

Human Settlement and Environmental Control Mechanism

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Abstract: *In Thailand, population distribution has been crowded in the city, especially Bangkok. This study aims to investigate the correlation of population distribution and dwelling development projects required Environmental Impact Assessment (EIA), as the crucial tool for environmental control mechanism. According to EIA legislation, the projects are enforced to comply environmental mitigation and monitoring specified in Environmental Impact Statements (EISs). The results was found that the number of population in each region from 2006 to 2015 were correlated with significant statistical association, beside Bangkok. Dwelling projects required EIA showed the same tendency in all regions. The number of Bangkok population was found strongly associated statistical significance (p -value = 1.000) with Thailand population. As to Bangkok, dwelling official registered also showed high statistical association ($p < 0.01$) with dwelling required EIA. However, the negative correlation with the number of population were found. The results of this study strongly confirm further requirement to control population distribution of the main city.*

Keywords: *Population Settlement, Environmental Impact Statements, Dwelling Projects, Thailand.*

1. Introduction

Human settlement directly concerns the ability of environment to support the needs of human being. However, one of the crucial problem is the population distribution which mainly crowded in the main city. Consequently, many infrastructures to support the needed of population and the supply from their ecosystem are imbalanced.

Environmental Impact Assessment (EIA) is widely acknowledged to be an effective tool in environmental management and its benefits are well known. The key elements of the EIA process have been incorporated in many legal systems around the world [1]. As a formal process, project EIA deals with development proposals from their entry into the decision making process through to the post Environmental Impact Statement (EIS) during which projects are built and operated. With respect to Thailand, project screening is controlled by the Office of Natural Resource and Environmental Policy and Planning (ONEP), through the Environmental Impact Evaluation Division (EIED). The EIED is responsible for managing the EIA system in Thailand. The Thai EIA screening process is a compulsory system under the National Environmental Quality Act (NEQA), 1992. The types and sizes of projects, as well as locations for certain types of development, which require EIA are listed in the Government Gazette. Thus, EIA is required if any proposed project is categorized as a "prescribed activity". The ONEP identifies such projects based on threshold levels. To comply Section 50 of the NEQA (1992) [2], the measures to prevent and control the environmental effects are forced by mitigation and monitoring program identified in EISs. Therefore, EIA through the EIS documents is crucial mechanism to control the impacts from project development activities.

This study aims to analyze population distribution with related to some environmental control mechanism. In this study, the mechanism of Environmental Impact Assessment is interested. The data of population from the year 2006-2015 in each region together with the EISs of real estate project produced in the same year were collected and analyzed their relationships. For the next, the study further focused on Bangkok. Population and

dwelling official registered and dwelling required EISs of twenty years period were investigated their relationships by Pearson Correlation Coefficients. The results could illustrate some circumstance of the ways to protect the environment resulting from human settlement.

2. Results

2.1 Population Settlement

In Thailand, the number of population has been increased from 53,336,072 in 1993 to 65,729,098 in 2015. Table I illustrates the distribution of population in each region during the past ten years. The Northeast of Thailand shows the highest number of population, with around one-fourth of total. The number of population agrees with their areas (Table II). However, around one-tenth of population is crowded in Bangkok, with the number of 5,696,409 in 2015. Besides the capital of Thailand, the main city of economic hub and its prosperity are prominent factors.

TABLE I: The Number of Thailand Population in each Region between 2006-2015

Years	Bangkok	Central	Northeast	Northern	Southern	Total
2015	5,696,409	16,753,526	21,916,034	12,072,421	9,290,708	65,729,098
2014	5,692,284	16,532,023	21,845,254	11,846,651	9,208,504	65,124,716
2013	5,686,252	16,366,870	21,775,407	11,825,955	9,131,425	64,785,909
2012	5,673,560	16,222,892	21,697,488	11,802,566	9,060,189	64,456,695
2011	5,674,843	16,060,141	21,585,883	11,783,311	8,971,855	64,076,033
2010	5,701,394	15,922,094	21,573,318	11,788,411	8,893,050	63,878,267
2009	5,702,595	15,742,529	21,495,825	11,770,233	8,813,880	63,525,062
2008	5,710,883	15,615,968	21,442,693	11,878,641	8,741,545	63,389,730
2007	5,716,248	15,409,587	21,385,647	11,871,934	8,654,831	63,038,427
2006	5,695,956	15,264,732	21,376,830	11,890,752	8,600,436	62,828,706

Source: [3]

TABLE II: Areas of Thailand regions

Regions	Areas (m ²)
Bangkok	1569
Central Region	178,286
Northeast	168,854
Northern	93,691
Southern	70,715
Total	513,115

Source: [3]

Considering on the pattern of population in each region within ten years period, Pearson correlation coefficient is analyzed, illustrated in Table III. Significant correlations ($P < 0.01$) are found for populations in the southern, the northeast and the central regions of Thailand. On contrary, the population of Bangkok results the opposite correlation with the others, including the southern, the north-east and the central regions. It illustrates the unique of population pattern of Bangkok. The question regarding carrying capacity of the areas to support the demand of tremendous number of population is concerned.

TABLE III: Pearson Correlation Coefficient of population within ten years period in each regions

	Southern	Northern	Northeast	Central	Bangkok
Southern	1				
Northern	0.278	1			
North East	0.992**	0.348	1		
Central	0.999**	0.295	0.989**	1	
Bangkok	-0.537	0.258	-0.489	-0.511	1

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed)

2.2 Projects required Environmental Impact Assessment

Under Section 46, NEQA (1992), the types and sizes of projects or activities requiring EIA were established. Dwelling project is one of the categories of EIA mandatory under NEQA, 1992. They cover condominium projects which more than 80 rooms and housing development project in which the areas are more than 100 rais (0.16 km²) or more than 500 units. Table IV shows the number of dwelling project EISs, produced from 2006-2015 in each region. The number was double increased from 2006 to 2015. Their statistical relationships are shown in Table V. Significant statistical associations are found nearly all regions of Thailand. The tendency of dwelling project developments is nearly in the same direction, excluding the southern part.

TABLE IV: The number of dwelling project EISs produced between 2006-2015

Years	Bangkok	Central	Northeast	Northern	Southern	Total
2015	125	164	5	8	105	407
2014	149	195	17	16	134	511
2013	110	145	14	6	37	312
2012	93	136	6	11	36	282
2011	127	178	10	12	39	366
2010	76	91	1	2	38	208
2009	57	65	0	1	23	146
2008	136	166	1	4	56	363
2007	82	99	2	1	29	213
2006	75	100	3	7	17	202

Source: [4]

TABLE V: Pearson Correlation Coefficient of dwelling project EISs in each regions

	Southern	Northern	Northeast	Central	Bangkok
Southern	1				
Northern	0.606	1			
Northeast	0.544	0.783**	1		
Central	0.859**	0.844**	0.810**	1	
Bangkok	0.761*	0.679*	0.644*	0.916**	1

*, Correlation is significant at the 0.05 level (2-tailed). **, Correlation is significant at the 0.01 level (2-tailed).

2.3 Relationship between population settlement and dwelling project EISs

Table V shows the statistical relationship between the number of population and dwelling projects required EIA. Statistical significant ($p < 0.05$) are found for the southern, the northeast and the central of Thailand. Remarkably, the relationship of Bangkok shows negative correlation. Therefore, Bangkok areas are further considered.

TABLE V: Pearson Correlation Coefficient of dwelling project EISs and population in each regions

Regions	Statistical association
Southern	0.711*
Northern	0.067
Northeast	0.668*
Central	0.719*
Bangkok	-0.232

*, Correlation is significant at the 0.05 level (2-tailed). **, Correlation is significant at the 0.01 level (2-tailed).

Population, dwelling units of Thailand and Bangkok in twenty years period (1993-2015) illustrated in Table VI. It also noted that 1993 is the first year that the enforcement of NEQA, 1992 became effective for condominium project types. Consequently, the projects must comply the conditions specified in the EISs. The results in Table VII show some remarkable statistical association. It was found that the tendency of Thai population has been strongly associated statistical significance with Bangkok population, with p -value = 1.000. Hence, this is clearly confirmed that the influence of population settlement in Thailand has heavily relied on Bangkok population. Consideration on Bangkok, surprisingly, negative correlation of dwelling registered shows negative correlation with population. However, dwelling registered also shows high statistical association ($p < 0.01$) with dwelling EISs.

TABLE VI: The Number of dwelling Registered and Population of Thailand and Bangkok, together with Bangkok dwelling EISs between 1993-2015

Year	Bangkok dwelling EISs	Bangkok dwelling registered	Thailand dwelling registered	Bangkok population	Thailand population
2015	125	2,753,972	24,712,420	5,696,409	65,729,098
2014	149	2,672,423	24,091,404	5,692,284	65,124,716
2013	110	2,593,827	23,466,417	5,686,252	64,785,909
2012	93	2,522,855	22,836,819	5,673,560	64,456,695
2011	127	2,459,680	22,240,259	5,674,843	64,076,033
2010	76	2,400,540	21,681,635	5,701,394	63,878,267
2009	57	2,334,126	21,143,975	5,702,595	63,525,062
2008	136	2,263,680	20,608,269	5,710,883	63,389,730
2007	82	2,207,453	20,089,221	5,716,248	63,038,427
2006	75	2,150,706	19,582,845	5,695,956	62,828,706
2005	69	2,091,558	19,016,784	5,658,953	62,418,054
2004	90	2,050,411	18,432,937	5,634,132	61,973,621
2003	34	2,020,019	17,853,423	5,844,607	63,079,765
2002	24	1,963,660	17,309,344	5,782,159	62,799,872
2001	16	1,928,921	16,910,473	5,726,203	62,308,887
2000	7	1,900,235	16,516,322	5,647,799	61,878,746
1999	15	1,876,577	16,248,890	5,662,499	61,661,701
1998	21	1,849,249	15,888,639	5,680,380	61,466,178
1997	14	1,810,530	15,495,755	5,604,772	60,816,227
1996	12	1,829,758	15,341,204	5,937,430	60,116,182
1995	11	1,701,166	14,697,085	5,705,871	59,460,382
1994	2	1,600,235	13,997,449	5,718,333	59,095,419
1993	1	1,509,472	13,336,167	5,704,600	53,336,072

Source: [3],[4]

TABLE VII: Pearson Correlation Coefficient of Population, the Number of Dwelling Registered and Dwelling Projects required EIA of Thailand and Bangkok from 1993 to 2015

	Thai Population	Thai dwelling Registered	Bangkok population	Bangkok Dwelling Registered	Bangkok Dwelling EISs
Thai Population	1				
Thai Dwelling Registered	-0.181	1			
Bangkok population	1.000**	-0.181	1		
Bangkok Dwelling Registered	-0.155	0.996**	-0.155	1	
Bangkok Dwelling EISs	-0.222	0.910**	-0.222	0.894**	1

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

3. Conclusion

Results of this study show some hidden factors influencing population settlement. Dwelling is the basic necessary element for human being. Thus the control of dwelling by EIA enforcement should be one of the effective mechanism to control environmental impacts from population distribution.

Dwelling projects required the EIA must comply the conditions of mitigation and monitoring measures identified in their EISs. Section 50 of the NEQA (1992) stipulates that the mitigation and monitoring recommendations included in an EIS must be prescribed in the license for project implementation. Although for projects requiring EIA, EISs are the key factor in the licensing of projects. The study of [5] confirmed that mitigation and monitoring programs for projects requiring EIA are more satisfactory for project implementation. The case of Bangkok in this study provide the good point for the correlation of dwelling registered projects and dwelling EISs.

The number of Thai population has been relied on Bangkok population pattern. The number of population should agree with the number of dwelling, however, Bangkok case is opposite. In this study, although dwelling projects registered of Bangkok have been correlated with dwelling EISs, the number of population in Bangkok also illustrate consequent question, especially the negative correlation with dwelling. Population distribution of Bangkok depends on many factors, such as foreign workers, non-registered population, land use planning, and some official policy. In addition, from the study of [6], they found the new dwelling projects have been developed along the new transportation routes. These are indirectly effect from the mega project implementation. Hence, the other mechanisms, especially from the policy level, are required.

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5. References

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