

## Impact of land consolidation on profitability of rice production in the selected townships, Nay Pyi Taw

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### Abstract

This study was investigated the socio-economic characteristics, the profitability of rice cultivation, the determinants of rice production and major constraints of rice production of participant and non-participant households. The survey was conducted by personal interviewing with 60 participant households who participated in land consolidation program and 60 non-participant households who did not participate in that program from Pyinmana and Zeyarthiri Townships, Nay Pyi Taw. Descriptive analysis, cost and return analysis and production function analysis were used for data analysis. Participant households possessed more traditional farm implements and machineries than those of non-participant households. In cost and return analysis of monsoon rice production, benefit-cost ratios of participant and non-participant households were 1.10 and 1.21, respectively. Moreover, benefit-cost ratios of summer rice production were 1.30 in participant households and 1.45 in non-participant households. In the regression analysis for monsoon rice and summer rice production, rice production was negatively and significantly related to participant households. Majority of participant and non-participant households faced with constraints of high labor cost, high fertilizer application, high production and transportation cost. Moreover, most of participant households described constraints in labor scarcity and poor irrigation and drainage system after land consolidation.

**Key words:** land consolidation, cost and return analysis and production function

### Introduction

Nowadays, land consolidation is often understood in a much broader sense. Land consolidation can promote management of natural resources and support better land use planning and land management, including solving potential conflicts over changes to the use of land (Lisec et al., 2012). In transition countries, land consolidation is one of the most important fundamentals for helping to resolve the structural problems in agriculture and agricultural production (Sadegh et al., 2012).

The classical form of farmland consolidation involves changing the land tenure structure and providing the necessary infrastructure such as roads and irrigation networks, for efficient agricultural development (Demetriou et al., 2012). Generally, land consolidation has some negative impacts such as decreasing biodiversity in rural areas and change in the long-established habitats of animals around the villages (Lisec and Pintar, 2005). Positive impacts of land consolidation are increasing community participation, improving technical knowledge,

increasing cultivated area, decreasing conflict between farmers, mechanized agriculture, improving irrigation and drainage systems, better roads, increasing land and labor productivity, decreasing migration from rural areas, better farm management and finally, decreasing costs (Mirandaa et al., 2006).

Farmland consolidation in Myanmar had started in mid 1990s as pilot basis. During the previous government era (1995-1996 to 2010-2011), a total of 9,969 hectares of farmland has been consolidated. Then, under the present government, an annual plan is formulated and according to the budget availability, land consolidation has been put into implementation. By April 2015, a total of 24,258 hectares farmland has been consolidated including the area implemented by the previous government. In Nay Pyi Taw, land consolidation programs were initiated in the late of 2010-2011. The total farmland consolidation area was 577 hectares in 2011-2012, 1,708 hectares in 2012-2013, 1,310 hectares in 2013-2014 and 219 hectares in 2014-2015 April (AMD, 2015).

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## Rationale of the Study

Myanmar agriculture sector is still affected by land fragmentation. According to agricultural census 1993, there were 2.7 million landholdings comprising over 6.1 million plots of land. The average farm size was 2.35 hectares (5.8 acres) with the average number of plots 2.2 per holding. The average farm size slightly increased to 2.52 hectares (6.2 acres) in 2003 agricultural census (Lon et al., 2010). Land fragmentation where a single farm has a number of parcels of land, is one of the important features of agriculture in many countries, especially in developing countries (Hung et al., 2007). The agricultural land in Myanmar including Nay Pyi Taw has led to too small fragmented parcels, too many field ridges, low or unsustainable productivity, incomplete road and irrigation systems and lots of unused marginal land or wasteland. Land consolidation is generally as the most favorable approach for solving land fragmentation problem and also reduces the number of irregular parcels. The politicians recommended integration of land use to solve the problem of land distribution.

Because of the extensive nature of fragmentation and the growing importance of rural space for non-agricultural purposes, land consolidation has remained an important instrument in strategies. Farmland consolidation in Myanmar was launched with 369 hectares by government subsidy since the period of 1984-1985. During the period of 1995-1996 to April 2014-2015, Yangon Region was the most farmland consolidation area which was about 10,813 hectares and the second largest farmland consolidation area was Nay Pyi Taw about 3,814 hectares. Moreover, in Nay Pyi Taw, land consolidation program was implemented since 2011-2012. Therefore, it is necessary to study and analyze impact of land consolidation on production and profitability of rice cultivation in the selected households, Nay Pyi Taw.

In this study, there were four objectives.

1. To study the demographic and socio-economic characteristics of participant and non-participant households in the study area,
2. To analyze the profitability of rice production between participant and non-participant households in the study area,
3. To investigate the determinants of rice production of the sample farm households and
4. To assess the major constraints of rice production between these two groups.

## Research Methodology

The survey was conducted during the period of November to December, 2014. A combination of multi-stage and purposive sampling methods was used to select the sample farm households for the study. Firstly, Pyinmana and Zeyarhthiri Townships in Nay Pyi Taw were purposively selected as the study areas based on land consolidation area. Within the selected townships, Nutthaye village tract from Pyinmana Township and Mautaw village tract from Zeyarhthiri Township were purposively selected. Afterward, four villages (Nutthaye, Tartikone, Panpaesu and Kyanpho) from Nutthaye village tract of Pyinmana Township and two villages (Mautaw and Seinsarpin) from Mautaw village tract of Zeyarhthiri Township were randomly selected.

The primary data were collected by interviewing 60 participant households who participated in land consolidation program and 60 non-participant households who did not participate in land consolidation program from Pyinmana and Zeyarhthiri Townships. They were randomly selected and interviewed with well structural questionnaires. The secondary data were obtained from different government agencies including Ministry of Agriculture and Irrigation (MOAI), Department of Agriculture (DoA), Agricultural Mechanization Department (AMD) and other relevant data sources.

Descriptive analysis as a part of the numerical methodology such as mean, minimum, maximum and percentage was used to describe or summarize the demographic and socio-economic characteristics, cropping patterns, yield, inputs used in rice production, general constraints and perception of participant and non-participant households. The cost and return analysis (Olson, 2009) was used to assess the profitability of rice production in the study area on an average basis. The Cobb-Douglas production function was used to determine influencing factors of rice production.

## Results and Discussion

### Socio-economic Characteristics of Participant and Non-participant Households

The results showed that the average heads' age of participant households were around 50 years and that of non-participant households were around 52 years. Participant household heads had 25.13 years farm experience on average while non-participant household heads had farm experience of 25.50 years

on average. In the education statuses, nearly half of participant and non-participant household heads were at the primary education level (Table 1). The average family size was about 5 members and the average number of family labor was about 2 members between participant and non-participant households. The average farm size of participant and non-participant households were 2.49 hectares and 1.95 hectares. In the ownership of farming assets, participant households possessed more traditional farm implements such as plough (48.33%), harrow (46.67%) and bullock cart (46.67%) and machineries such as power tiller (41.67%), thresher (26.67%)

and pump (31.67%) than those of non-participant households (Table 2).

Both participant and non-participant households mainly depended on farm income (85% and 71% of total income). Among the farm income, summer rice income of participant households (48%) was higher proportion than that of non-participant households because participant households (39%) received the irrigation water to grow summer rice. For both participant and non-participant households, rice income was more important than the other crops income for their livelihoods (Table 3).

**Table 1. Socio-economic characteristics of participant and non-participant households**

| Items                          | Units | Participant households<br>(N = 60) | Non-participant households<br>(N = 60) | Total households<br>(N = 120) |
|--------------------------------|-------|------------------------------------|--|-------------------------------|
| Average head's age             | Year  | 50.48                              | 51.88                                  | 51.18                         |
| Average head's farm experience | Year  | 25.13                              | 25.50                                  | 25.32                         |
| <u>Head's education level</u>  |       |                                    |  |                               |
| Monastery                      | No.   | 10 (16.67)                         | 9 (15.00)                              | 19 (15.83)                    |
| Primary                        | No.   | 25 (41.67)                         | 32 (53.33)                             | 57 (47.50)                    |
| Middle school                  | No.   | 16 (26.67)                         | 9 (15.00)                              | 25 (20.83)                    |
| High school                    | No.   | 8 (13.33)                          | 7 (11.67)                              | 15 (12.50)                    |
| University                     | No.   | 1 (1.66)                           | 3 (5.00)                               | 4 (3.34)                      |

Note: Figures in the parentheses represent percentage.

**Table 2. Productive assets of participant and non-participant households**

| Assets           | Participant households<br>(N = 60) | Non-participant households<br>(N = 60) | Total households<br>(N = 120) |
|------------------|------------------------------------|--|-------------------------------|
| Plough           | 29 (48.33)                         | 17 (28.33)                             | 46 (38.33)                    |
| Harrow           | 28 (46.67)                         | 18 (30.00)                             | 46 (38.33)                    |
| Cattle           | 24 (40.00)                         | 16 (26.67)                             | 40 (33.33)                    |
| Bullock cart     | 28 (46.67)                         | 18 (30.00)                             | 46 (38.33)                    |
| Power tiller     | 25 (41.67)                         | 14 (23.33)                             | 39 (32.50)                    |
| Seeder           | 10 (16.67)                         | 3 (5.00)                               | 13 (10.83)                    |
| Inter-cultivator | 6 (10.00)                          | 3 (5.00)                               | 9 (7.50)                      |
| Thresher         | 16 (26.67)                         | 8 (13.33)                              | 24 (20.00)                    |
| Sprayer          | 56 (93.33)                         | 53 (88.33)                             | 109 (90.83)                   |
| Pump             | 19 (31.67)                         | 11 (18.33)                             | 30 (25.00)                    |
| Warehouse        | 43 (71.67)                         | 30 (50.00)                             | 73 (60.83)                    |

Note: Figures in the parentheses represent percentage.

**Table 3. Household incomes from all sources by participant and non-participant households**

| Items              | (Percentage)                       |  |
|--------------------|------------------------------------|--|
|                    | Participant households<br>(N = 60) | Non-participant households<br>(N = 60) |
| 1. Farm income     | 85                                 | 71                                     |
| (a) Monsoon rice   | 37                                 | 49                                     |
| (b) Summer rice    | 48                                 | 39                                     |
| (c) Black gram     | 4                                  | 9                                      |
| (d) Sugarcane      | 11                                 | 3                                      |
| 2. Non-farm income | 14                                 | 28                                     |
| 3. Off-farm income | 1                                  | 1                                      |

### Cost and Return Analysis

In monsoon rice production, participant households expended total variable cost (810,878 MMK/ha) and non-participant households expended total variable cost (782,345 MMK/ha). The average monsoon rice yield of participant households (4,319.47 kg ha<sup>-1</sup>) was lower than that of non-participant households (4,524.01 kg ha<sup>-1</sup>). Therefore, average gross benefit for non-participant households (945,756 MMK/ha) was higher than that of participant households (894,195 MMK/ha). The net benefit (RAVC) of participant households was 9.32% of gross benefit whereas non-participant households were 17.28% of gross benefit. Hence, the benefit-cost ratios were 1.10 and 1.21 for participant and

non-participant households, respectively (Table 4).

In summer rice production, although participant households expended total variable cost (983,715 MMK/ha) and yield (6,146.72 kg ha<sup>-1</sup>), non-participant households expended less total variable cost (829,595 MMK/ha) and produced average yield of (5,505.08 kg ha<sup>-1</sup>). Therefore, gross benefit for participant households was 1,282,320 MMK per hectare whereas non-participant households were 1,204,732 MMK per hectare. The net benefit (RAVC) of participant households was 23.29% of gross benefit and non-participant households were 31.14% of gross benefit. Hence, the benefit-cost ratios were 1.30 and 1.45 for participant and non-participant households, respectively (Table 5).

**Table 4. Enterprise budget for monsoon rice production of participant and non-participant households**

| Items                                     | (MMK/ha)                           |  |
|---|------------------------------------|--|
|   | Participant households<br>(N = 60) | Non-participant households<br>(N = 60) |
| Gross benefit (GB)                        | 894,195                            | 945,756                                |
| Total material cost                       | 270,593                            | 269,490                                |
| Total family labor cost                   | 112,851                            | 103,802                                |
| Total hired labor cost                    | 407,102                            | 389,289                                |
| Interest on cash cost                     | 20,331                             | 19,763                                 |
| Total variable cash cost (TVCC)           | 698,027                            | 678,543                                |
| Total variable cost (TVC)                 | 810,878                            | 782,345                                |
| Return above variable cash cost (RAVCC)   | 196,168                            | 267,213                                |
| Return above variable cost (RAVC)         | 83,317                             | 163,411                                |
| Return per unit of capital invested (BCR) | 1.10                               | 1.21                                   |

**Table 5. Enterprise budget for summer rice production of participant and non-participant households**

(MMK/ha)

| Items                                     | Participant households<br>(N = 56) | Non-participant households<br>(N = 40) |
|---|------------------------------------|--|
| Gross benefit (GB)                        | 1,282,320                          | 1,204,732                              |
| Total material cost                       | 386,195                            | 302,210                                |
| Total family labor cost                   | 115,835                            | 114,872                                |
| Total hired labor cost                    | 456,407                            | 391,696                                |
| Interest on cash cost                     | 25,278                             | 20,817                                 |
| Total variable cash cost (TVCC)           | 867,880                            | 714,723                                |
| Total variable cost (TVC)                 | 983,715                            | 829,595                                |
| Return above variable cash cost (RAVCC)   | 414,440                            | 490,009                                |
| Return above variable cost (RAVC)         | 298,605                            | 375,137                                |
| Return per unit of capital invested (BCR) | 1.30                               | 1.45                                   |

#### **Determinants of Monsoon Rice and Summer Rice Production of Participant and Non-participant Households**

In the production function, the characteristics of household head's age, education level, farm experience; inputs used such as seed, FYM, total fertilizer, pesticide, herbicide, fungicide and labor inputs including total machine day, total animal day and total man day were independent variables. Monsoon rice production was assumed as dependent variable. Dummy variable of land consolidation program (participant households = 1, non-participant households = 0) and monsoon rice variety (Manawthukha = 1, other = 0) were also included. In summer rice production function analysis, dependent variable was summer rice production and independent variables were same as monsoon rice production's variables except dummy variable of summer rice variety (Pearlthwe = 1, other = 0).

Monsoon rice production in the study area was positively and significantly influenced by seed rate and total man day at 1% level, if other things remain constant. It means that if use of seed rate and man day in rice production is increased in the study area, monsoon rice production will be increased. And also monsoon rice production was positively related to total fertilizer amount, herbicide amount and total machine day at 5% level and pesticide amount at 10% level. The positive relationship in the regression means the more inputs put into rice cultivation the more the monsoon rice production would be. Similarly, the higher the monsoon rice production, the more profits would obtain from monsoon rice cultivation. Participant households in land consolidation program were negatively and significantly

influenced on monsoon rice production at 5% level.

According to the summer rice production regression estimates, the significant influencing factors of summer rice production were participant households in land consolidation program, household head's age, seed rate, total fertilizer amount, total machine day, total animal labor, total man labor and Pearlthwe variety. Summer rice production was positive relationship with total machine day and total man labor at 1% level, total fertilizer amount and Pearlthwe variety at 5% level and household head's age, seed rate and total animal labor at 10% level. Participant households in land consolidation program were negatively and significantly influenced on summer rice production at 1% level.

#### **General Constraints and Perception of Participant and Non-participants on Land Consolidation Program**

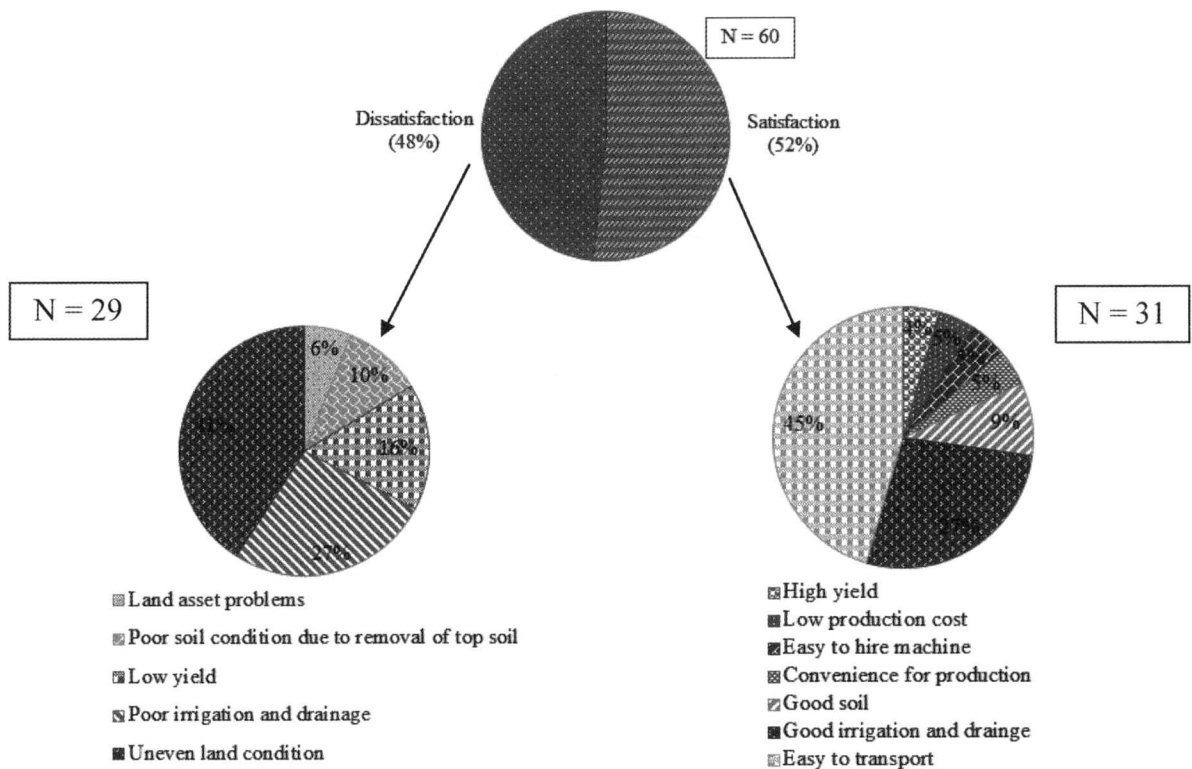
Major constraints described by participant households were high labor cost, labor scarcity, high fertilizer application, high production and transportation cost and poor irrigation and drainage system due to urgent preparation. Moreover, major constraints described by non-participant households were high production cost, high labor cost, high transportation cost, and high fertilizer application.

There were two types of participants; satisfied participants (52%) and unsatisfied participants (48%) in land consolidation program. In satisfied participants, there were various reasons of satisfaction concerning land consolidation program. The most satisfaction reason described by satisfied participants was easy to transport (45%) and good irrigation and drainage system (27%). And also, about

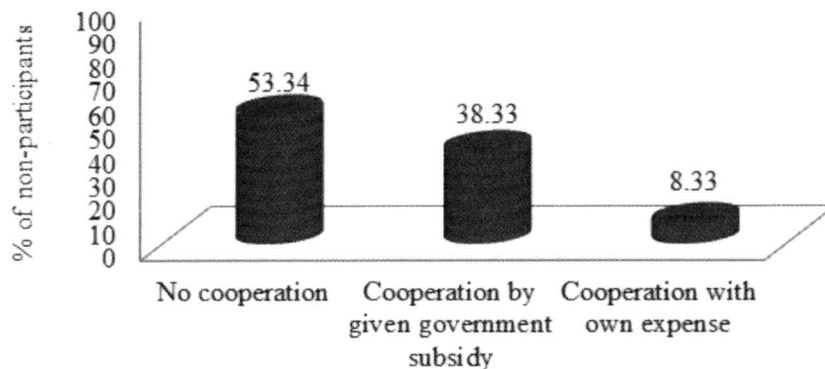
41% and 27% of unsatisfied participants mentioned the most reasons of uneven land condition and poor irrigation and drainage system (Figure 1).

In non-participants, about 53.34% of non-participants were unwillingness to cooperate in land consolidation program whereas 46.66% of non-participants were willingness to cooperate in that program (Figure 2). Non-participants had different reasons of willingness to cooperate in land consoli-

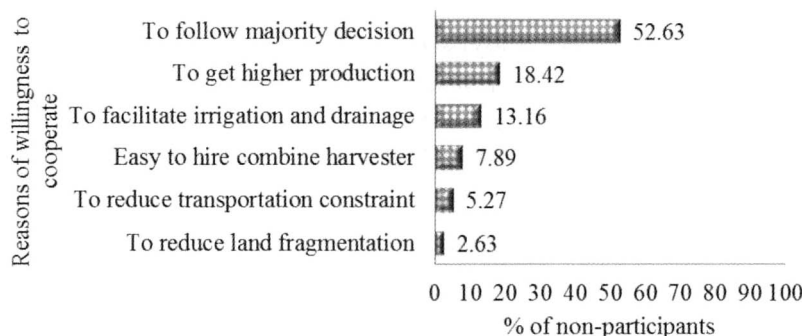
dation program. The reasons given by about 52.63% and 18.42% of non-participants were to follow majority decision and to get higher production (Figure 3). There were several unwillingness reasons to cooperate in land consolidation program by non-participants. Their main reasons were uneven land condition (36.95%) and followed by loss of some land area (28.26%), poor soil condition due to removal of top soil (21.74%) (Figure 4).



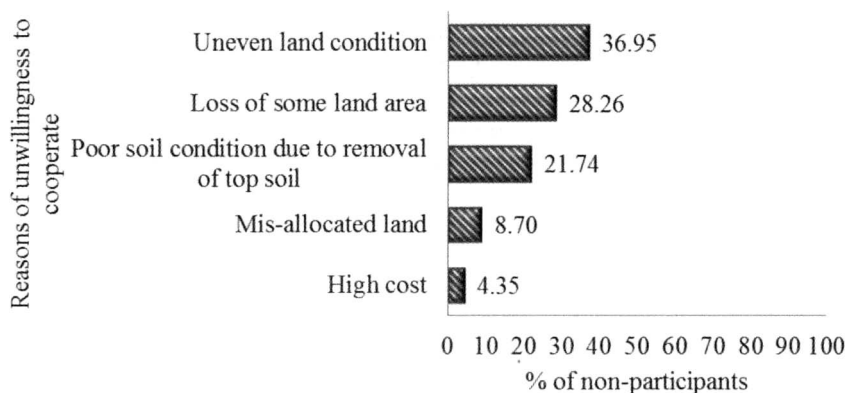
**Figure 1. Participants' attitudes and their reasons on land consolidation program**



**Figure 2. Willingness to cooperate in land consolidation program by non-participants (N = 60)**



**Figure 3. Reasons of willingness to cooperate in land consolidation program by non-participants (N = 28)**



**Figure 4. Reasons of unwillingness to cooperate in land consolidation program by non-participants (N = 32)**

### Conclusion and Policy Implication

The majority of both participant and non-participant household's heads were male and the average farm experience was about 25 years. In the study area, nearly half of household heads were at the primary education level. Meanwhile, education is very important for everyone to be able to adopt new technologies.

Participant households possessed more traditional farm implements and machineries than those of non-participant households. In the total households' income, both participant and non-participant households mainly depend on rice crop income. Second largest income for participant and non-participant households was non-farm income. Therefore, programs on capital based intensive agriculture more accompanied with small and medium enterprise development in the study area are needed to encourage and achieve high production with less

labor per unit area and increase non-farm income job opportunities.

The average rice seed rate used by participant households was lower than that of non-participant households because most of participant households used hybrid rice variety. In rice cultivation, the average monsoon rice yield obtained by participant households was lower than that of non-participant households but the average summer rice yield obtained by participant households was higher than that of non-participant households.

In the evaluation of the profitability of monsoon rice production, participant households received lower gross benefit than non-participant households. Therefore, benefit-cost ratio of participant households was lower than that of non-participant households. In summer rice production, participant households received higher gross benefit than non-participant households. However, benefit-cost ratio of participant households was lower than

that of non-participant households. In the study area, return from rice production just covered the total variable costs. In the regression analysis for monsoon rice and summer rice production, rice production was negatively and significantly related to participant households.

Major constraints described by participant households were high labor cost, labor scarcity, high fertilizer application, high production and transportation cost and poor irrigation and drainage system due to urgent preparation. Moreover, major constraints described by non-participant households were high production cost, high labor cost, high transportation cost, and high fertilizer application. About half of participants were satisfied on land consolidation program. Similarly, about half of non-participants were willingness to cooperate in land consolidation program with government subsidy or their money.

So, proper planning is needed for land consolidation program in the long run. Further studies on impact of land consolidation program are needed to get better understanding and complete picture for proper planning extensively. In doing so, we may see benefits from nationwide land consolidation program along with sustainable natural resources.

Therefore, the benefits from land consolidation program should be emphasized to increase gross income of farmers. As well as, the policy for land consolidation program should be to improve rural livelihoods rather than to improve only the primary production of agricultural products.

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