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Agricultural Zoning and Policy Conflict: Thailand's Experience

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Additional information is available at the end of the chapter

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Abstract

Agricultural zoning is a regulatory approach that redefines property rights. The technique has been used to preserve agricultural area and ensure food security of a country. This chapter described a historically grounded approach to establish the agricultural zoning of a country and its applications for Thailand, including the analysis of its performance using the historical research method. Reviews of historical literatures, research papers, agricultural acts, government office reports, and news have identified the most crucial factor that causes agricultural zoning in Thailand to fail both at the farm level and at the country level, as the agricultural commodity price. The findings suggest that agricultural zoning in Thailand should undergo major revision by taking the agricultural commodity price into account. The agricultural commodity price set based on its origin was proposed to be appended in the existing agricultural zoning program. The method will address the two critical issues that the agricultural zoning programs in Thailand try to solve: the mismatch land-use problem and the crop price instability.

Keywords: property right, agricultural zoning, Thailand, agricultural transformation, agricultural policy

1. Introduction

The tragedy of the commons is the ruin of a common-property resource by uncontrollable use when each rational person pursuing his own best interest in a society that believes in the common-property regimes. As individuals increase their use of the resource, they gain the full benefits of the increased use but share only a proportion of cost. Since there is no guarantee on the property right, there is no incentive to preserve or increase the production of the resource for future use. One obvious example of the tragedy of the commons happens

in Ethiopia where there is a huge increase in the demand of fuel wood. When the harvest of fuel wood exceeds the rate of the wood production, farmers use straw and dung which are used to maintain soil fertility for fuel resulting in dramatic soil erosion. At the end, all trees are wiped out, and farmers abandon their land as there is a total collapse in soil fertility. The country does not have sufficed food for its population and has to rely on the food aid from international institution. As Hardin [1] stated “Freedom in a commons brings ruin to all.”

The establishment of property rights was seen as a tool to avoid the tragedy of the commons especially in land resource. However, the full ownership land right establishment led us to the same route in which all land resources are converted to nonagricultural use. Property rights form the basis for all market exchange and lead to the efficiency in land-use allocation. Unfortunately in the case of land use, most of the efficiency uses are in the nonagricultural activities. As landholder weighs the value of land in different uses, the benefit from agricultural use is typically a lot lower than other types of use even in extensive farming. Therefore, the full ownership land right turns out to be another nightmare. We then fall into the same situation that food security is in crisis due to dramatic reduction in agricultural land. Every country tries to solve this problem by introducing different types of land right in between the two extremes. Considering **Figure 1**, two extremes of property right are presented at the end of the line. Common right is property that is owned by a group of individuals. Access, use, and exclusion are controlled by the joint owners, while the full ownership right is the property that is owned by private owner or a group of legal owners. Access, use, exclusion, and management are controlled by the private owner or a group of legal owners.

In the middle of the line, it is the partial formal right such as preemptive right and usufruct right. These types of right restrict transfer of holding to only by inheritance and prohibit the transfer of ownership or rental. The restrictions aim to preserve agricultural area and ensure that the landless farmers cannot sell their land for a conversion purpose. Therefore, its occupancy level is in between the two extremes of land right type. However, the partial formal land right gains limited successes as it reduces incentives to invest in agricultural land and pose constraints to agricultural growth and natural resource management [2, 3]. Furthermore, it is found that rich people grabbed these lands with partial formal right especially prime plots with commercial prospect although the restriction is in place. Therefore, policy maker tries to find other methods to preserve agricultural land. The list of regulatory method varies which includes such things as purchase development right, purchase in fee, gifting to a trust, use-value taxation, growth-management acts, agricultural protection zoning, and many others. Among these long list methods, the agricultural protection zoning is the most persistent method despite many criticisms of its shortcomings [4].

The agricultural protection zoning or agricultural zoning is a regulatory approach that redefines property rights. It has been widely used since the publication of The Economics of Zoning

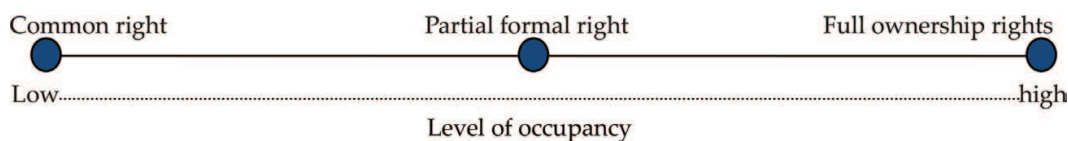


Figure 1. Land right map.

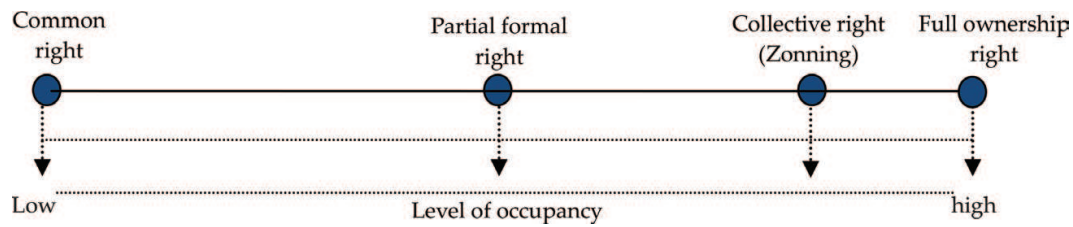


Figure 2. Agricultural zoning in land right map.

Laws [5]. The method was subtitled a property right approach to American land-use controls [6]. Nelson [7] stated that zoning creates collective property rights that are held by the local government. The entitlement itself is shared between the local government and the individual owner, and by this the individual right declines. The method is intended for protecting agricultural land and farming activities from incompatible nonfarm uses by specifying many factors, such as the uses allowed, minimum farm size, the number of nonfarm dwellings allowed, or the size of a buffer separating farm and nonfarm properties. If we take a look at the land right map again, the collective right or zoning should be located at the right-hand side of the line next to the full ownership right as shown in **Figure 2**. The level of occupancy is prone to the side of full ownership right as its restriction is weaker than that of the partial formal right.

Considering the location of zoning method on the land right map, zoning would appear to effectively address the issue of agricultural land reduction and food scarcity as it removes the decision to convert from the agricultural landowner, which is the shortcoming of the full ownership right, as well as address the occupancy level issue of partial formal right which creates uncertainty that leads to lower investment on agricultural land of farmer. There are a number of attempts to evaluate the effectiveness of agricultural zoning method; therefore, after discussing the methodological chapter in the next section, the review of agricultural zoning performance literature will be explored followed by the application of agricultural zoning in Thailand, its policy conflict, findings of the study, and a proposal to revise the agricultural zoning used, respectively.

2. Methodological chapter

This chapter was motivated by three major objectives: to examine the general application of the agricultural zoning to a country; to examine the adjusted application of agricultural zoning to Thailand; and to analyze the historical tendency of agricultural zoning policy and propose an additional tool that could bring success to the objectives of the agricultural zoning program used in Thailand.

The method employed for this chapter is historical research method. The method examines an account of what has happened in the past and presents events in the context of the present condition. It helps to reflect and provide possible answers to current issues and problems. The past events reveal the general and the particular in historical phenomena and give an understanding of various development stages of the event. The method helps to capture the

nuance and idea of the event and helps to answer the questions: where have we come from, where are we now, and where are we going? [8].

The secondary sources which include historical literatures in agricultural zoning, research papers, Thailand agricultural acts, government office reports, and online news were used as a tool to gain an experiential sense of the past and provide policy design resource. In the previous section, the review of general application of agricultural zoning program reveals that the method is actually one of the kinds of property rights, and the general objectives to apply the agricultural zoning of a country are to preserve the agricultural area and ensure food security. In the next section, the review of agricultural zoning performance paper in various countries will be discussed. This step helped to establish a background of the historical analysis into the policy design process.

3. Effectiveness of agricultural zoning

Researchers have developed several techniques and models to capture the impact of agricultural zoning on land-use change. These techniques can be grouped into two main approaches which are the pricing approach and the outcome approach. The pricing approach is the way which researchers use market prices as a proxy for effects on land use as land price reflects the conversion potential of the zoning policy that embodies in the parcel. While the outcome approach focuses on observing the physical land-use change comparing to the use before the implementation of the policy.

Pricing approach has several features. One popular feature of pricing approach is based on the land rent theories of Von Thunen and Ricardo. Given respective attributes and location, any parcel of land can be modeled for use in a way that would earn the highest rent. A number of studies have attempted to estimate the extent to which support policies have increased farmland prices, but I found only one that examines the effect of zoning policy on farmland price which is the work of [9]. The work found that large lot zoning, total acreage, distance from a highway, distance from a town, and the presence of a house on the parcel are the determinants of the price per acre of farmland. In addition, weighted productivity index and greater soil value were found to be negatively correlated with land prices. Another popular feature of pricing approach is based on the concept of local government that tries to maximize profit through zoning policy. Zoning is a function of land attributes and land price. Land prices are also a function of parcel characteristics and the designed zoning. If zoning policy is effective, the method should produce an effect on land price. Many works examine the effect of the zoning on land price based on this concept. Vaillancourt and Monty [10] found that the land zoned for agriculture is 15–30% less in price than unrestricted land. Wallace [11] also found that zoning policy decreases the price of parcel zoned for large lots and the land price is found to be higher for other type of zoning. Logan and Zhou [12] indicated that zoning has modest effect on the changes in land rent, local population, family income, and the number of black population. The agricultural landowners perceive that the limitations imposed on their permitted uses will decrease their land value, but it is not always be the case. McMillen and McDonald [13] analyzed the correlation between zoning policy and land use, finding policy to have a strong effect on land utilization. Henneberry

and Barrows [14] indicated that the effect of agricultural zoning on land price depends on the location and characteristics of the parcel. The agricultural zoned parcel that is located far from the city center is found to have a higher price than the agricultural zoned parcels close to the city. The result is in line with [15] who found that the land zoned for low-density development has a significant decrease in value, while the land zoned for high density or for community has a significant increase in value. More recent work of [16] also showed that agricultural zoning can be an effective policy for protecting productive farmland, while in the evidence from Japan, Nishihara [17] showed that agricultural land zoning policy has a great impact on land value increase and discourages the landowner from cultivating the land. A small gap in the anticipation of land policy to convert agricultural zone to residential development zone prevents landowner from selling or leasing the land to a more efficient farmer. Some studies based on this concept indicated that the zoning policy is not an effective tool for managing land use. Mark and Goldberg [18] examined the relationship between rezoning and changes in property values and the ability of zoning to mitigate externalities and found that rezoning does not necessarily lead to changes in land use and value. In the evidence from the United States, Pogodzinski and Sass [19] showed that zoning has no effect on house price but instead the minimum lot sizes, minimum side yard restriction, and maximum height restrictions affect house price, suggesting that the zoning method does not affect land use.

The other approach that uses to evaluate the effectiveness of zoning measure is the outcome approach. The approach is a direct proxy on land-use change as it compares the real physical change before and after the implementation of the policy. Not much research has been done on this approach. In England, Coughlin [20] found that agricultural zoning significantly reduces the sales of farmland to the conversion purpose, while in the evidence from the United States, Kline and Alig [21] found that the zoning reduces the likelihood of development on the land located within forest use, but the result for exclusive farm use zones is inconclusive. Levine [22] examines the effect of the growth-control enactment between 1979 and 1988 on net housing construction between 1980 and 1990. The study showed that local growth-management measures significantly displaced new construction such as rental housing and an expansion of the metropolitan areas into the interiors of the state. The measures have strong impact on low-income households and minorities, but not all growth-control measures were associated with this change, and the strong effect was found in the zoning measure. Cho and Wu [23] also adopts this concept to evaluate the interactions between residential development, land-use regulations, and public financial impacts in California, Idaho, Nevada, Oregon, and Washington. The study found that the land-use regulation decreases land development, long-run expenditure and property tax at the higher cost of housing prices, and property tax, while land-use regulations, land development, public expenditure, and property tax are affected by population, geographic location, land quality, housing prices, and the risks and costs of development. Mayer and Somerville [24] found that land-use regulation lowers the steady-state level of new construction. Metropolitan areas with more extensive regulations have up to 45% fewer starts and price elasticities that are more than 20% lower than those in less regulated markets. Kuminoff and Sumner [25] found that population growth and edge length of urban interface are statistically significant and positively correlated with conversion. Zoning and development restrictions were not significant explanatory variables for conversion. More strong result was found in the work of [26]. They evaluated the efforts of Utah County to discourage the farmland

conversion to other uses and found that zoning has not been successful in agricultural land protection. Coxhead and Demeke [27] evaluated the determinants of land-use decisions made by farmers in an upland area of the Philippines. According to the findings, the most important predictors explaining substantial farmland allocations were crop prices and policy reform.

The past evidence and studies do not provide any conclusion, that is, if the agricultural zoning policy is actually helpful to protect agricultural land and ensure the food sustainability. The only best conclusion that can be drawn from these researches is that the performance of zoning policy depends on the circumstance and the context of each government. One must be tempted to think that the government that has similar context and circumstance will be able to refer to the research result of each other as a guideline for managing their land use, but in reality there is no absolute likeness in a context and circumstance of government. The agricultural zoning formulation of a country is, in fact, a complex issue. Therefore, there is a need for evaluating each government policy performance separately in order to improve and solve an individual measure while the policy is on process.

4. Agricultural zoning in Thailand

In this section, the history and the implementation of agricultural zone in Thailand will be discussed as a case study. Thailand has a unique circumstance and context which other countries cannot refer to its success or failure in agricultural zoning policy as their guideline for formulating their own agricultural zoning. What happened in Thailand will be a supporting evidence to the conclusion in the previous section that the effectiveness of agricultural zoning cannot be judged by referring to the result of other area and the evaluation must be done separately for each area. Again, the historically grounded approach was used by reviewing relevant Thailand agricultural acts and policies, various government office reports, agricultural economics crop zoning management manual, and online news.

Thailand is one of the Asian developing economies. As an agricultural country that is facing dynamic change in all aspects especially land use and land market, Thailand has introduced the Agricultural Economics Act which creates the agro-economic zone or in short “agro-zoning” since 1979.” The act defined an agro-zoning as “an area of agricultural production, to be established according to the soil type, rainfall, temperature, economic crop, farm type and main income of farmer by using the boundary line of the province as border zone.” The objective of the agro-zoning is to plan the long-term development in agriculture, promote land-use type that match with its parcel suitability, control the agriculture data and statistic, and follow up the agricultural program with low budget and timeframe. In 1987, the government has divided the agro-zoning into 24 zones as shown in **Table 1** based on the factors prescribed in the act. Therefore, the provinces that have similar attribute and characteristics were included in the same zone, and the specific crop type was set and encouraged for production in each zone.

In 2013, the government adjusted the agro-zoning to become agricultural economic zone or in short “agricultural zoning” in order that it is possible to carry out in practice. The definition of agricultural zoning has been adjusted to “an area of agricultural production, including animal husbandry and reforestation to be established according to the market conditions and

Zone number	Province	Important commodities
1	Udon Thani, Nong Bua Lamphu, Nong Khai	Cassava, rice, cow, buffalo
2	Sakon Nakhon, Nakhon Phanom, Mukdahan	Cassava, rice, cow, buffalo
3	Yasothon, Ubon Ratchathani, Amnat Charoen	Cassava, rice, cow, buffalo, jute
4	Khon Kaen, Kalasin, Maha Sarakham, Roi Et	Cassava, rice, cow, buffalo
5	Surin, Buriram, Sisaket	Rice, buffalo, corn
6	Nakhon Ratchasima, Chaiyaphum	Cassava, rice, cow, buffalo, jute
7	Phetchabun, Lopburi, Saraburi	Rice, corn, green beans, millet
8	Nakhon Sawan, Uthai Thani	Rice, corn, millet, buffalo, cassava
9	Tak, Kamphaeng Phet, Sukhothai	Rice, cow, soybean, peanut, fruit
10	Phichit, Phitsanulok	Rice, green bean, buffalo, cow, tobacco, corn
11	Nan, Phrae, Uttaradit	Rice, soybean, peanut, tobacco, buffalo
12	Chiang Rai, Phayao, Lampang	Buffalo, rice, tobacco, vegetable
13	Chiang Mai, Lamphun, Mae Hong Son	Vegetable, buffalo, cow, soybean
14	Chai Nat, Suphan Buri, Sing Buri, Ang Thong	Rice, cow, sugarcane
15	Ayutthaya, Pathum Thani, Nonthaburi, Bangkok	Rice, fruit, vegetable, flower
16	Kanchanaburi, Rajburi, Phetchaburi, Prachuap Khiri Khan	Sugarcane, cow, rice, corn, fruit
17	Samut Songkhram, Samut Sakhon, Nakhon Pathom	Coconut, fruit, fisheries, flower
18	Prachinburi, Sa Kaeo, Chachoengsao, Nakhon Nayok	Rice, buffalo, cassava
19	Samut Prakan, Chonburi, Rayong	Cassava, fisheries, rice, sugarcane, coconut
20	Chanthaburi, Trat	Fruit, cassava, rubber, corn, fisheries
21	Chumphon, Ranong, Surat Thani	Rubber, coffee, cow, coconut, fisheries, oil palm
22	Nakhon Sri Thammarat, Phatthalung, Songkhla, Satun	Rubber, cow, rice, fisheries, coconut
23	Phang Nga, Krabi, Trang, Phuket	Rubber, coffee, cow, cashew nut, fisheries, oil palm
24	Pattani, Yala, Narathiwat	Rubber, cow, coconut, fruit

Source: Office of Agricultural Economics, 2015 [28]

Table 1. Twenty-four agricultural economic zones in Thailand.

agricultural economy of the country by taking into consideration conditions similar to the main factors such as climate, water resources, crop area, animal feed, types of farming and income of farmers.” The main objective of the agricultural zone in this era is to promote the land use that matches with its suitability; to balance the crop supply with the market demand, in the hope that the balance quantity will solve the crop price instability issue; and to develop a systematic control of the agricultural program at a provincial level. The government uses

zoning to set specific area for specific crop production based on water, soil, rainfall level, temperature, location, and farmers' income. It is also anticipated that the zone set will help to increase the production productivity in each area as the crop set offers better suitability for the farmers' respective areas. Since farmers are not familiar with such crops, the government provides training for farmers on the production of new crop. In addition, a guaranteed selling price was implemented to help farmers who need to replace the crop type to comply with the zone set. By these actions the crop production will be matched with the physical characteristics of the area, and the farmers will have sufficed knowledge and experience for production. The government also moves and expands the existing factories to the most suitable agricultural areas, so that there will be markets to support such crops. Since the establishment of the program in 1979, the program appears to have limited success. Therefore, the government tries to catch the public attention by announcing the agricultural economics crop zoning of 20 agricultural commodities in 2013. These commodities comprise thirteen agricultural crops (rice, cassava, hevea, oil palm, sugarcane, maize, pineapple, longan, rambutan, durian, mangosteen, coconut, and coffee), five livestock (beef cattle, dairy cattle, swine, chicken, and hen), and two fisheries (sea prawn and freshwater animal). The Ministry of Agriculture and Cooperatives (MOAC) then has scheduled a road map to speed the development of the zoning in the period of 2013–2032 which is totally 20 years.

The crucial point here is that Thailand has established the agricultural zoning with different sets of objectives from other countries. The measure does not intend to prevent the loss of agricultural land or to control an expansion of urban area into agricultural area. The data from the Office of Agricultural Economics (OAE) in **Table 2** showed that Thailand has an increasing trend of agricultural land area. There was a drastic increase in agricultural land area between 1986 and 2015, and a quick surge of agricultural land area was found between 2001 and 2002. It was increased from 127,431,751 rai in 2001 to 146,768,298 rai in 2002 due to a great number of agricultural price support schemes and huge demand of economic crop in the global market. However, after 2002 its trend still appears to be increasing along the horizon even in the top ten most urbanized city in Thailand, except for Bangkok, the capital city, as shown in **Tables 3** and **4**.

The figures and facts indicated that Thailand uses zoning to address the issue of mismatching between land use and land suitability and the issue of crop price instability. Therefore, the agricultural zone has been adopted by adjusting it to be commodity-based format and not use-based format as in other countries. As mentioned previously, we can see that agricultural zoning in Thailand has been divided into two periods. In the beginning of the program which is during 1979–2012, the area was first set followed by deciding the suitable crop to be produced in each area, while the second period which is between 2013 and 2032, the crop was first to be set (how much the country wants the specific crop in the market) and then followed by matching the area with the announced crop. The MOAC has created the country's Agri-map which provides suitability information of land in each area, and the provincial office needs to confirm if the map complied with the real physical land of the province. In this period, the zoning program will be operated at a provincial level.

Year	Total land area (rai)	Agricultural area (rai)	(%)
1986	320,696,888	127,789,900	39.85
1987	320,696,888	128,062,343	39.93
1988	320,696,888	128,545,799	40.08
1989	320,696,888	128,546,022	40.08
1990	320,696,888	128,762,844	40.15
1991	320,696,888	129,621,724	40.42
1992	320,696,888	128,589,662	40.10
1993	320,696,888	127,794,556	39.85
1994	320,696,888	128,338,834	40.02
1995	320,696,888	128,959,887	40.21
1996	320,696,888	128,303,197	40.01
1997	320,696,888	127,602,084	39.79
1998	320,696,888	126,901,617	39.57
1999	320,696,888	127,762,512	39.84
2000	320,696,888	127,597,090	39.79
2001	320,696,888	127,431,751	39.74
2002	320,696,888	146,768,298	45.77
2003	320,696,888	146,541,409	45.69
2004	320,696,888	146,602,041	45.71
2005	320,696,888	146,673,114	45.74
2006	320,696,888	146,895,404	45.81
2007	320,696,888	147,119,966	45.88
2008	320,696,888	147,492,689	45.99
2009	320,696,888	147,588,846	46.02
2010	320,696,888	148,055,549	46.17
2011	320,696,888	148,067,113	46.17
2012	320,696,888	149,240,058	46.54
2013	320,696,888	149,236,233	46.53
2014	320,696,888	149,225,195	46.53
2015	320,696,888	149,242,393	46.54

Source: Office of Agricultural Economics, 2018 [29]

Table 2. Agricultural land area in Thailand from 1986 to 2015.

Year	Agricultural area (rai)				
	Bangkok	Chonburi	Songkhla	Samut Prakan	Nakhon Ratchasima
1986	395,075	1,861,900	1,879,848	311,154	7,857,931
1987	355,211	1,724,904	1,878,161	266,853	7,780,447
1988	323,837	1,716,842	1,895,693	245,732	7,746,955
1989	306,574	1,621,656	1,863,396	217,131	7,716,845
1990	313,599	1,446,529	1,913,696	179,865	7,720,889
1991	288,292	1,492,668	1,933,158	239,123	7,833,264
1992	253,871	1,474,013	1,919,411	198,333	7,832,394
1993	237,315	1,466,989	1,924,027	187,608	7,807,216
1994	221,131	1,416,303	1,975,175	197,666	7,747,841
1995	206,822	1,367,404	2,040,258	201,977	7,680,030
1996	181,099	1,336,578	2,035,236	211,205	7,626,904
1997	159,288	1,303,320	2,034,943	213,217	7,615,387
1998	139,394	1,267,573	2,034,351	221,155	7,573,219
1999	125,359	1,271,462	2,062,808	206,558	7,659,630
2000	120,828	1,287,038	2,066,468	200,875	7,676,804
2001	119,623	1,305,153	2,071,358	194,711	7,661,896
2002	322,363	1,631,771	2,428,149	217,151	8,392,312
2003	323,070	1,627,028	2,439,855	216,859	8,299,745
2004	323,361	1,620,896	2,444,975	216,424	8,293,541
2005	323,779	1,620,333	2,450,061	216,666	8,291,510
2006	324,046	1,621,946	2,458,414	216,668	8,310,461
2007	323,269	1,834,552	2,459,470	214,764	8,336,850
2008	323,661	1,624,954	2,463,045	213,389	8,349,161
2009	325,012	1,620,023	2,470,831	212,981	8,336,476
2010	324,645	1,622,629	2,452,728	212,346	8,379,865
2011	326,573	1,621,671	2,451,857	212,248	8,378,455
2012	233,995	1,720,845	2,266,426	211,838	8,382,871
2013	233,911	1,720,137	2,266,511	211,449	8,383,120
2014	233,266	1,718,785	2,267,234	211,421	8,382,551
2015	233,186	1,719,457	2,269,009	211,704	8,385,473

Source: Office of Agricultural Economics, 2018 [29]

Table 3. Agricultural land area of the top ten most urbanized cities: Bangkok, Chonburi, Songkhla, Samut Prakan, and Nakhon Ratchasima.

Year	Agricultural area (rai)				
	Nonthaburi	Chiang Mai	Udon Thani	Pathum Thani	Khon Kaen
1986	198,698	1,401,397	4,829,053	763,674	4,068,582
1987	209,468	1,370,415	4,986,930	780,590	4,158,015
1988	201,581	1,381,934	5,062,530	707,577	3,979,004
1989	196,101	1,377,851	5,080,723	686,146	4,112,119
1990	194,967	1,269,312	5,097,243	695,483	4,157,993
1991	179,941	1,279,141	5,163,631	716,225	4,200,254
1992	166,071	1,247,978	5,184,504	670,599	4,100,790
1993	157,400	1,234,921	3,743,486	613,007	4,073,572
1994	153,632	1,250,985	3,737,699	607,271	4,099,446
1995	148,965	1,265,266	3,726,665	601,844	4,130,219
1996	160,802	1,259,494	3,706,577	577,502	4,089,495
1997	171,899	1,257,296	3,678,779	545,589	4,049,981
1998	184,525	1,248,918	3,638,467	521,029	4,000,177
1999	180,115	1,300,222	3,650,181	502,336	4,044,045
2000	170,652	1,300,530	3,645,349	491,555	4,054,090
2001	165,677	1,308,829	3,632,734	484,043	4,054,701
2002	227,610	1,724,473	4,385,100	572,478	4,502,696
2003	227,992	1,735,925	4,347,167	573,399	4,471,391
2004	228,184	1,742,904	4,346,415	573,884	4,472,107
2005	228,438	1,744,032	4,348,154	574,508	4,474,476
2006	228,596	1,749,532	4,356,468	574,889	4,480,981
2007	228,034	1,758,322	4,371,859	573,489	4,495,596
2008	228,172	1,769,898	4,382,422	573,796	4,507,209
2009	229,089	1,775,998	4,376,284	574,765	4,500,321
2010	228,568	1,790,597	4,397,072	573,062	4,520,704
2011	228,437	1,788,971	4,398,996	572,401	4,519,542
2012	219,259	1,830,686	3,868,581	510,265	4,219,317
2013	219,160	1,830,291	3,867,979	510,192	4,219,427
2014	219,012	1,830,078	3,868,003	509,752	4,219,573
2015	219,185	1,829,976	3,868,703	510,443	4,219,853

Source: Office of Agricultural Economics, 2018 [29]

Table 4. Agricultural land area of the top ten most urbanized cities in Thailand: Nonthaburi, Chiang Mai, Udon Thani, Pathum Thani, Khon Kaen.

After the implementation of the agricultural zoning, the agricultural sector in Thailand has transformed in the dimensions of crop diversification. Using the formula of Gibbs and Martin with the data from OAE, crop diversification index was calculated and presented in **Figure 3**. The index showed that Thailand has moved from mono-cropping pattern to a more diversified cropping pattern especially during the 1980s and 1990s which after the agricultural zoning was implemented. In 1977 and 1978, before the implementation of the zone, the index was 0.51, but in 2015, it was increased to 0.68. More farmers switch from rice to perennial crops such as coffee, sugarcane, cassava, corn, oil palm, fruit, vegetables, and flowers, livestock, fisheries, etc.

Despite that agricultural zoning has caused a significant agricultural transformation in Thailand, the level of success is considered to be limited considering that it has already been implemented for over 35 years. Only my work [30] analyzes the root cause of failure of the agricultural zoning in Thailand. The work found that the agricultural zone in Thailand was set based on physical and environmental characteristics and failed to consider crop prices, input price, and property right, which farmer prioritizes as their top priorities when allocating production to their agricultural land. These missing factors except property rights are economic factors. The zoning control results in land-use efficiency fail because variable factors that the government considers are not in line with private demand. The government fails to adequately perceive the private demands existing in land use of landowner and responds instead to the political pressure of organizing land use at the country level. The analysis of the work is however limited to the farm-level variable. The external factors at the country level such as the government policies are not included in the analysis. In reality, such factors have tremendous effect on the zoning program. Therefore, in the next section, we will go over some of the governments’ agricultural policies that conflict with the zoning program and cause it to fall short of expectation.

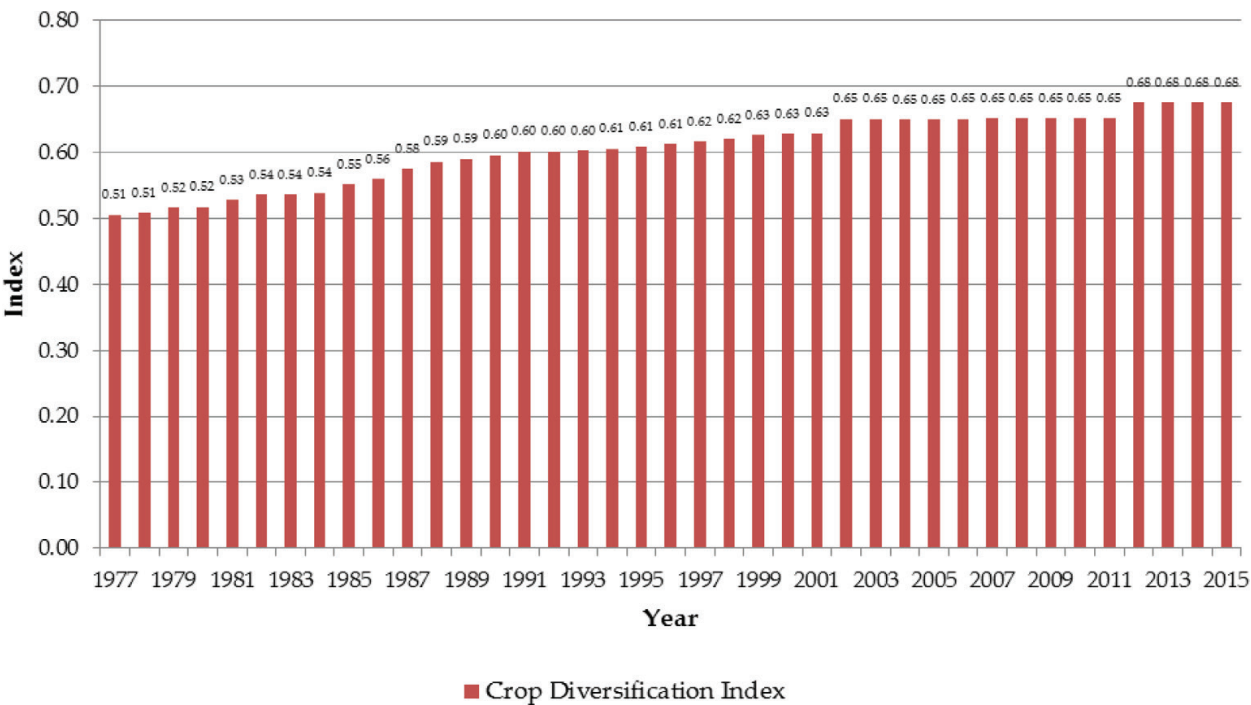


Figure 3. Crop diversification index of Thailand between 1977 and 2015.

5. Policy conflict

Most of the agricultural policies in Thailand were found to be conflicted with each other especially the policy of agricultural zoning and crop subsidy schemes. Agricultural commodity price in Thailand has been intervened by its government from time to time (more appropriate phase is “all the time”). There were mortgage schemes for rice, cassava, longan, rubber, oil palm, shallots, sunflower seed, and many more. On top of this, there are aid fund, act, strategic plan, and programs for many agricultural commodities such as rubber aid fund, the Sugarcane and Sugar Act of 1984, rubber price stability program, oil palm industry strategic plan, etc.

The most notorious program that ruins the agricultural zoning program is the rice mortgage scheme. Rice production is the largest portion of the Thai economy and labor force; therefore, any policy on rice will produce a widespread effect in the country. In 2011, while the agricultural zoning is functioning, the rice mortgage scheme was implemented with the objective to increase the rice price, create stabilize Thai economy through increased domestic consumption, increase Thai farmers' well-being, and control the world market price of rice. The attempt to replace rice paddy field with sugarcane field by agricultural zoning failed because most farmers switch from other crops to rice in order to obtain the guaranteed price. Likewise, this incident happens in the case of the mortgage scheme for cassava, longan, hevea, oil palm, etc. While one of the main objectives of agricultural zoning is to control the supply quantity of products, so that the product price is not fluctuated, the price is in fact the cause of the change in the quantity supply. This happens because the agricultural commodities are in fact in the perfectly competitive market. In microeconomics theory, equilibrium price in the perfectly competitive market is determined through a process of interaction between the market demand and market supply not the market supply alone. Therefore, by introducing the series of mortgage scheme for each crop, the zoning policy has failed to function properly.

Another program to be discussed is the government's strategic plans for palm oil year 2008–2012 which aim to expand the plantation area of oil palm from 2.5 million rai in 2007 to 5 million rai in 2012, and the strategic plans for palm oil year 2015–2026 which aim to expand the plantation area of oil palm from 5 million rai in 2017 to 7.5 million rai in 2026. The strategic plan is part of the government's alternative energy development plan for 2015–2036. Oil palm is a primary raw material for biodiesel production which is an alternative energy of the country with an increasing demand in recent year. In 2012, the Ministry of Energy has a target of biodiesel production of 3100 million liters per year to increase the country's energy security. According to the Agri-map of the MOAC, the suitable area for oil palm production is in the south of Thailand where there is the highest rainfall in the country. The rainfall in the south of Thailand is regular and scattered throughout the region. Oil palm needs plenty of water and 6 hours of sunlight each day with the plantation area lower than 300 meters above sea level. Each tree needs 5–350 liters of water daily, monthly rainfall of 150 millimeters, and dry season not more than 60 days [31]. Therefore, the zone set for oil palm is in the southern area of Thailand. However, the high demand of domestic palm oil and the oil palm strategic plan creates an attractive economic incentive for farmer to switch the production from other crop to oil palm. In 2015, the Ministry of Agriculture and Cooperatives (MOAC) introduced the oil palm to northeast of Thailand through the pilot projects in Nong Khai

province. Northeast of Thailand is not suitable for the production of oil palm as it has poor soil, low rainfall, and a long dry season. However, the expansion of oil palm plantation area has been promoted through various interventions, such as seedling, low-interest rate funding, input, mills, and refineries. As a result, oil palm plantation area has rapidly increased in the northeast of Thailand. The attempt to encourage land use according to its suitability of the zoning program has again failed due to an attractive economic incentive created by the government. Besides, the other objective of zoning which is to stabilize the crop price also failed. Consider **Figure 4**, it presented the price of oil palm during 1997–2018. The oil palm price has been fluctuated even during the period of both oil palm strategic plans (2008–2012 plan and 2015–2026 plan). In 2017, only 2 years after the implementation of the second plan, oil palm price starts a dramatic fall due to the excess supply of the crop. The government tries to solve the low-price issue by exporting the residual quantity to global market, but the attempt has not succeeded in solving the excess supply problem and low oil palm price in the country. As of March 2018, the oil palm price is as low as 3.02 baht per kilogram. The government is now considering an income compensation scheme for farmer as a short-term assistance and a cut down oil palm tree program with compensation as a long-term measure to combat the low-price issue.

The last instrument to discuss is the Sugarcane and Sugar Act of 1984. The act was enacted after the implementation of agricultural zoning. Since the enactment of the Sugarcane and Sugar Act of 1984, sugarcane production area has considerably expanded by almost 160% from 1982 to 1996 [32]. According to the act, sugarcane farmers and sugar factories share the profits from production at a rate of 70:30 under the condition that the sugarcane field must not be located more than 80 km from the factory. The objective of the act is to stabilize the sugarcane price for farmer. After the enactment of the act, the sugar factory has been expanded to 53 factories in 2015 from 17 factories in 1984. The sugar price remains quite high as sugarcane

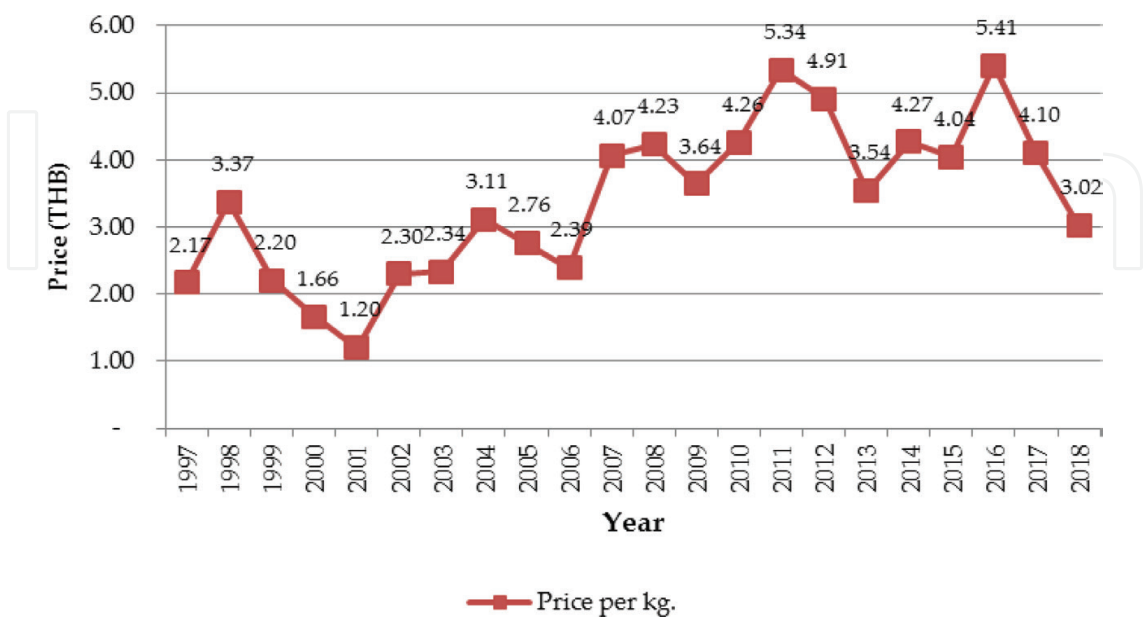


Figure 4. Oil palm price between 1977 and 2018.

farmers and factories try to push the domestic price up to share the set benefit. The country exports approximately 70% of sugar product, and only 30% was distributed for domestic use. The agricultural zoning again could not resist the expansion of land use in sugarcane production because of the high economic incentive initiated by the act.

The government tends to implement the policy to tackle the issue at hand without considering the existing active policies. These actions make each agricultural issue more complicated to be handled and result in a high government budget spending in each incident. After the implementation of the agricultural zoning, the government should have a minimum intervention in the market, so that the instrument will be able to function properly.

6. Findings of the study

The most crucial factor that causes failure on agricultural zoning in Thailand at the farm level is the agricultural commodity price, while the governments' latter crop subsidy scheme is the most crucial factor that causes the failure of agricultural zoning at the country level.

Obviously, the finding reveals that the most crucial factor that causes agricultural zoning in Thailand to fail at the farm level and at the country level is actually agricultural commodity price. This suggests that agricultural zoning in Thailand should undergo major revision by taking the agricultural commodity price into account. Therefore, a proposal to revise the agricultural zoning used in Thailand based on this finding will be discussed in the next section.

7. A proposal for a revision of agricultural zoning in Thailand

The revision of agricultural zoning proposed here is based on the principles for dealing with two critical issues that agricultural zoning program in Thailand tries to solve: the mismatching between land use and land suitability and the crop price instability.

The proposal is to set agricultural commodity price based on its production area or in other words its origin. This zone pricing is to be included in the existing zoning program. The Land Development Department (LDD) has completed the country soil survey and matched the land quality with each crop growth requirement in order to help the government to determine the crop zone. They have divided land suitability into four categories: highly suitable (S1), moderately suitable (S2), marginally suitable (S3), and not suitable (N) [33]. The government will be able to set the crop price according to these criteria. The crop that is grown in the area with highly suitable category will have the highest price followed by the crop that is grown in the moderately suitable area, marginally suitable area, and not suitable area, respectively. The proof of the commodity origin is the certificate of origin issued by the local government office. By setting the agricultural commodity price based on its production area, an incentive for farmer to allocate their land to the most suitable crop set by the government is initiated. The method will eliminate the price risk for farmer and the mismatch land-use problem at the same time. The factory and the mill are assured of the quality of the product as it was

produced on the most suitable area for such crop. To “set” the price is different from to “control” and to “fix” the price. The proposal here is not to control the market mechanism of demand and supply. The price based on the commodity origin can be set in several ways such as the percentage difference between the crop grown in highly suitable area and the crop grown in moderately suitable area.

One concern of this method is that the agricultural commodities are in the perfectly competitive market, so the country cannot prevent imported agricultural commodities especially their price set. However, when the use of agricultural land is complied with its suitability, it can be anticipated that the commodity produced can be competed with imported product in terms of quality. The origin declaration will also be applied for imported agricultural commodities. Typically, all types of the certificate of origin (Form D, CO, Form FTA, etc.) are included in the import document set. The importer only needs to put the tag on their commodity showing where the origin of their product is, and this practice has already been done recently in Thailand for agricultural product sale in modern trade store. The consumer will benefit from the information on the commodity origin as some imported product prices are much lower than that of the domestic product but with great poor quality especially in terms of safety. Consumer behavior is changing as there is a raised concern on safety food; therefore, the product origin information is a crucial factor for making a purchase decision instead of price. The agricultural commodities are price inelastic of demand as it is a basic necessity product. In the short run, the quantity purchase is not very responsive to price change. Therefore, the concern of the lower price of imported product is quite considerable. In the worst case, the impact from imported product can be dealt through price protection scheme, but it is not suggested as Thailand has an obligation under the Doha Round of WTO negotiations in November 2001 to reduce the domestic agricultural support and protection. Therefore, the price protection will not be a sustainable way to deal with the problem.

8. Conclusion

Agricultural zoning is a regulatory approach that redefines property rights. The technique has been used to preserve agricultural area and ensure food security. Many empirical evaluations of its effectiveness in several countries have been made, but they cannot be used as a reference to other countries as each country has unique context and circumstance.

Thailand is one of the Asian developing countries, which has adopted the agricultural zoning, but the method is adjusted to be the commodity-based format and not use-based format. The main objectives of agricultural zoning in Thailand are to address the issue of mismatching between land use and land suitability and the issue of crop price instability. Agricultural zoning in Thailand has been established since 1979, but it showed limited success mainly due to the variable factors that the government considers which are not in line with private demand. In addition, the implementations of latter policies are contradicted to the zoning policy. The program has caused an agricultural transformation in Thailand in the dimension of crop diversification, but it needs a major revision in order to achieve its goals.

The revision proposed is to set agricultural commodity price based on its origin. There are two strategies for meeting Thailand's agricultural zoning objectives. First, after setting the price based on its origin, the government should also play a small role as possible in intervening the agricultural commodity market. Second, the government should integrate a crop production information system with the Agri-map of the MOAC for farmer to check the production area quantity of each crop in the country. This current production quantity information should be updated at least monthly, so that farmer will have sufficient information to make a decision on the quantity supply of the agricultural commodity apart from the price.

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