Structural Transition in Crop Composition in Chumphon Province, Thailand

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Abstract

This study captures the structural transformation in crop composition in Chumphon Province in southern Thailand at the macro (province) and micro (farm household/plot) levels. Based on the decomposition of crop production value growth into the effects of price, productivity, area reallocation between crops, and enlargement of the total area, production at the province level has been found to be driven by price and productivity effects for the past two decades. This raises the question of how farmers obtain crop price or technical information for crop choice decisions. In our original survey, farm or plot-level crop diversification was studied in villages where coffee production was historically active. We found that the capacity for diversification differs according to farm scale, and information use regarding crop price or farming practices is highly dependent on informal social networks. Furthermore, the role of social relationships in information sharing on price and farming practices of a specific crop is important even for farmers who do not produce that crop, suggesting that social relationships are the effective channel for the promotion of crop diversification and sustainable farming practices.

Keywords
crop diversification, information use, social relationships, Thailand

Introduction

Thailand, a traditional exporter of agricultural products, has experienced a structural industrial transformation under the country’s rapid economic growth. Agriculture’s share in the GDP declined from 31.84% in the 1980s and 8.3% in 2000s to 6.2% in 2017. This is a common phenomenon in regions witnessing economic development. The share of agriculture in the labor force shows a similar trend, declining from 58.5% in the 1980s and 42.53% in the 2000s to 38.23% in 2017. The difference between the share in production and the labor force is consistent with the disparity in per capita production between the agricultural and non-agricultural sectors. Moreover, some traditional agricultural export products have recently lost their positions in the global market. For example, Thailand now has to compete with Vietnam and India as the top rice exporter. How the competitiveness of the country’s agricultural products should be maintained or improved is a growing concern and was addressed in a recent government strategy report (Ministry of Agriculture and Cooperatives 2017).

In addition, in a globalized economy, prices in the global market directly affect the decisions of local producers. If the escalating prices of certain products lead to irreversible use of a resource, this could be a challenge for sustainable development and for main-
taining livelihoods in rural society, leading to a deterioration in the country’s future competitiveness in agricultural products. The southern regions of Thailand have been switching from rice production to perennial cash crops. Rural livelihoods in these regions have been highly linked with the global market.

This paper analyzes the crop structural transformation in the southern province of Chumphon. This province depends highly on primary commodities for industrial use, such as palm and rubber at present, but this has been transformed from past circumstances where the area used for these products was comparable to other major commodities, coffee and coconut. The latter two commodities have rapidly lost their land allocation. Our analysis aims to capture the effects of price, productivity changes, and crop area reallocation on the growth of crop production value in this province. However, the shift in crops at the province level does not mean the replacement of one piece of cropland by another. In order to clarify this crop transformation at the micro-level, the actual diversification strategy by farmers is analyzed from our survey conducted in villages where coffee production was previously dominant. In this micro survey study, the situation of crop information use by farmers involved in the crop shift is described. This can provide the strategic support for the dissemination of knowledge about the practices for sustainable farm management through social networks.

The paper is organized as follows. Section 2 examines Chumphon’s crop production value growth decomposed into the price effect, productivity effect, area reallocation effect, and area enhancing effect. This section shows that price and productivity effects are not negligible factors in the province’s crop structural transformation. Section 3 uses our original survey for capturing farm-level crop transition and diversification, and we shed light on the farmer’s use of information regarding price and farming practices by crop. The final section discusses an efficient strategy for ensuring resilience in the region based on the findings in the previous section.

**Decomposition of production value growth and crop land allocation structure**

**Chumphon and its crop profiles**

The total land area of Chumphon Province is 0.601 million hectares, of which approximately 0.354 million hectares (59%) is used for agricultural purposes. Only 0.016 million hectares (4.6% of agricultural land) is irrigated. Natural forest covers about 0.126 million hectares (21% of the province), and about 0.120 million hectares (20% of the province) is non-agricultural land. The province has a total population of 500,575 inhabitants, of whom 266,643 (53.3%) are farmers (Information Center of Agriculture, Office of Agricultural Economics 2014).

Perennial crops cover almost all the crop area. These crops include coconut, coffee, durian, mangosteen, palm, rambutan, and rubber. Fig. 1 shows the change in planted area over the last two decades for these crops, excluding mangosteen and rambutan because of their small area size. Coconut and coffee have rapidly decreased in land area, but palm and rubber have increased. The total planted area in this province reached its peak by the mid-2000s.

The characteristics of rubber, palm, coffee, durian, and coconut are summarized in Table 1 based on interviews with farmers in
our study region. Here, we note some points for further discussion. First, the harvest frequency differs between crops. Rubber and palm provide their products throughout most of the year, but coffee and durian have one main harvest season per year. There is no available fund for other crops, but the Rubber Replanting Aid Fund, started in 1960, supports rubber growers based on the funds contributed by rubber exporters. Through this fund, rubber growers receive support for seven years for land preparation, introducing rubber variety trees, fertilizer, and other related activities in cases of replanting on rubber farms. Compared with palm and coffee, rubber requires less chemical fertilizer. Durian is the most water sensitive crop. All crops can be harvested until 20–30 years of tree age.

In cases where labor is hired, rubber farmers enter into contracts with them by sharing payment. Buyers of palm, durian, and coconut basically provide the harvest labor for farmers. For coffee, the harvest depends highly on the seasonal immigrant labor from the northeastern part of the country (Suksavead et al. 2012; Napaporn 2014; Kwanmuang et al. 2018)

Production value growth decomposition

To capture Chumphon’s crop structure transformation quantitatively, we decompose the production value growth of commodities into price effect, productivity effect from commodities, area reallocation effect among commodities, and total area enlarging effect. This decomposition approach is an application of growth accounting that considers the contributions of sector-wide productivity growth and efficient resource allocation between sectors to macroeconomic productivity growth. We can refer to the literature review by Sonobe and Otsuka (2001; footnote 2, page 2).

Let \( V \) be the real value of total production of the main crops of this province (i.e., coffee, coconut, durian, mangosteen, palm, rambutan, and rubber) as shown in Equation (1).

\[
V = \sum_i V_i = \sum_i P_i Q_i
\] (1)

Here, \( V_i \) is the real production value of commodity \( i \), \( P_i \) is the deflated, or real, price of commodity \( i \), and \( Q_i \) is the production quantity. Production can be attributed to the contributions of cropped/harvested land \( A \) and yield (land productivity) \( Y_i (=Q_i/A) \) represented as:

\[
Q_i = A_i \times Y_i
\] (2)

As the growth rate of the total value of production can be described as the weighted sum of each crop production value growth, we can derive Equation (3).

\[
\frac{\Delta V}{V} = \sum_i \frac{\Delta V_i}{V_i} \approx \sum_i \frac{V_i}{V} \left( \frac{\Delta P_i}{P_i} + \frac{\Delta A_i}{A_i} + \frac{\Delta Y_i}{Y_i} \right)
\] (3)

Here, this approximation is obtained by dropping the interaction terms between growth rates of price, land, and productivity, and \( v_i \) stands for the share of production value of commodity \( i \), that is, \( v_i = V_i/V \). The total area \( (A=\sum_i A) \) and its growth can be described as the sum of each crop’s area growth weighted by area share \( a_i = A_i/A \), and therefore, the real value production growth decomposition can be described as below:

\[
\frac{\Delta V}{V} \approx \sum_i v_i \left( \frac{\Delta P_i}{P_i} + \frac{\Delta A_i}{A_i} \right) + \sum_i (v_i - a_i) \Delta Y_i \frac{A_i}{A}
\] (4)

We refer to each term in the right-hand side of Equation (4). The first term is called the ‘(real) price effect.’ The second term is the ‘productivity effect.’ The third term reveals the ‘area reallocation effect,’ and the final term is the ‘total area enlarging effect.’

Considering the area reallocation effect in more detail, this term should be positive when the area increases for a crop whose share of value is larger than its share of the total area. When the crop has a higher value of land productivity and its crop area increases, this term is positive, as confirmed by \( v_i \geq a_i \iff \frac{V_i}{V} \geq \frac{A_i}{A} \). We can name this effect as the ‘area reallocation effect’ because this term contrib-
utes positively to the total production value growth when the area increases (decreases) for crops with higher (lower) productivity. This effect could be interpreted as the “reallocation effect” because the value of production can be improved by reallocating crop areas in accordance with the land productivity of crops.

It should be noted that there are previous studies related to the present approach. In the context of area allocation effects on agricultural production growth, Kurosaki (2002, 2003) estimated the decomposition of the quantity growth of agricultural production for India and Pakistan. The present approach decomposes total crop production growth differently from Kurosaki’s study. This decomposition is applied to the value of production; therefore, the price effect is involved. The productivity effect and area effect are derived by both approaches. However, the area reallocation effect in the present approach shares a similar concern with the static crop shift effects in the decomposition by Kurosaki (2002, 2003), which focuses on the relationship between crop area share changes (not crop area change) and productivity. However, this approach cannot capture the dynamic crop shift effect in the approach adopted by Kurosaki (2002, 2003) because approximation (3) neglects the interaction terms of area and yield growth. Therefore, there are discrepancies in the present decomposition of production value growth.

Table 2 shows this decomposition result. We use the production, harvested area, and price data from the Office of Agricultural Economics, Agricultural Statistics of Thailand, and price is deflated by the GDP deflator of the agricultural sector, also issued by the Office of Agricultural Economics. The estimation period covers 1997–2016, but the figures shown in this table are the five-period moving average derived from the decomposition of annual growth change in order to mitigate the price/yield fluctuations.

The findings are summarized as follows. Rubber showed a remarkably positive price effect until the 2000s. This positive effect was also found for palm; however, its effect was less positive than that of rubber and turned negative for a few years since the late 2000s. Durian showed a negative price effect until the mid-2000s, but the effect has been remarkably positive in recent periods. The price effect of coffee was negative both before the 2000s as well as since the late 2000s; however, it showed positive price effects in the early and mid-2000s, when the market price of coffee increased. However, the share of the production value of this commodity decreased to less than 10% during this period; therefore, its price effect was not remarkable compared with that of the other three crops.

The productivity effect for coffee was negative before the mid-2000s. This was a leading phenomenon for decreasing cropped area since 2005 as shown in Fig. 1. It could be understood as the tree aging effect resulted in the relative lowering of productivity, as this province’s coffee production started after the 1980s. On the other hand, palm shows a positive productivity effect for almost the full estimation period. This could be a driver for increasing this crop. The productivity effect of rubber varies between periods. It was remarkably positive until the mid-2000s and subsequently turned negative. Durian’s productivity effect was negative, but it has recently improved.

Regarding the area reallocation effect, durian’s positive effect before the beginning of the 2000s was significant. This was due to the commodity’s larger share of production value during those periods. Coconut and coffee have the positive effects in area reallocation. This is because they decreased their areas more than other crops in the situation relative lower land productivity compared with other crops. Rubber has a nearly positive effect from area reallocation. Interestingly, palm has a negative area reallocation effect, implying that the area of palm would be in excess of the productivity value of the land. However, as seen in the positive productivity effect of this crop, this would mobilize more area reallocation to this crop.

**Transition in farmers’ crop decisions from survey data**

**Motivations**

Chumphon Province is one of the main provinces for producing Robusta coffee in southern part of Thailand, even though coffee was replaced by other main cash crops such as rubber, palm and fruits. The transformation of crop composition at the province level does not imply the complete replacement of a crop by others in a field area. At the plot and/or farm levels, the mixing of some commodities is common. The study area survey shows the mixed crop, or intercrop, between coffee, durian, palm, and rubber (Kwanmuang et al. 2018).

In this section, the transition in crop diversification at the farm household level is discussed based on the survey data from regions where coffee production was previously active. There has been a drastic increase in the diversification of crop choice. However, the findings from our study region cannot be completely generalized for Chumphon’s situation. Under the limitation of interpretation, we will confirm farmers’ attitudes toward obtaining crop information through the process of diversification. Interestingly, the structures of crop information usage differ between crops and the data reveal that there is active information sharing among the communities.

Kurosaki (2003) discusses the importance of shedding light on crop diversification or specialization at more disaggregate levels by applying the decomposition approach of the yield growth effect to inter-district crop shift effects in the context of rural market development. In coping with risk, transaction costs due to spatial locations of farming, and other market imperfections, farm households must face different farm-gate prices or evaluation of shadow prices (wage). In other words, rural market development implies less diversification at the disaggregate level. In this context, the find-
ings in our study area, in which the farmer’s crop choice transition is diversified from their past coffee monocrop production, could underline the importance of information in the crop choice mechanism because farmers are concerned with several uncertainties in introducing new crops or market risks. We find that information has a crucial role in determining crops’ comparative advantage.

Table 2  Production value growth decomposition

| Period       | Rubber | Palm | Coffee | Price effect |
|--------------|--------|------|--------|--------------|
|              | Area   | Productivity |      |              |
|              | reallocation | effect |      |              |
|              | Total  | Total   |      |              |
| 1997 / 1998 - 2001 / 2002 | 0.009 | 0.011 | 0.016 | -0.034 | 0.003 | 0.001 | -0.003 | 0.003 |
| 1998 / 1999 - 2002 / 2003 | 0.028 | -0.002 | -0.018 | -0.018 | -0.009 | -0.007 | -0.008 | -0.035 |
| 1999 / 2000 - 2003 / 2004 | 0.034 | 0.012 | -0.017 | -0.031 | -0.010 | -0.008 | -0.030 | -0.049 |
| 2000 / 2001 - 2004 / 2005 | 0.037 | 0.009 | -0.004 | -0.047 | -0.002 | -0.004 | 0.020 | 0.008 |
| 2001 / 2002 - 2005 / 2006 | 0.050 | 0.008 | -0.008 | -0.016 | -0.002 | -0.004 | 0.020 | 0.048 |
| 2002 / 2003 - 2006 / 2007 | 0.039 | 0.018 | 0.003 | -0.007 | 0.000 | 0.002 | 0.001 | 0.055 |
| 2003 / 2004 - 2007 / 2008 | 0.020 | 0.015 | 0.004 | -0.008 | 0.001 | -0.005 | 0.002 | 0.029 |
| 2004 / 2005 - 2008 / 2009 | 0.003 | -0.003 | 0.010 | 0.000 | 0.000 | -0.003 | 0.006 | 0.014 |
| 2005 / 2006 - 2009 / 2010 | 0.022 | 0.004 | 0.004 | 0.002 | 0.000 | -0.004 | -0.005 | 0.024 |
| 2006 / 2007 - 2010 / 2011 | 0.022 | 0.022 | 0.003 | 0.000 | 0.001 | 0.000 | -0.001 | 0.046 |
| 2007 / 2008 - 2011 / 2012 | -0.007 | -0.016 | -0.001 | 0.004 | 0.000 | -0.001 | 0.004 | -0.017 |
| 2008 / 2009 - 2012 / 2013 | -0.015 | -0.036 | -0.003 | 0.008 | 0.000 | 0.000 | 0.003 | -0.043 |
| 2009 / 2010 - 2013 / 2014 | -0.017 | -0.006 | -0.006 | 0.004 | 0.001 | 0.000 | 0.008 | -0.017 |
| 2010 / 2011 - 2014 / 2015 | -0.052 | -0.003 | 0.002 | 0.016 | 0.000 | 0.003 | -0.001 | -0.036 |
| 2011 / 2012 - 2015 / 2016 | -0.058 | 0.008 | 0.000 | 0.040 | 0.000 | 0.002 | 0.004 | -0.004 |

Table 2 Continued...

| Area reallocation effect | Price effect | Productivity effect |
|--------------------------|--------------|---------------------|
| Period       | Rubber | Palm | Coffee | Price effect | Rubber | Palm | Coffee | Price effect |
|              | Area   | Productivity |      |              |
|              | reallocation | effect |      |              |
|              | Total  | Total   |      |              |
| 1997 / 1998 - 2001 / 2002 | -0.007 | -0.005 | 0.000 | 0.025 | 0.000 | 0.005 | 0.005 | 0.005 | 0.025 | 0.043 | 0.051 |
| 1998 / 1999 - 2002 / 2003 | -0.004 | -0.003 | 0.000 | 0.019 | 0.000 | 0.005 | 0.010 | 0.027 | 0.015 | 0.011 |
| 1999 / 2000 - 2003 / 2004 | 0.001 | -0.003 | 0.000 | 0.018 | 0.000 | 0.004 | 0.009 | 0.028 | 0.015 | -0.006 |
| 2000 / 2001 - 2004 / 2005 | 0.002 | -0.002 | -0.001 | 0.014 | 0.001 | 0.003 | 0.009 | 0.026 | 0.009 | 0.015 |
| 2001 / 2002 - 2005 / 2006 | 0.004 | -0.005 | 0.000 | 0.004 | 0.001 | 0.001 | 0.006 | 0.011 | 0.028 | 0.055 |
| 2002 / 2003 - 2006 / 2007 | 0.004 | -0.007 | 0.000 | 0.001 | 0.001 | 0.001 | 0.004 | 0.004 | 0.039 | 0.089 |
| 2003 / 2004 - 2007 / 2008 | 0.005 | -0.008 | 0.001 | 0.001 | 0.001 | 0.000 | 0.004 | 0.004 | 0.038 | 0.072 |
| 2004 / 2005 - 2008 / 2009 | 0.004 | -0.006 | 0.002 | 0.000 | 0.002 | 0.000 | 0.004 | 0.004 | 0.034 | 0.032 |
| 2005 / 2006 - 2009 / 2010 | 0.005 | -0.007 | 0.002 | 0.000 | 0.001 | 0.000 | 0.003 | 0.004 | 0.041 | 0.053 |
| 2006 / 2007 - 2010 / 2011 | 0.005 | -0.005 | 0.003 | 0.000 | 0.001 | 0.000 | 0.003 | 0.006 | 0.027 | 0.093 |
| 2007 / 2008 - 2011 / 2012 | 0.005 | -0.001 | 0.003 | 0.000 | 0.001 | 0.002 | 0.003 | 0.013 | 0.012 | 0.013 |
| 2008 / 2009 - 2012 / 2013 | 0.005 | -0.001 | 0.002 | 0.000 | 0.001 | 0.002 | 0.001 | 0.010 | 0.009 | -0.018 |
| 2009 / 2010 - 2013 / 2014 | 0.005 | -0.002 | 0.003 | -0.001 | 0.000 | 0.002 | 0.001 | 0.009 | 0.007 | 0.013 |
| 2010 / 2011 - 2014 / 2015 | 0.004 | -0.002 | 0.003 | 0.000 | 0.000 | 0.002 | 0.001 | 0.009 | 0.006 | 0.003 |
| 2011 / 2012 - 2015 / 2016 | 0.002 | -0.001 | 0.003 | 0.001 | 0.000 | 0.002 | 0.001 | 0.007 | 0.004 | 0.000 |

Source: Authors’ estimation

Note: Figure is the five-period average from annual growth rate decomposition. This decomposition has some discrepancies due to approximation. Refer the detail in the text.
Indeed, risk coping for ensuring rural livelihood and sustainable farm management are practical issues in Thailand. At present, diversification is a concern in the national agricultural strategy. Since 1993, the Agricultural Development Strategy under the National Economic and Social Development Plan in Thailand has been aimed at achieving sustainable agriculture/farming by supporting or enhancing crop diversification (Ministry of Agriculture and Cooperatives 2017). This plan discusses the strategy for departing from mono-crop or monocultural agriculture, which has, at times, caused environmental issues such as soil erosion or excessive dependency on chemical inputs. The strategy mentions five types of sustainable agriculture practices (Office of the Permanent Secretary for the Ministry of Agriculture and Cooperatives 2019); integrated farming based on multiple activities in a field, organic farming, natural farming, new theory farming which was introduced by His Majesty, King Bhumiphol Adulyadej to support self-sufficiency among small-scale farmers, and agroforestry, which combines agriculture and afforestation.

Study area

Our survey was conducted in September 2015. This involved a multi-stage sampling survey in four villages from two districts (two villages chosen from each district) with an active coffee production. One district (district A) is located in a mountainous or hilly region unlike another district (district B). Fifty farmers were randomly nominated in each village. In total, approximately 160 households voluntarily participated in our survey. In this study, we use information about the plot types used for their crops by asking for their recollections about the circumstances of the years 2005, 2010, and 2015. We also consider the data collected regarding the usage of price or crop information. We discuss the crop transitions for 157 farmers for whom the replies regarding crop history were complete for all three time periods.

Crop choice transition

The transition in crop choice from samples in each district between 2005 and 2015 is shown in Fig. 2. In this figure, the labels C, D, P, R stand for coffee, durian, palm, and rubber, respectively. For example, the label “C” represents coffee monocrop farming, and the label “C+D” indicates that the farmers farmed both coffee and durian. The size of box is consistent with the number of farmers categorized into each type of crop choice. The thickness of the arrow is consistent with the number of households under a transition.

The transition in crop choice for surveyed farmers is as follows. First, in 2005, almost all farmers (around 96% of the sample 67 households in district A, 98% of the sample 90 households in district B) were engaged in coffee monocrop farming (C). However, by 2010, a significant number of farmers in both districts had diversified their crops, with a notable increase in the number of farmers farming durian (D) and palm (P). By 2015, the proportion of farmers engaged in coffee monocrop farming had decreased further, while the number of farmers farming durian and palm had continued to increase. The figure in the parentheses is the share of households under the crop choice type in each district.
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district B, and around 97% of the sample of 157 total farmers) planted coffee. However, the share of farmers who planted coffee decreased to 63% in 2010 and 59% in 2015 of 157 households. This situation differs between regions. In 2005, almost all farmers cropped coffee in both districts A and B. However, approximately 40% of sample farmers in district A kept coffee production, while approximately 80% of sample farmers in district B cropped coffee production in 2015. Second, the number of monocrop coffee farmers has drastically decreased in both districts: only 7% of farmers in district B were solely dependent on coffee by 2015. This means that the number of monocrop coffee farmers in 2005 started managing other commodities along with coffee. In particular, durian has become a main commodity in the survey regions. Durian is planted along with coffee, palm, and rubber.

As these findings describe, crop diversification has progressed in these villages, but the number of farmers who depend on a single crop other than coffee has also increased. Single-crop rubber farmers account for around 13% of total 157 farmers, and single-crop durian and palm farmers each account for around 5% in 2015. Actually, this crop choice has location-specific characteristics. The farmers from the hilly villages in district A prefer farming rubber. In this hilly district, around 80% of the households farmed rubber and around 20% of households has a plot for palm in 2015, while 30% of households farmed rubber and approximately half of the households grew palm in district B in the same year. Around 65% of farmers farmed durian in 2015, and this figure is indifferent between districts.

This transition diagram can help understand farmers’ decision regarding their crop portfolio. In this study area, some farmers planted 20–30 years old coffee trees, and this means they had the opportunity to keep (replant) or quit coffee production. Thus, some farmers partly introduced other crops into their management, while other farmers completely changed their crop from coffee to rubber or palm. In this study, we cannot identify the mechanism of their crop choice. However, when we refer to the findings by Kwanmuang et al. (2018), a farmer’s choice of crops depends on the evaluation of price levels and movement, attitude toward risks, and their resource endowment and constraints.

This transition reveals the extent of farmers’ dynamic decisions. For example, some farmers introduced additional crop(s) between 2010 and 2015. This reveals that the farmers sought comparative advantages and/or a risk coping strategy by diversifying their crop portfolio. The comparative advantage likely depends on their resource endowment, location of plot, accessibility to the market, market situation, and climate. Additionally, we investigate how farmers can learn or master farming management knowledge or production technology relating to (newly) introduced crops in such dynamic crop choice. Some farmers who quit coffee production in 2010 reintroduced coffee in 2015, and we believe this was not a difficult decision for them if they have previous experience of managing this crop.

In the context of this dynamic crop choice process in the study area, we should pay attention to a farmer’s capacity for diversification. Two aspects are examined for addressing this issue; their resource endowment (land size) and attitude toward crop information.

Transition in plot crop mix structure

For example, a farmer who grows durian and coffee can manage the plot in the following ways: (1) single coffee plot(s) and single durian plot(s), (2) mixed crop of coffee and durian, and (3) a mix of cases (1) and (2). Here, we confirm the transition in plot composition in Table 3. This is summarized by the total area size classes in 2005. The figures in this table do not report the number of households who had/have mixed crop plots, but the share of the households among the total in each class. For example, we see that the largest area class was more than or equal to 4.8 ha (30 rai). The table reports that 77% of farmers in this class had a single plot of coffee in 2005, and 44% had a mixed plot of coffee and durian, and so on.

In total, it was found that the diversification of farm management has progressed in all classes, but this progress differs between classes. When we see the total figure in the bottom row, it is found that farmers from the smallest total area class managed only one type of plot on average (1.07 in 2005), but farmers from the largest area class managed two types of plots. In addition, the smallest farmers were unable to diversify the plot type (it increased to 1.24 in 2015), but the largest farmers have diversified more (nearly three types of plots in 2015).

Furthermore, the larger classes of farmers manage more varied types of plots. The majority of smaller farmers exited from coffee monocrop management and started to manage mixed crop plot(s), but the larger farmers seem to have been able to engage in more diversified farm management. This table clearly shows that the larger farmers are more likely to maintain their coffee plots, but this scenario differs previous times when all classes of farmers were highly-dependent on the single coffee plot. These findings show no difference between the two districts, although the detailed figures are not shown.

Information utilization

Price information regarding commodity crops is necessary for efficient production management in planning shipment volumes and timing or in applying inputs such as nutrition or pesticides. The decomposition of production value growth in Section 2 finds that the price effects and yield effects are not negligible at the province level. This implies that information regarding prices or technology would be required for farmers’ decisions on area allocation or crop choice. Kwanmuang et al. (2018) also find the farmers’ experimental choice on crops significantly depends on the price movements.
of all alternative crops. This means they are concerned about the prices of other commodities, even though they do not actually grow them, because they are interested in the alternative crops for future choices. As the transition diagrams of Fig. 2 and Table 3 reveal, the crop shift, or change, in the study region has been drastic.

Here, two types of information are discussed. The first is price information, and the second is information about the farming practice or variety characteristics of each crop. The farmer can be supposed to access such information via several channels. In the case of price information, we suppose the farmer can get some information from the merchant, middleman, or buyer of their products when they ship. This channel via the markets could be a major source of information. As another price information source, media, such as TV, radio, and recently certain websites managed by the various agencies or associations, have significant roles for the dissemination of price information. In the case of obtaining farming practice or variety information, the extension office or workers have functions for this dissemination.

In the study region, the cooperatives, especially the coffee cooperatives, are active not only in procuring the products, but also in providing some input materials and sharing technological information among their members through the facilitation of meetings or training programs. Furthermore, the social network functions significantly in technological diffusion or knowledge dissemination by “learning from others” (Foster and Rosenzweig 1995), also known as “social learning” (Bardhan and Udry 1999; Chapter 12) in the literature. This is understood as the behavior for coping with the uncertainty in outcomes of new technology. We supposed the farmers would be able to exchange their information on the different crops.

Several pieces of literatures mentioned information used among farmers in Thailand. Here, the studies in our target province are introduced. Pokeeree et al. (2017) studied factors related to Robusta coffee production in Chumphon Province. They found that personal channels, especially from neighbors in informal discussions, followed by television as a media channel, and meetings were the channels most utilized by farmers for receiving Robusta coffee production knowledge. In the case of durian, also in Chumphon Province, Sararak et al. (2016) revealed that farmers received the most information on durian production and area use from friends, followed by meetings and trainings, and mass media in the form of TV and radio. However, Reantong et al. (2017) found that durian farmers in Chumphon Province preferred farm practice information from extension officers. The activities of the extension were in the form of field trips, lectures, demonstrations, and field work.

For coconut, the study of Thailaong et al. (2014) in Chumphon Province reported that even though farmers used personal channels from friends/neighbors the most, following by training and distributed documents, the level of information received for coconut was still at a low level (measured on a scale of 1 to 5). In addition, Juntra (2007) demonstrated appropriate media for promoting production extension for palm farmers in Chumphon Province. It was found that palm farmers preferred to receive information regarding farm practices from visiting extension staffers, followed by television. The studies not only describe the actual situation regarding information use, some of the studies also shed light on the farmers’ profiles explaining the decision on the use of the information channels (Linh et al. 2016).

This paper, however, aims to capture their use of information under the crop diversification process. It means we need to consider

### Table 3 Transition in plot type composition

| Plot Type/Year | No.HHS | Total AREA in 2005 |
|----------------|--------|-------------------|
|                |        | <=1.6ha (<=10 rai)| 1.6ha < and <=2.4ha (10 rai < and <= 15 rai)| 2.4ha <= and < 4.8ha (15 rai < and <= 30 rai)| >= 4.8ha (>= 30 rai) |
| Coffee Only    | 0.78   | 0.15             | 0.19             | 0.83             | 0.17             | 0.71             | 0.07             | 0.82             | 0.35             | 0.21             | 0.77             | 0.44             | 0.44             |
| Coffee+Durian  | 0.17   | 0.35             | 0.31             | 0.20             | 0.27             | 0.30             | 0.15             | 0.21             | 0.24             | 0.44             | 0.56             | 0.56             |
| Coffee+Durian+Palm | 0.04 | 0.04             |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| Coffee+Durian+Rubber | 0.02 |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| Coffee+Palm    | 0.04   | 0.06             | 0.07             | 0.03             | 0.03             | 0.03             | 0.09             | 0.06             | 0.05             | 0.15             | 0.18             |
| Coffee+Rubber  | 0.02   | 0.06             | 0.04             | 0.03             | 0.07             | 0.03             | 0.18             | 0.15             | 0.06             | 0.03             | 0.05             | 0.05             |
| Durian Only    | 0.04   | 0.09             |                  | 0.07             | 0.20             | 0.06             | 0.15             | 0.29             | 0.13             | 0.31             | 0.33             |
| Durian+Palm    | 0.06   | 0.06             |                  | 0.07             | 0.10             |                  | 0.06             | 0.06             | 0.03             | 0.08             | 0.13             |
| Durian+Rubber  | 0.04   | 0.04             | 0.03             | 0.17             | 0.13             | 0.03             | 0.12             | 0.12             | 0.05             | 0.05             |
| Palm Only      | 0.06   | 0.09             | 0.09             | 0.07             | 0.23             | 0.23             | 0.03             | 0.15             | 0.18             | 0.31             | 0.46             | 0.44             |
| Rubber Only    | 0.02   | 0.24             | 0.26             | 0.10             | 0.33             | 0.40             | 0.18             | 0.38             | 0.47             | 0.33             | 0.56             | 0.54             |
| Palm+Rubber    | 0.02   | 0.02             |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| Other Crop     | 0.04   | 0.02             | 0.02             |                  |                  |                  |                  |                  |                  |                  |                  | 0.03             |
| Total          | 1.07   | 1.17             | 1.24             | 1.30             | 1.40             | 1.53             | 1.47             | 1.71             | 1.74             | 2.08             | 2.67             | 2.74             |

Source: Authors’ survey

Note: The figure shows the share of households managing each plot type by class.
the farmers’ attitudes towards information use for alternative crops as well as the commodities under production. Our approach here is a naive one because we focus on the correlation between information utilization and the present crop situation. In other words, we focus on the differences in the utilization of information between the information sources to capture non-croppers’ interests in alternative crop information.

Fig. 3 shows the frequency of price information usage for each crop by information source. This is a mosaic plot, and the size of the rectangle in the plot reveals the number of respondents for each category. The farmers were asked about their usage of each source of price information: market, friends and media (TV, radio, and
internet). They replied regarding the frequency of usage, classified by always (colored in the darkest gray), often, sometimes, and never (colored in white). This was asked even for crops they didn’t produce.

We summarize their information usage structure as follows. First, it is acceptable that the actual croppers of each commodity have higher frequencies for price information use from any sources than non-croppers. Second, among the sources, the market serves as a significant channel for inquiring about or getting prices for the actual producers. Even for the producers, mass media is not an active source for price information. However, this source can be utilized by the producers of rubber, which is tapped almost every day, unlike other crops. Rubber price information is available on the web, and it is quickly updated.

Third, we can find the similarities and differences in the information utilization structure between commodities. Mosaic plot structures of information use for durian and coffee are very similar, and this seems to be due to the fact that these crops are jointly managed (see Fig. 2 and Table 3). Moreover, these crops have a different harvest frequency from palm and rubber, as they have only one main harvest season per year. This makes the farmers more sensitive to price situations. In addition, this difference of attitude towards getting information from friends between croppers and non-croppers is relatively small for coffee and durian. As seen before, durian production has drastically increased in the study region, where almost 65% of farmers produced the crop at the time of the survey. The fact is that many farmers were attracted to this crop production, and it implies that some non-croppers would also be interested in this commodity. As many of the social learning studies pointed out, followers of adaptation are concerned with the outcome or experience from the leaders in the adoption of new technology or varieties/crops.

The farmers in the study region have similar attitudes towards using general information regarding crops, as well as price-specific information. We asked them their usage of the different information sources of extension office/workers, cooperatives, and friends for inquiring or getting information regarding farming practice and management or variety characteristics. This is also drawn in a mosaic plot (Fig. 4) for their dichotomous reply; use or not use. We summarize the findings as follows. The usage structure of general crop information is similar to that of price information. The majority of the farmers for all crops used or received information mostly from friends and neighbors. The majority (90%) of coffee farmers also obtained information from informal discussion with their friends, around 83% received information from the extension office, and 80% from coffee cooperatives or groups. These structures are not different between actual croppers and non-croppers. This would reflect the past experience of coffee production. Friends were used as more important sources of farming practice information than extension offices or cooperatives, and it is confirmed that non-croppers also use this source.

This is significant in coffee and durian. As durian is harvested only once a year, it seems non-adapters are more concerned with better management in the adoption of this new fruit. The extension office may provide information on variety or technology, but friends and social relationships have a significant role in inquiring about the practice under area-specific conditions. The “learning from others’” attitude for durian implies the possibility of a further increase in farming this crop. The similarity in structure of use of social networks for durian information is supported from a simple statistical test. Table 4 reports the results of the Mantel-Haenszel test in considering the village strata. The hypothesis of no association between information use from friends and crop situation is not rejected at a 5% level of significance for durian. However, the information usage structure of palm and rubber is different between cropping and non-cropping farmers, but there is an active information exchange among producers for these crops.

**Discussion**

In this study we confirm that Chumphon Province has drastically changed in crop structure. The relative price changes, productivity changes, and area reallocation between commodities have worked in this dynamic transformation. Our survey showed that a part of this crop structural transformation could be realized by crop diversification at the farm or plot level. Crop diversification is actually promoted by the government in order to introduce sustainable and self-sufficient ways to farmers. Our study captures that crop diversification has actually progressed, but some concerns must be discussed in this section.

First, the province’s crop production value growth has been dominated by price effects. By the mid-2000s, there was an increase in planted land, but there was no further room for growth. This implies the importance of increasing productivity in crop production growth. Second, our study clarifies that the capability of crop diversification or diversified plot management differs among scales of farming. The study area has been departing from the monocrop of coffee, but smaller farmers have limited capacity for diversification compared with larger farmers. If crop diversification requires a larger area, this creates an issue for deforestation. The strategy of enlarging the total farmed area is unrealistic under the land constraints and also undesirable in the context of sustainability from a deforestation perspective. The necessary way forward for these situations is not only to improve productivity, but also to strengthen coping ability with respect to vulnerability against price fluctuations or unsustainable practices. The feasibility of strategies for agroforestry management or organic farming and valuing their crops for consumers should be discussed.

For this approach, ways of finding “local wisdom” with respect to good practices must be identified. Some scientific or other tech-
Fig. 4  The farmers’ sources of information about variety or farm practice / farm management

Source: Authors’ Survey. Drawn by R package “vcd” (Meyer, Zeileis and Hornik 2017)
Note: Observations with nothing to reply is shown in white colored area.

Table 4  Cochran-Mantel-Haenszel test for information use and crop situation

| Crop Type | Cooperatives | Extension Office | Friends |
|-----------|--------------|------------------|---------|
| Coffee    | 2.54         | 2.17             | 5.80**  |
| Palm      | 17.02***     | 7.00***          | 18.41***|
| Rubber    | 1.29         | 8.58             | 13.09***|
| Durian    | 13.04***     | 5.20**           | 3.47*   |

Source: Authors’ survey
Note: *** p<0.01, ** p<0.05, * p<0.1. A few observations with nothing to reply is omitted. Woolf test for homogeneity of odds-ratio between villages is rejected at a 5 percent level of significance for coffee and rubber information from cooperatives, but not rejected at a 1 percent level of significance for both.

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