitability of rice production between borrowers and non-borrowers. The study found that borrowers had recorded greater rice yield than non-borrowers. In line with this, the gross margin per hectare for borrowers was relatively higher than the non-borrowers. Thus, it concluded that farmers with credit were more profitable than rice farmers without credit due to the intensive use of farm inputs. Furthermore, there were significant differences between the borrowers and non-borrowers in inputs usage. This result reflects a positive relationship between microcredit and rice production, which leads to increase in rice yield. The t-tests confirmed that microcredit has a significant impact on rice production of the borrowers. Therefore, rice farmers who access microcredit had greater rice output compared to others who did not access credit. Thus, the null hypothesis was rejected.

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Appendix 1: Questionnaire

I. General Information on the Interviews

Study Location			
1	Code of Questionnaire	Number	
2	Date	DD/MM/YYYY	
3	Time of interviewing	Started	
4		Finished	
5	Location	Province	
6		District	
7		Commune	
8		Village	
9	Interview Checker	Full name	
10	Name of Enumerator	Full name	
Interviewee's Profile			
11	Name of Interviewee	Full name	
12	Age	Number	
13	Sex	1. Male 2. Female	
14	Phone Number	Line 1.....	Line 2.....
15	What is your position in the household?	1. Head of Household 2. Spouse of Head Household 3. Child of Head Household 4. Parents of Head Household 5. Relative of Head Household 6. Other (Specify)……	
16	Marital Status	1. Single 2. Married 3. Divorced / Separated 4. Widow / Widower	

17	What year of schooling did you complete?	
18	How long have you had experience in farming activities? (Year)	
19	How many members are there in your household? (Including you)	

N^0	Relationship with HH (1)	Marital Status (2)	Sex 1. Male 2. Female	Age	Year of schooling	Farming Experience	Off-farm activities
1							
2							
3							
4							
5							
6							
7							
8							

Code:

(1): 1. Head of HH 2. Spouse of HH 3. Son/daughter 4. Parents 5. Relatives 6. Other, (Specify)…….

(2): 1. Single 2. Married 3. Divorced/ Separated 4. Widow/Widower 5. Other, (Specify)…….

II. Farming Activities

Early Season Rice (4 -8)																		
20	Farm Area	Yield	Consumption	Sold	Price	Income	Seeds		Fertilizer		Pesticide		Herbicide		Sack		Rental Land
	(ha)	(Ton)	(Ton)	(Ton)	Price /Kg	(Riel)	Kg	Price/ Kg	Kg	Price/ Kg	Unit	Price/ Unit	Unit	Price/ Unit	Quantity	Price	Price
1	Plot 1																
2	Plot 2																
3	Plot 3																
4	Plot 4																
5	Total																

21	Farming Activities	Other expenditure		Household Labor				Hired Labor				Gasoline/ Diesel		
		Hired-Tractor Hired Hand-Tractor	Hired-Harvesting Machinery	N. of worker	Day/Hours	Wage/Day	Total	N. of worker	Day/Hours	Wage/Day	Total Expenditure	Littre	Price/Littre	Total
1	Soil Preparation (Plowing 1st)													
2	Plowing 2nd + Broadcasting													
3	Weeding													
4	Fertilizer Application													
5	Spraying													
6	Water pump machinery													
7	Harvesting and Threshing													
8	Threshing													
9	Transportation													

III. Information on microcredit

Role of gender in microcredit			
22	Do you take credit in 2015?	1. Yes 0. No	
23	Who is the first loan initiative proposal for working capital?	1. Wife 2. Husband 3. Both (wife and Husband)	
24	Who is the main actor in proccess of borrowing?	1. Wife 2. Husband 3. Both (wife and Husband)	
25	Who is the main actor in loan management within the household?	1. Wife 2. Husband 3. Both (wife and Husband)	
26	In your household, who make decision on using agricultral credit? (e.g. buy seeds, fertilizer, herbicide, pesticide and so on)?	1. Wife 2. Husband 3. Both (wife and Husband)	
27	Where are sources of loan did you borrow from?	1. Microfinance institutions 2. NGOs microfinance 3. Moneylenders 4. Relatives/Friends 5. Others please specify……	
28	How much?	Amount: .....Riel/US$	
29	How long?	: .....Month	
30	Interest rate?	: ……...%	
31	For what purpose?	1. Agriculture 2. Small business 3. Health treatment 4. Education 5. Household consumption 6. Payment for other loan 7. Others……	

32	Could you estimate the loan used for agriculture purpose? How much?	Amount:……..Riel/US$	
33	If you used the loan for agriculture, what did you buy?	1. Hired Tractor/ Hired Hand-Tractor 2. Hired threshing machinery 3. Buying Chemical Fertilizer 4. Buying Pesticide 5. Buying Seeds 6. Buying Herbicide 7. Buying Water Pump Machine 8. Buying Sprayer Machine 9. Buying Hand-Sprayer 10. Buying Bag 11 Buying Gasoline 12. Other, specify……	
34	What are your sources for repaying loans?	1. Farming (Harvested Season) 2. Fishing 3. Small business 4. Remittance 5. Borrowing from MFIs 6. Animal raising 7. Salary from the government 8. Construction Worker 9. Others……. ……	
Any suggestion:			

Thank you very much for your participation!!!

Appendix 2: Gross margin Calculation

Variable and Cost	Borrowers	Non-borrowers
Avg. Land Size (ha)	2.61	2.52
Avg. Labor force input (man-day)	28.34	24.93
Family labor	19.74	16.88
Hired Labor	8.60	8.05
Avg. Value of Production (US$)	1,370.69	1,049.02
solds	1,156.15	790.39
Household Consumption	216.83	258.66
Avg. Variable Cost (US$)	1,014.87	828.10
Seeds	237.84	199.01
Fertilizer	163.79	127.48
Pesticide	14.09	15.88
Herbicide	37.29	27.62
Sacks	22.54	21.69
Hired tractor	85.37	73.72
Hired harvester machinery	190.28	145.04
Gasoline	59.55	42.76
Household labor	140.74	124.06
Hired labor	63.38	50.85
Gross Margin (US$)	355.85	220.96
Gross Margin per ha (US$/ha)	136.34	87.67
Gross Margin per labor resources	12.56	8.86

Appendix 3: Farmer interview

Appendix 4: Focus group discussion

Appendix 5: Typical farmers in study area

Appendix 6: Weed control