Sustainable Urbanization in Thailand

Bhanupong Nidhiprabha
Thammasat University

Abstract

Urbanization is a process of economic development involving a changing structure of the economy. Transformation of an agrarian society into a modern society involves migrating labors from agriculture to manufacturing and service sectors. Economic development strategy therefore affects the degree of urbanization as well as its consequences. Sustainable urbanization requires institutional infrastructure that nurtures property rights and the rule of law to enable efficient operation of the market system.

Thailand offers an example of sustainable urbanization, although many problems still remain unresolved. The paper discusses the extent to which urbanization and industrialization contribute to environmental problems and how economic growth improves quality of life in both rural and urban areas. Air pollution and traffic congestion have improved significantly in the past because of successive appropriate policy application. Product pricing policy affects the outcome of urbanization in terms of water and air quality.

Rapid economic growth does not always necessarily imply unsustainable urbanization. Nevertheless, economic growth can slow down excessive primacy due to insufficient human and physical capital investment. Thailand has been experiencing deconcentration of urban population in large cities since the early 1970s. Labor mobility is high and responsive to wage differentials caused by large discrepancies in the capital labor ratio in different regions. Though there are remaining disparities between rural and urban areas, the improving trend is encouraging.

1. Introduction

Fifteen percent of Thais resided in cities in 1975. Twenty-five years later, urban population accounted for 22 percent of the total population. Secondary school enrolment was 25 percent of relevant age group in 1975. By 1997, the ratio increased to 48 percent. Infant mortality in 1975 was 74 per 1,000 infants. By 1998, the infant morality dropped to 29. Life expectancy at birth in 1975 was 58 years old, rising rapidly to 72 and 66 years of age for females and males born in 1998. Strong economic growth, rapid urbanization, and quality of life are intricately related.

Rapid urbanization in some developing countries has led to increasing urban poverty, widespread slums, urban environmental degradation, and inadequate housing and health care. The paper shows that negative consequences of rapid urbanization can be mitigated. Quality of urban life can be enhanced by slowing population growth through reducing fertility and promoting primary health care and education for the poor. Environmental degradation is not an unavoidable consequence of urban growth. With effective urban planning and stringent rules and regulations, environmental

quality need not be severely threatened by growth in industrial activity and population density.

High economic growth generates explosive traffic congestion, threatening air quality in growing urban areas. But cleaner emissions technology and modern mass transportation modes can be affordable only when the country has been successful in economic development. Urbanization is a natural consequence of economic growth that tends to reduce poverty incidence. There is always negative externality in the process of urbanization, but these problems must be managed to ensure that positive externality of urbanization outweighs its negative impact and results in sustainable urbanization.

The rest of the paper is organized as follows. Section 2 examines the relationship between urbanization and population growth in Thailand. It discusses the declining primacy of Bangkok and the increasing importance of its satellite cities. Section 3 explores the relationship between urbanization and poverty in rural and urban areas. Section 4 deals with negative consequences of urbanization. Section 5 provides successful examples of environmental management in Thailand. Section 6 concludes with a remark on the issue of urban sustainability.

2. Urbanization and population density

In 2000, the population density in Bangkok was 4,060 persons per square kilometer. Bangkok primacy was clearly demonstrated by its size of population, which was 60 times the density of population in the Northern region, where 67 persons lived per square kilometer (table 1). However, the population density in Bangkok has experienced a declining trend as the city has encountered the urbanization diseconomies of agglomeration. Between 2000 and 2002, the population of the whole kingdom increased by 3.1 percent, implying increased urbanization for the whole country. But the density of population in Bangkok actually declined by 9 percent to 3,694 persons, which was about 51 times the least densely populated Northern area in Thailand. When compared with the whole kingdom's density, Bangkok was 30 times the national average in 2002.

In fact, the degree of urbanization has been slowing down in all regions. Figure 1 illustrates that, except for the spike in 1980, population density in all regions including Bangkok has been decelerating since 1960. This indicates that urbanization was not so rapid as it may seem. Urban population was 15 percent in 1975, increasing gradually to 17 and 22 percent in 1980 and 2000 respectively.

The major factor behind this slow urbanization process is the sharp drop in the population growth rate, which reflects the success of family planning programs. Map 1 illustrates that population growth rate in 2000 was low, less than one percent in Bangkok. The highest population growth can be observed in border provinces next to Burma, suggesting the impact of migrant workers. Nevertheless, the population density in the central region including Bangkok and in the Northeast remains the highest in the country (map 2). While the two regions share a similar high degree of population density, the income gap between the two is also the widest in the country.

As table 1 indicates, while Bangkok population density has been declining, border cities of Bangkok such as Nontaburi and Pratumthani have experienced increasing density. Nonthaburi, in particular, experienced a sharp increase, as farmland was converted into residential areas led by the property boom in the aftermath of the economic recovery. The Bangkok Metropolitan Region (BMR) has absorbed the out-migration from Bangkok as commuters substitute distance and travel time for higher quality residential areas in the suburbs surrounding Bangkok. As land prices in the capital city have been rising again after the economic crisis, Bangkokians are increasingly being forced to reside outside Bangkok and take advantage of the improved infrastructure connecting Bangkok with its satellites.

It should be noted that not all cities in the BMR experienced higher population density. For example, Samutprakan, Nakornpratom, and Samutsakon actually experienced a decline in population density. These are the cities that once provided manufacturing employment and initiated the first stage of deconcentration of Bangkok. Between 1970 and 1986, the urban population of Bangkok Metropolitan Area grew at 4.3 percent per year, while the key satellite suburban areas of Samutprakan, Nonthaburi, and Prathum Thani grew by 8 percent. Manufacturing employment grew between 8 and 12 percent annually in the 5 suburban areas, while Bangkok employment increased by 7 percent during the same period.

The deconcentration took place as standardized manufacturing production tends to move to medium-sized metropolitan areas, while production in large metropolitan areas focus on services and non-standardized manufacturing (Henderson, 2000). As table 1 indicates, the second stage of deconcentration has already begun as industries are gradually moving away from the BMR, because of higher production and transactions costs and government incentive to locate factories in industrial parks outside the BMR. If the trend continues, it is likely that we would observe a more balanced process of urbanization with less concentration of industries in large cities. The situation in Bangkok differs significantly from Hanoi and Ho Chi Minh City, where population density is much higher than official figures suggested. According to Deakakis-Smith and Dixon (1997), the rapid urbanization of the two cities has led to urban poverty and environmental problems that would threaten the economic growth of Vietnam. In contrast, the rapid process of urbanization in Thailand has begun to decelerate since the last decade.

3. Urban Poverty and Migration

Rapid economic growth involves transforming the traditional rural sector into the modern urban sector. The agricultural output share in GDP declines as per capita income rises. As manufacturing output share in GDP increases, the employment share in the manufacturing sector also rises as agricultural laborers move to seek jobs in factories in urban areas. Population density rises in urban areas, as the manufacturing sector becomes the engine of growth to the economy. Thus urbanization is an unavoidable process of economic development.

Rapid economic growth has resulted in poverty reduction. The poverty level in Thailand declined substantially from 32.6 percent in 1988 to just 11.4 percent in 1996 (figure 2). The economic crisis that caused output contraction by 10 percent in 1998 resulted in higher unemployment. Consequently, the percentage of the poor in total

population rose to almost 16 percent in 1999. The degree of poverty incidence in rural areas was much higher than in urban areas (table 1). Although the rate of poverty in the rural sector increased to 21.5 percent in 1999, it has been declining gradually as the economy recovers. In contrast, poverty incidence in urban areas is much lower than in the rural sector. This observation is consistent with the empirical evidence from cross-sectional data of 39 countries indicating that the urban poverty rate rises slowly relative to the rural rate (Ravallion, 2002). The strength of the economy between 1988 and 1996 had cut the urban poverty from 12.6 percent in 1988 to a mere 3.1 percent in just 8 years. Furthermore, when the Thai economy was hit by the financial crisis, the poverty rate in 1999 increased to only 3.8 percent. The rural population bears the brunt of the economic meltdown more than the city people who created the economic crisis. Figure 2 clearly demonstrates that economic growth helps reduce poverty. The Thai government aims to reduce poverty incidence below 12 percent by 2006. If the recent growth trend can be sustained, the government seems to be able to meet this target sooner than planned. If rapid economic growth can reduce poverty, then urbanization and poverty reduction in both rural and urban areas can occur simultaneously.

It is not necessarily true that income growth can be achieved at the expense of income equality. The Gini coefficient actually declined from 0.53 in 1992 to 0.5 in 2001 (table 2). The relationship between growth and income distribution is more complex than the simple u-shaped curve relationship of the Kuznets hypothesis. But it is clear that people in the lowest 20 percent of income bracket are mainly rural people, whereas the urban population sits in the top quintile. By examining table 2 closely, we can observe that the gain of the top quintile is always at the expense of the bottom quintile. In 1992 during the double-digit growth of the Thai economy, income share of the highest 20 percent went up to 59 percent while the income share of the lowest 20 percent declined to 3.9 percent. The corresponding numbers in 1999 tell a similar story that the poor are vulnerable to economic fluctuations.

If the urban sector can provide better job opportunities with more stable incomes, urbanization can clearly have positive implications and therefore should be welcome. The important question is how to make labors suitable for working in the urban sector. Education provides human capital and raises the value of marginal productivity of workers. Table 3 clearly shows that laborers from the Northeastern region of Thailand have the lowest level of investment in human capital. The proportion of Northeastern people with higher education level than the secondary level was only 5 percent in 2000, compared with the corresponding figure of 24 percent in Bangkok. Disparities in human capital endowment also explain large regional income inequality. Urban areas not only provide jobs for migrant labors, they also provide education for rural people. The government has recently imposed 12 years of compulsory education. By providing equal opportunity for educational attainment, the issue of income inequality can be addressed in the long run. The provision of basic education to all children can improve the future quality of Thai workers. Workers in rural areas migrating into cities can be provided with the sufficient amount of human capital suitable to work in the modern sector.

Urban areas provide employment in the service and industrial sectors. As stylized fact of development predicts, the shares of output and employment in the service sector would be rising while the corresponding shares in agricultural sector would be

declining. Table 4 shows that Thailand's case is consistent with that stylized fact. From 1995 to 2000, the rural sector cut the agricultural labor force from 68 to 64 percent, while its labor share of industry employment rose from 9.5 to 12.3 percent. In contrast, the urban sector shredded its labor shares in all sectors except in the service sector, which witnessed an increase from 55.7 to 61 percent. Some agricultural laborers are absorbed by some industries in rural areas, but a large part is attracted into the service sector in urban areas. Since the shares of employment in all sectors except services are declining, only the urban service sector can incorporate the migrating workers from the rural sector.

As discussed earlier, since agricultural workers have poor human capital endowment, their wages are depressed by their low values of marginal product. When compared to Bangkok wages, Nonthaburi as a part of BMR provides a relatively higher wages above Bangkok by 6.5 percent. These high wages correspond to a rapid rise in population density in this province as we have observed in Table 1. In contrast to Nonthaburi, the Northern and Northeastern regions were able to offer wages at only 39 percent of the Bangkok level. Also the wage rate on the national average in 2000 was only 60 percent of the Bangkok wage rate. Wage differentials between urban and rural areas, and between agricultural and service sectors are the determinant of migration between urban and rural areas. Population density in the urban sector and wage differentials are therefore related through migration.

Bangkok primacy has been declining over time; net migration into Bangkok Metropolitan Area had slowed down remarkably from 373,833 people during the period 1985-1990 to just 49,151 people during the period 1995-2000 (table 6). During the same periods, the net migration into the BMR had more than doubled. The out migration had been severe in the Northeast between 1995 and 2000. The industrial development in the Eastern seaboard explains the net migration into the Eastern region. Seen in this light, labor migration and urbanization possess positive implications and should be welcomed as they imply more efficient human resource allocation, and poverty reduction in both rural and urban sectors in the process.

As table 7 suggests, the share of output in the Eastern region rose from 9.5 percent in 1993 to 14.8 percent of GDP. Bangkok's share of output has continued to decline from 41.3 percent in 1993 to 35 percent in 2001. At the early stage of development, Bangkok was able to exploit the economies of scale in urban agglomeration. As the impacts of diseconomies of scale became apparent, the first stage of deconcentration occurred when Bangkok started to lose its comparative advantage in production. The output share of BMR declined from 53 percent in 1993 to 47.4 percent in 2000—confirming the second stage of deconcentration in suburban areas of Bangkok. This encouraging trend implies that the urbanization process in Thailand is sustainable, because large cities of BMR would not be expanding without limit. There would be no absolute convergence of the economic activity and income levels, since they are determined by regional factor endowment.

Economic planning and management is crucial for mitigating the problem of urbanization. If rural areas can generate sufficient income and employment, there would be fewer problems of concentration and congestion in the urban sector. Public expenditure allocated to each region indicates the seriousness of the government in dealing with income discrepancies and poverty eradication. Shown in figure 3, the

Northeast received 18 percent of the public expenditure, while its share of Thailand's GDP was 11 percent in 2000. Similarly, the North, whose output share was 8.8 percent, received 13 percent of the total budget. On the other hand, the East received 6 percent share of the budget while its GDP share was 14.8 percent. BMR received 46 percent of total government budget, which is more or less in the same proportion of its share in GDP. In conclusion, the central government budget is appropriate in the sense that it compensates for the regional inequality. The public expenditure policy also points out that the urbanization process is heading in the right direction of urban sustainability, as the government tries to slow down the growth of primal cities indirectly by providing resources for smaller cities in poorer regions.

The poor are vulnerable to economic shocks. They are subject to layoffs and do not have assets to sustain their consumption when they are unemployed. Thus the poverty incidence is directly related to the number of unemployed persons, which is the mirror image of the incidence of poverty. The poverty incidence (figure 2) that increased substantially during the 1998 crisis corresponds to a sharp increase in both rural and urban unemployment (figure 4). Rural unemployment increased more than urban unemployment in 1998. It is possible that workers who lost their jobs in the cities went back to their villages in rural areas. As the economy recovers, they move back to seek jobs in cities. Figures 5 and 6 provide the comparative composition of unemployment in the two sectors. People seek jobs in urban areas due to higher wage rates and degree of job security. Unlike laborers in the urban sector, rural laborers suffer from seasonal variations; thereby increasing the transitory component of their measured income. Rural people who are actually seeking jobs in rural areas are therefore in smaller proportion (less than 18 percent of the total unemployed) when compared to those who are actively seeking work in urban areas (40 percent).

One of the reasons for Thailand's relatively low unemployment rate is the flexibility in the labor markets. Migration of workers between urban and rural areas is flexible during the boom and bust. In addition, the wage rates can adjust downward during high unemployment. There is no downward rigidity in industrial wage rates. Minimum wage rates exist but they are flexible enough not to place burden on employers. The minimum wage rates also differ among regions corresponding with differential costs of living in different parts of the country. The flexibility in the labor market helps facilitate the movement of labor to strike out the efficient allocation of labor among different parts of the country. It is not surprising to see Northeastern workers employed in the service sector in the Southern part of Thailand. In sum, the problem of heavy concentration in urban areas can be mitigated by the flexibility of labor markets, allowing workers to seek work they deem appropriate in terms of the return and living conditions. The transfer of income from employees who choose to work in the urban sector can also enhance the income of people who remain in the rural areas.

4. Negative Consequences of Urbanization

Urban housing problems become serious as population density increases. Migrating workers who are actively seeking jobs in the cities within BMR are likely to face degraded housing conditions. The percentage of people dwelling in slums in

Pathumthani, Samutprakan, and Samutsakorn is exceedingly high (table 8). In general, the percentage of people living in slum communities is usually lower than 3 percent in all regions, except for Saraburi where the percentage was high at 7 percent in 1998. These are the areas where industrial factories are located. The government has launched housing programs as a means to stimulate the property sector and to provide housing for the poor. Although the policy of subsidizing the poor to own their own houses seems to be a populist-type policy to win votes from the poor, the welfare enhancing effect of such programs to eliminate poverty housing cannot be denied. One could argue that there is a positive externality involved in the program since urban housing problems can be addressed effectively. Another positive impact of the policy is its ability to redistribute income from the rich to build up housing assets for the poor. In addition, there is excess liquidity in the money market, depressing the current interest rates. As such, this is the best time to implement the urban program. Nevertheless, the government cannot ignore the macroeconomic impact of such public investment if the economy is fast approaching another bubble in the property sector.

4.1 Air Quality in Urban Ares

Increasing wealth caused by the booming economy creates poor air quality as automobiles become increasingly affordable. Traffic congestion is mainly responsible for 70% of the dust, which is caused by diesel and motorcycle exhaust and construction sites (Reutergardh and Thi Yen,1997). In Bangkok, where the number of cars per 1,000 populations had already exceeded 450 in the early 1990s, road congestion represents a significant detriment to human health. The urban road area to total urban area in Bangkok in 1995 was only 8,5 percent, compared to 14 percent in Tokyo, 17 percent in London, and 25 percent in Washington D.C. Figure 7 exhibits the number of motor vehicles registered in Bangkok between 1994 and 2000. Major increases are in sedans, van pickups, and motorcycles. Note that vehicles for large passenger buses did not keep up with the growth rate of small vehicles. The air quality problem becomes more acute when cities cannot provide sufficient alternative means of public mass transportation.

Air quality problems are more serious near the streets than in other general areas. Transport is the single largest contributor of carbon monoxide emissions, while industry and power generating sectors contributed the most sulfur dioxide, blamed for acid rain which falls hundreds of kilometers from the source of the pollution. Carbon dioxide emissions are related to global warming since they deplete ozone layers in the atmosphere. Table 9 reports that Bangkok air quality showed a slight improvement in 2003 compared with the 1998 level. Carbon monoxide, nitrogen dioxide, sulfur dioxides were below their ambient standards, but the carbon monoxide showed an increasing trend.

The most damaging kind of air pollution is PM10, which are small particles less than 10 micros in diameter. Vehicle exhausts, smoke from factories and funeral cremation, smoke, and dust stirred up by automobiles cause PM10. The small particles in the air enter the respiratory system causing allergies, lung cancer and heart disease. PM10 has a strong correlation with death rates. PM10 levels in Samut Prakarn, Sara Buri, and Lampang, where coal-based electrical generating plants are situated, exceed the standard of 100 micrograms per cubic meter for about 20% of the year. The large

cities such as Khon Kaen and Chiang Mai and industrial cities of Samut Sakorn and Chon Buri exceed the standard for about 10% of the year. In Bangkok, the average PM10 level over 24 hours at the busiest streets exceeds 120 micrograms.

Total Suspended Particulate (TSP) along roadside increased tremendously during the boom years between 1995 and 1997, but it declined after the collapse of the real estate construction (figure 8). Nevertheless, the 24-hour maximum average concentrations of TSP and PM10 at ambient stations in 2000 (measured at least 50 meter away from the main roads) were 400 and 240 micrograms, respectively. The problem of dust in Bangkok is a serious threat to air quality. Chay and Greenstone (2003) found evidence that a one percent reduction in TSPs results in a 0.35 percent decline in the infant mortality rate at the county level in the US. The results showed fewer deaths occurring within one month of birth, suggesting that fetal exposure is a potential pathophysiologic mechanism.

Factories that are polluting both air and water remain a serious threat to the environmental quality. Despite government attempts to introduce laws and regulations, it seems that the principle of 'polluters pay' is not widely adopted. Table 10 shows that in Bangkok and the BMR, where industrial activities are concentrated, the proportion of factories that produce hazardous wastes and pollute air and water is extremely higher than acceptable standards. The worst area is in Samut Sarkorn, where 41 percent of factories are polluting air and 77 percent of factories are polluting water. Samut Sarkorn is a fishery town where factories of processed seafood are concentrated. Because of tight regulations and close monitoring, factories in Bangkok are not major polluters compared to Prathum Thanee, where 60 percent of its industrial factories are still contaminating the water supply and 50 percent are generating hazardous industrial wastes. It seems that problems with water pollution are more common than air pollution among factories in the BMR.

4.2 Quality of Water Resources

The pollution control department of the Ministry of National Environment has been monitoring the quality of rivers in Thailand. The results of the survey in 2002 indicate that only 40 percent of the 49 rivers and 4 reservoirs in Thailand have a water quality above the standard. There were 32 percent below the standard and 3 percent with a low standard. Table 11 shows the Chao Phraya River water quality in 2000 at various sampling points. Each of the sampling points does not produce substantial variations of water quality. The Biochemical Oxygen Demand (BOD) remains more or less the same. Urbanization and industrialization are fundamental causes of poor quality of water. The Chao Phraya River, however, is not the worst polluted river in Thailand. The Tha Chin and Bang Pakong Rivers, which flow through urban and industrial areas as well as pig farms, are the most polluted rivers in Thailand, with high MPN (total coliform bacteria) and low Dissolved Oxygen (DO).

There is a tradeoff between having better environmental standards and achieving a more competitive industry with low cost of production. As long as these factories are not forced to pay for their negative externality imposed on the society, they will continue to produce output higher than the socially optimal level.

5. Urban Environmental Management

In this section, two examples of environmental management are chosen to highlight the role of institutional infrastructure including the rule of law and the role of coordinating organizations that can be used to sustain urbanization. According to Araby (2002), the Greater Cairo Metropolitan Region, which is the world's tenth largest mega-city, suffers from rapid urbanization. The reasons behind this unsustainable urbanization are: the increasing population density in the Cairo Metropolitan Region, (CMR), the growing urban poverty and income inequality, and environmental degradation. As discussed earlier, the situation in the BMR is rather different from the CMR. The current urban management policy seems to bode well for the comprehensive view of urban governance.

Pollution of the Mae Klong River by sugar mill wastes in 1971 was a wake-up call for the government to recognize the detrimental environmental impacts of industrialization. The objective of industrial pollution control was included in the third National Economic and Social Development Plan for the period 1971-76. The first National Environment Quality Act was passed in 1974, while the New Environmental Act came into effect in 1992. The new Act allows for the decentralization of responsibility of environmental actions to provincial governors. Sustainable urbanization requires effective institutions that promote and protect environmental standards so that environmental assets of people can be enhanced. These environmental assets include clean air, clean water, fisheries, and forest. Environmental rights and the rule of law are necessary to maintain the quality of such non-renewable assets.

Bangkok, as is well known, has been built over a swamp. Every rainy season, heavy rains cause floods on the streets of Bangkok. Bangkok is sinking because of the heavy use of underground water by factories and housing estates. The canals that could have prevented the flooding as they provided an effective draining mechanism in the past have now been converted into streets to accommodate rapid increases in automobiles.

Land subsidence is a chronic problem in 6 provinces: Nonthaburi, Ayuthaya, Nakorn Pratom, Samut Prakan, Samut Sarkon, and Bangkok. Artesian water well usage in these provinces is about 600,000 cubic meters per day—well above the available replacement supply. The main reason for the over usage of the underground water is the wrong pricing policy. The artesian water fee is 8.5 baht per cubic meter, whereas the tap water fee starts at 9.5 baht, and increases to 15.8 baht if the usage is above 200 cubic meters. Many factories in those 6 provinces choose to use artesian water. The price of underground water should be higher than tap water to include the externality imposes on the sinking of Bangkok.

There is however a success story in the case of Prathum Thani, where land subsidence is not a problem. Artisan water is allowed for use in activities in which product quality would be affected if tap water were used instead. Those activities are medical production, and the dyeing and tanning process in textile production. The demand for artisan water use and its supply is equated at 387,000 cubic meters a day. This quantity is equal to normal underground flows. In addition, the Provincial Waterworks Authority (PWA) and the Ground Water Department of Natural

Resources and Environment Ministry cooperate successfully with the provincial chapter of the Federation of Thai Industries to ensure that excess supply of water would meet the rapid increase in the demand from property and industrial development. Clearly, successful environmental protection requires the understanding of the private sector to take responsibility for the impact of their actions on society. Furthermore, it requires coordination among government organizations and effective regulations.

The long run solution to the problem of land subsidence is effective law and appropriate pricing policy. A draft of the artesian water conservation act is under the scrutiny of the parliament. Under the new law, users of artisan water will be charged at 10 to 15 baht to reflect the true social cost. Indeed, the Thai PM wanted all artesian wells located in areas where tap water is available be shut down by the end of 2003.

It should be pointed out that 20 million Thais do not have access to clean water. In addition, 15 percent of Thailand's cropland is irrigated, but that cropland uses 70% of dry season water supply. Here there is a conflict between competing usages of free water resource. Existing laws allow people at the head of a river to use as much water as they like, even when little or no water is left for villagers downstream. Ineffective property rights inhibit the efficient use of water resources. A new water resource bill has been in the drafting process for the last 10 years. The original version gives the government absolute power over resource management, but this is strongly opposed by NGOs, fearing that the government may not want the public to participate in water management. Political will is the most important factor for the issue of the environment to be pushed high on the agenda of lawmakers.

The World Bank reported that in early 1990s the average blood lead level of sample populations in Bangkok was 40 micrograms per deciliter. The lead level was much higher than those in Cairo, Budapest, and Mexico City. The average lead level in those cites was around 25 micrograms, compared to only 3 micrograms for the US average. The Thai government ordered the reduction of lead concentration in gasoline to 0.15 g/l in 1996, while new cars since 1993 must be installed with catalytic converters, which can only be used with unleaded gasoline. In fact, premium-unleaded gasoline had been available since 1991 when drivers were encouraged by the government to use it by taxing it less heavily than leaded gasoline. In 1996, the government absolutely prohibited the use of leaded gasoline.

Consequently, air quality in Thailand has improved significantly from the past decade. Rated by the World Bank Environment Monitor 2002, Bangkok's air quality was above that of Beijing, Jakarta, New Delhi, and Manila. Lead, dust, and carbon monoxide in Bangkok and urban areas had decreased to an acceptable level (Figure 8). The strategy of phasing out leaded gasoline has paid off. According to the BMA report of Bangkok State of the Environment 2001, the level of lead in the air has reduced dramatically after the introduction of unleaded gasoline in 1993.

Particulate matter with a diameter less than 10 microns is now considered the top air pollutant. PM10 comes mainly from diesel engine emissions and open fires. Crematoriums in Bangkok aggravate the poor air quality in Bangkok, since 65 percent of them burn wood chips and charcoal, while the rest use diesel fuel. BMA's Department of Health and the National Environment Board have established standards

for crematoriums. New technology is being developed but it will take some time before it is implemented in all crematoriums.

The government also promotes four-stroke engines for motorcycles and three-wheelers. The four-stroke engines are cleaner, though they are initially more costly, but they are cheaper to maintain and require less fuel. The government is phasing out vehicles with two-stroke engines. The process of fighting with pollution requires tremendous perseverance and political will, because of the apparent conflict with interest groups.

If the gasoline price is too low, it encourages the profligate use of vehicles. By international standards, the gasoline price in Bangkok is relatively low--only 35 cents per liter. The low price encourages utilizing large sized engines and making unnecessary trips, which cause traffic congestion and produce more pollution. The long-term solution is to gradually adjust the gasoline price upward to reflect the social cost. It should be pointed out that we cannot solve environmental problems with clean technology alone, because technology is less important than institutional capacity, legal safeguards, and political will.

6. Concluding Remarks

In contrast to the popular view that Bangkok is facing insurmountable environmental and social problems, the paper shows that Bangkok and its surrounding cities are moving towards sustainable urbanization. The degree of urbanization in Thailand has been slowing down in all regions. The major factor behind this slowing urbanization process is the sharp drop in the population growth rate, which reflects the success of family planning programs. The relative size of economic activity in the BMR has been declining gradually. This trend implies the second stage of deconcentration in suburban areas of Bangkok. This encouraging trend suggests that urbanization process in Thailand is sustainable, because large cities of the BMR would not be expanding without limit.

The public expenditure policy indirectly mitigates the problem of rapid urbanization. The fiscal policy fosters the sustainability of Thailand's urbanization process, because the government attempts to slow down the growth of primal cities indirectly by providing resources for smaller cities in poorer regions.

Relying on the efficient mechanism of the labor markets can reduce the problems caused by heavy concentration of economic activity in urban areas. Flexibility in wage rates and migration encourage workers to seek jobs where they deem appropriate in terms of the returns and living conditions. Labor migration is a means to efficiently allocate human resources for productive employment.

As a result of the ban on leaded gasoline, air quality in Thailand has improved significantly from the past decade. Whenever social cost is greater than the private cost, the government has every reason to intervene in the case of market failure. Product pricing policy is important to ensure that polluters pay for their negative externality. The currently low price of gasoline in Thailand encourages the profligate use of vehicles.

It should be pointed out that environmental problems cannot be solved with clean technology alone, because technology is less important than institutional capacity, coordinating governance among government agencies and the responsible private sectors, legal safeguards, and political will. Political will is the most important factor if the issues of environmental degradation can be fully addressed. Sustainable urbanization requires institutional infrastructure that nurture property rights and the rule of law to enable efficient operation of the market system.

REFERENCES

Araby, M. El (2002) "Urban growth and environmental degradation" Cities, Vol. 19, no. 6, 389-400.

Chay, Kenneth Y., and Michael Greenstone (2003) "The impact of air pollution on infant mortality: Evidence from geographic variation in pollution shocks induced by a recession" The Quarterly Journal of Economics, August, 1121-1167.

Drakakis-Smith, David, and Chris Dixon (1997) "Sustainable Urbanization in Vietnam" Geoforum, Vol. 28, no. 1, 21-38.

Henderson, Vernon (2000) "Urbanization in developing countries" World Bank Research Observer, Vol. 17, no. 1.

Ravallion, Martin (2002) "On the urbanization of poverty" Journal of Development Economics, Vol. 38, 435-442.

Reutergardh, Lars Baetz, and Nguyen Thi Yen (1997) "The Thai environment: prospering or suffering from development?" Trend in Analytical Chemistry, Vol. 16, no.8.

TABLE 1
Population Density (per square km)

Region/Province	2000	2002	Percentage Change
Whole Kingdom	118.7	122.4	3.1
Bangkok	4060.3	3694.2	-9.0
Central	138.9	145.0	4.4
Samutprakan	1024.2	1023.5	-0.1
Nonthaburi	1312.2	1454.6	10.81
Pratumthani	444.1	464.6	4.6
Nakornpratom	375.9	369.9	-1.6
Samutsakorn	534.5	507.7	-5.0
North	67.4	71.6	6.3
Northeast	123.3	128.0	3.8

TABLE 2
Poverty and income distribution in Thailand

	1988	1992	1996	1999	2000	2001
Total poor (% of total population)	32.6	23.2	11.4	15.9	14.2	13.0
Urban poor (% of total population)	12.6	6.6	3.1	3.8	3.8	5.5
Rural poor (% of total population)	40.3	29.7	14.9	21.5	19.1	16.6
Gini coefficient	0.485	0.536	0.515	0.533	0.525	0.500
Income share of the lowest 20% of income earners	4.6	3.9	4.2	3.8	3.9	4.2
Income share of the highest 20% of income earners	54.2	59.0	56.7	58.5	57.6	55.4

Sources: National Economic and Social Development Board

TABLE 3
Educational attainment by region in 2000
(6 years of age and over)

	Total	**Bangkok**	**Central***	**Northern**	**Northeastern**	**Southern**
Elementary level	64.46	36.66	61.10	69.69	73.27	63.76
Lower secondary level	13.64	15.91	14.68	12.71	12.09	15.18
Upper secondary level	12.20	21.35	13.60	10.41	8.85	13.19
Higher education	8.66	23.93	9.66	6.21	4.99	6.89
Religious education	0.17	0.15	0.21	0.21	0.16	0.06
Other education	0.01	0.01	0.00	0.01	0.00	0.04
Unknown level of education	0.22	1.54	0.05	0.06	0.04	0.10
Unknown	0.64	0.44	0.70	0.69	0.60	0.77
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00

*(Excl. Bangkok)
Source: National Statistical Office

TABLE 4
Sectoral Share of Employment

	1995	1996	1997	1998	1999	2000
Rural						
Agriculture	68.38	66.16	67.25	65.37	64.34	63.79
Industry	9.50	10.62	9.61	11.28	11.32	12.28
Construction	5.09	6.34	6.27	4.12	4.09	3.93
Services	17.03	16.88	16.86	19.24	20.25	19.99
Total	100	100	100	100	100	100
Urban						
Agriculture	12.01	11.78	11.43	11.40	11.16	10.75
Industry	25.26	22.12	22.97	23.10	23.25	23.66
Construction	7.05	7.66	5.71	4.22	4.08	4.54
Services	55.68	58.44	59.89	61.27	61.51	61.06
Total	100	100	100	100	100	100

TABLE 5
Relative wages and income of private employees in 2000
(Bangkok = 100)

Region and Province	(Baht/Month)	
	Wage	Income
Whole Kingdom	60.3	59.4
Bangkok	100.0	100.0
Vicinities	72.2	74.0
Sumatprakan	67.6	68.3
Nonthaburi	106.6	106.5
Patumthani	79.1	86.5
Nokornpratom	57.2	57.5
Samutsakorn	56.4	58.4
Central	51.3	50.5
North	39.9	37.3
Northeast	39.0	37.0
South	50.0	48.9

Source: Ministry of Labor and Social Welfare

TABLE 6

Net Migration by Region

	1985-1990*	1995-2000**	2000-2005
Bangkok Metropolis Area	373,833	49,151	52,984
Vicinity Provinces	237,838	482,857	550,438
Sub-Central	-60,819	10,581	9,094
East	33,572	129,569	133,236
West	-47,175	-27,882	-30,376
North	-107,686	-157,523	-177,853
Northeast	-410,195	-494,531	-546,760
South	-19,368	7,779	9,238

Source: National Census Survey

TABLE 7

Gross Regional Product and Gross Provincial Product at Constant 1988 Prices

Region and Province	1993	1994	1995	1996	1997	1998	1999	2000	2001
Whole Kingdom	100	100	100	100	100	100	100	100	100
Bangkok	41.3	40.1	39.2	38.1	37.5	35.3	35.3	35.2	34.9
Nakornpratom	1.2	1.4	1.5	1.4	1.4	1.4	1.4	1.4	1.4
Nonthaburi	1.6	1.5	1.7	1.7	1.7	1.7	1.6	1.5	1.5
Patumtani	2.5	2.8	3.0	3.0	2.9	2.8	3.1	2.7	2.8
Samutprakan	4.5	4.3	4.3	4.3	4.1	3.8	4.0	4.2	4.4
Samutsakorn	1.9	2.2	2.1	2.1	2.1	2.1	2.2	2.2	2.2
Central	4.3	4.6	4.6	4.8	4.8	4.7	4.7	4.8	4.8
East	9.5	9.9	10.6	11.6	13.0	13.9	14.3	14.7	14.8
West	4.3	4.2	4.3	4.1	4.1	4.1	4.2	4.2	4.2
North	9.3	9.1	8.9	9.0	8.8	9.3	9.0	8.9	8.8
Northeast	10.9	11.1	11.2	11.2	11.0	11.4	11.2	11.1	11.1
South	8.7	8.7	8.7	8.7	8.7	9.4	9.1	9.1	9.0
Bangkok and Vicinity	53.0	52.3	51.7	50.6	49.6	47.3	47.6	47.4	N.A.

TABLE 8
Percentage of Slum Communities by Region (1998)

Region	Percent
Bangkok Vicinities	
Pathum-Thani	12.0
Nonthaburi	4.9
Nakornpathom	4.5
Samut-Prakan	21.2
Samut-Sakorn	12.5
Central	
Chonburi	1.9
Chachoengsoa	1.4
Saraburi	7.1
North	
Nakornsawan	0.7
Changmai	1.5
Changrai	1.0
Northeast	
Kornkan	2.0
Nakornrachasima	3.1
Ubonrachatani	0.5
South	
Nakornsrithammarat	1.2
Narathiwart	2.2
Songkla	2.8

TABLE 9

Bangkok Air Quality

	1998	1999	2000	2001	2002	2003
PM-10	69.89	79.81	63.86	41.96	58.22	58.38
CO	1.39	1.34	0.98	1.7	1.27	0.995
Ozone	16.15	11.73	11.12	12.25	15.99	17.68

TABLE 10
Polluting Factories in Bangkok and Vicinity
(% Of total factories)

	Air	Water	Hazardous wastes		
			Rank1	Rank2	Rank3
Bangkok	20.7	52.1	11.6	12.6	0.8
Phatum Thani	35.8	61.5	15.5	30.3	4.8
Samut Prakan	20.1	52.5	11.9	18.0	1.8
Samut Sakhon	40.8	77.1	7.5	17.8	2.6
ChaChoengsao	20.4	72.5	8.2	17.5	0.8
Nakorn Nayok	36.0	36.0	4.4	14.0	1.5
Nakorn Pathom	34.4	66.2	7.5	12.8	2.1
Nonthaburi	29.9	53.3	17.9	10.1	1.6

TABLE 11
The Chao Phraya River Water Quality (2000)

Sampling Point	Temp. °C	pH	DO	BOD	SS
Nonthaburi Pier	27.8	7.3	3.9	3	69
Rama VI Bridge	27.9	7.32	3.7	3	67
Chang Pier	27.9	7.34	3.9	3	68
Memorial Bridge	28.6	7.31	3.4	4	69
Supphanava-Navy Pier	28.7	7.26	3.5	3	54

Source: Department of Drainage and Sewerage, BMA, 2001

Figure 1

Slowdown in Population Density
(Percentage change of population density)

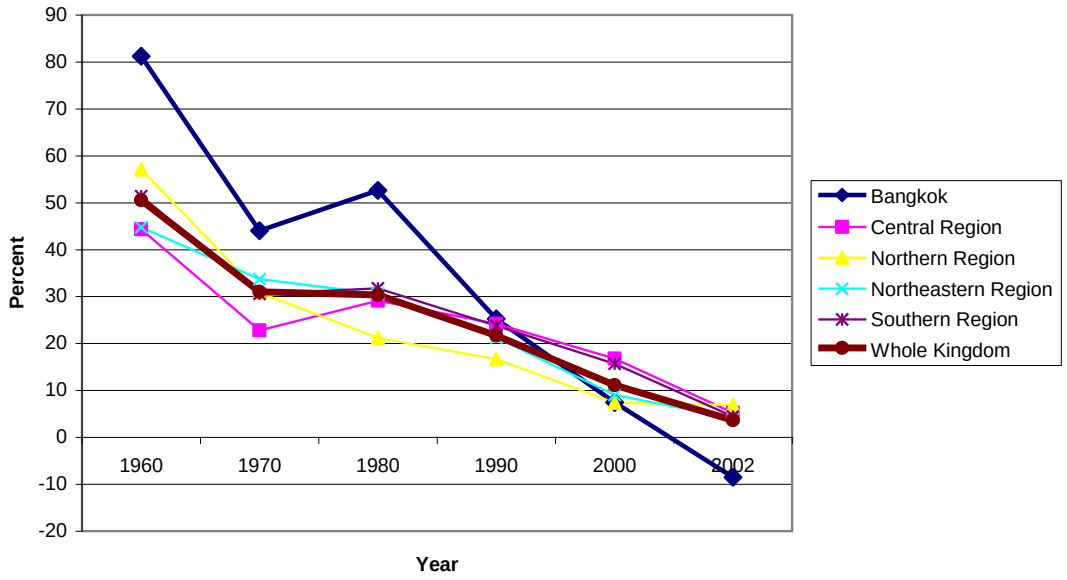
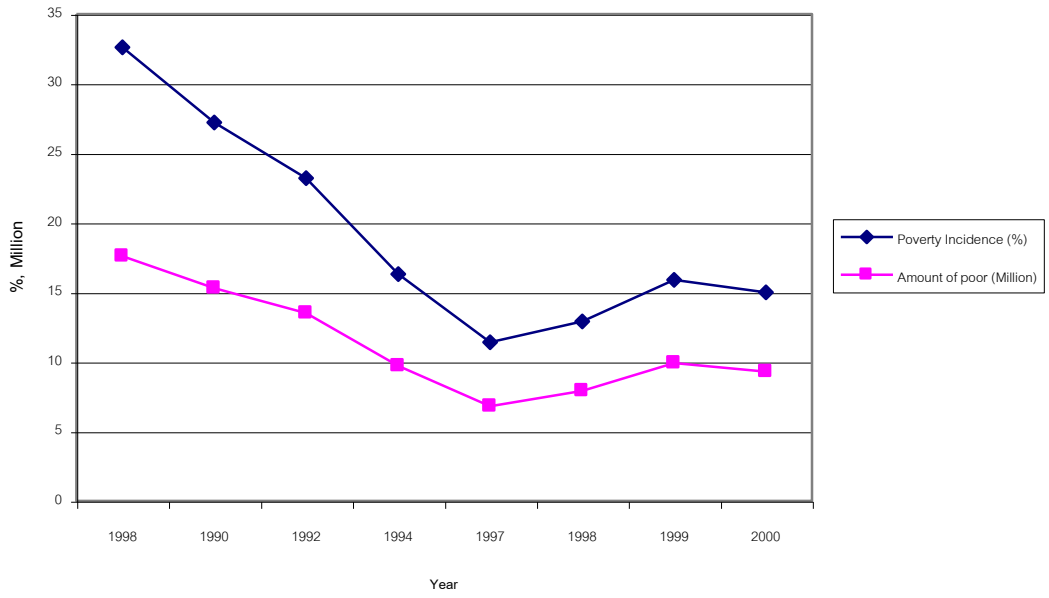


FIGURE 2
Poverty Incidence



Source : National Economic and Social Development Board December, 2001
Thailand aims to reduce poverty incidence to 12% by 2006.

FIGURE 3
Public Expenditure by Region (2000)

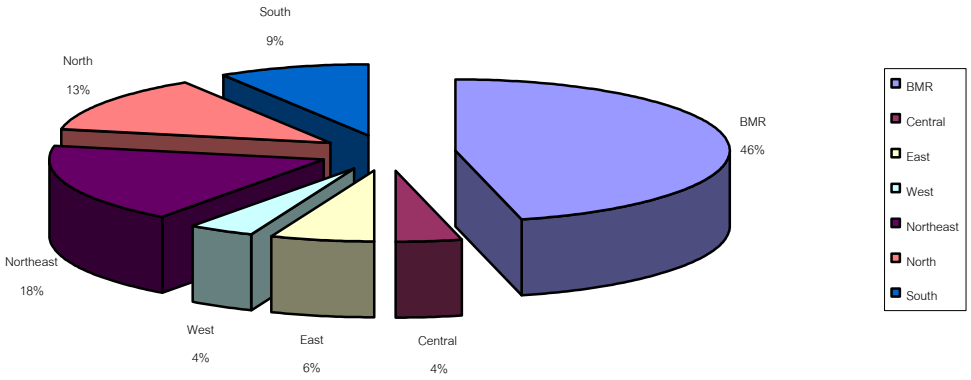


Figure 4

Number of Unemployed Persons (OR) Total unemployment

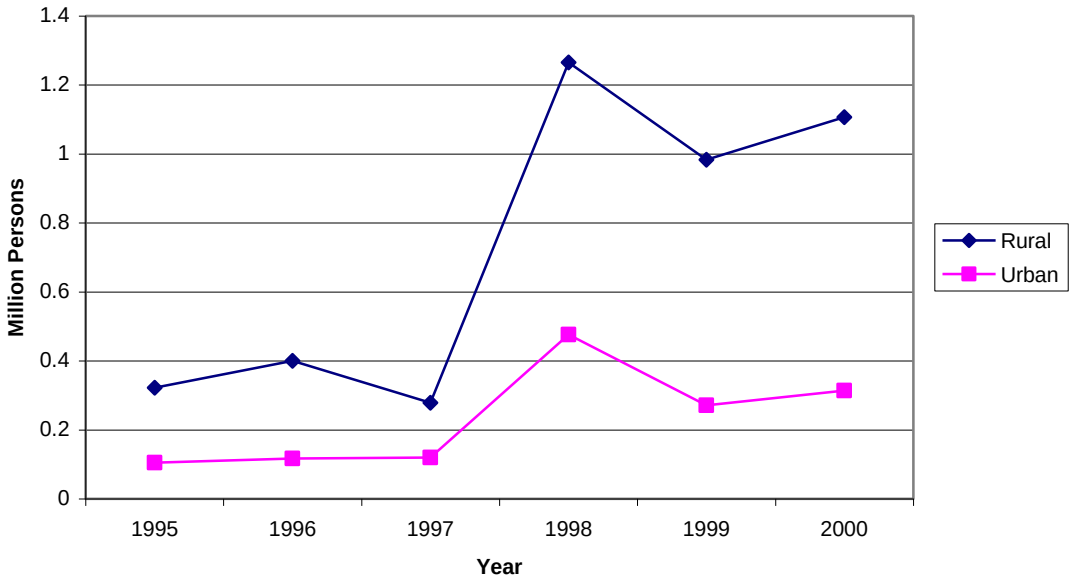


Figure 5
Rural Unemployment

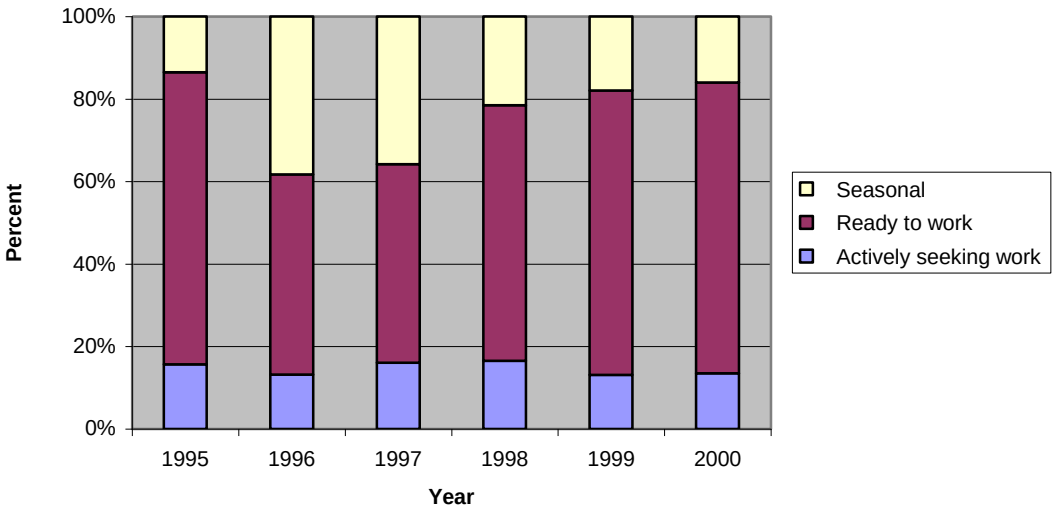


Figure 6
Urban Unemployment

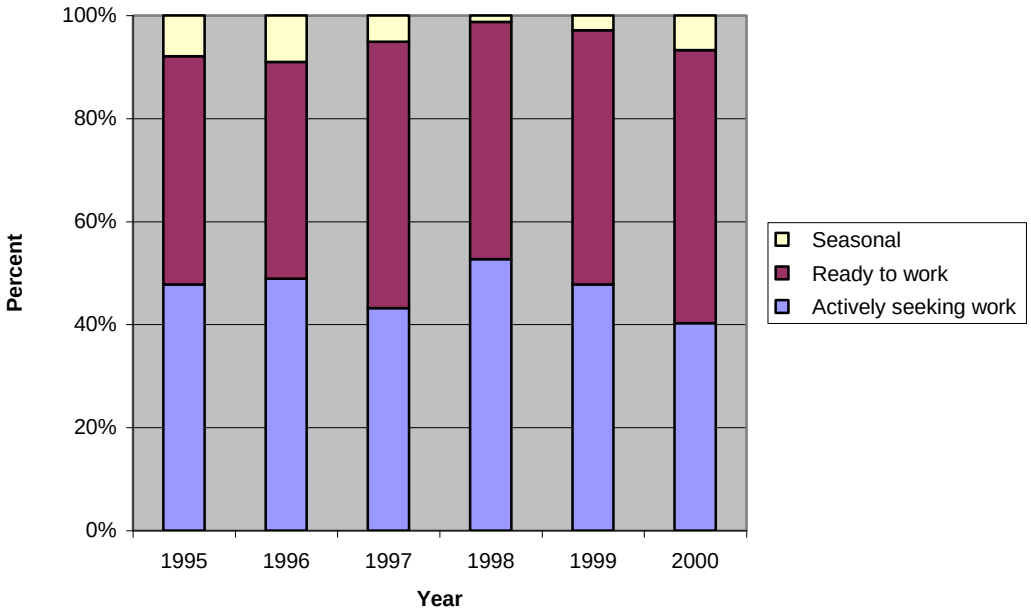
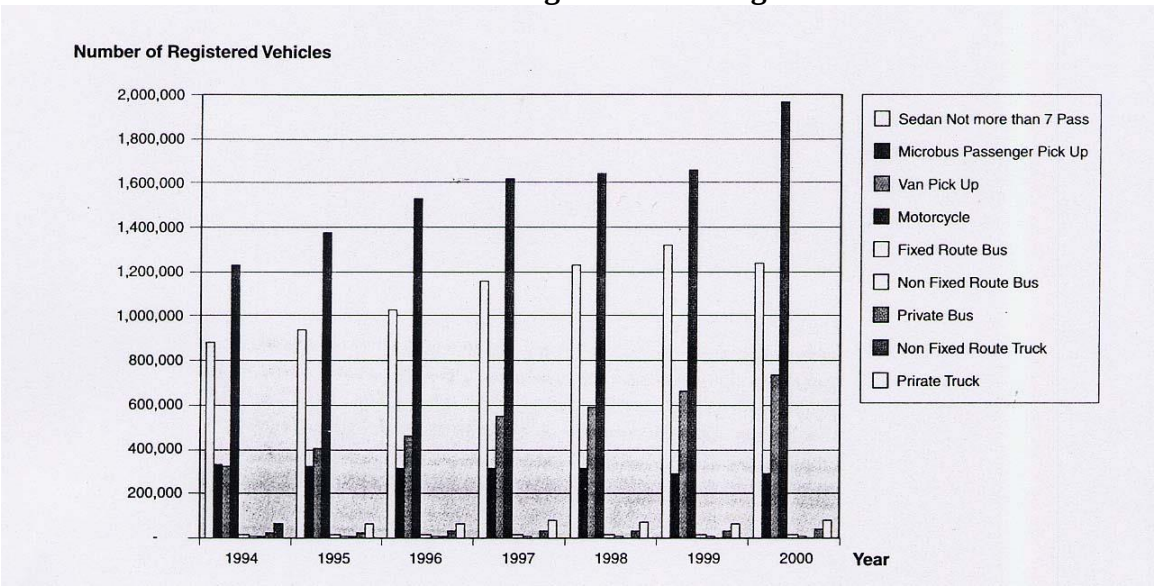


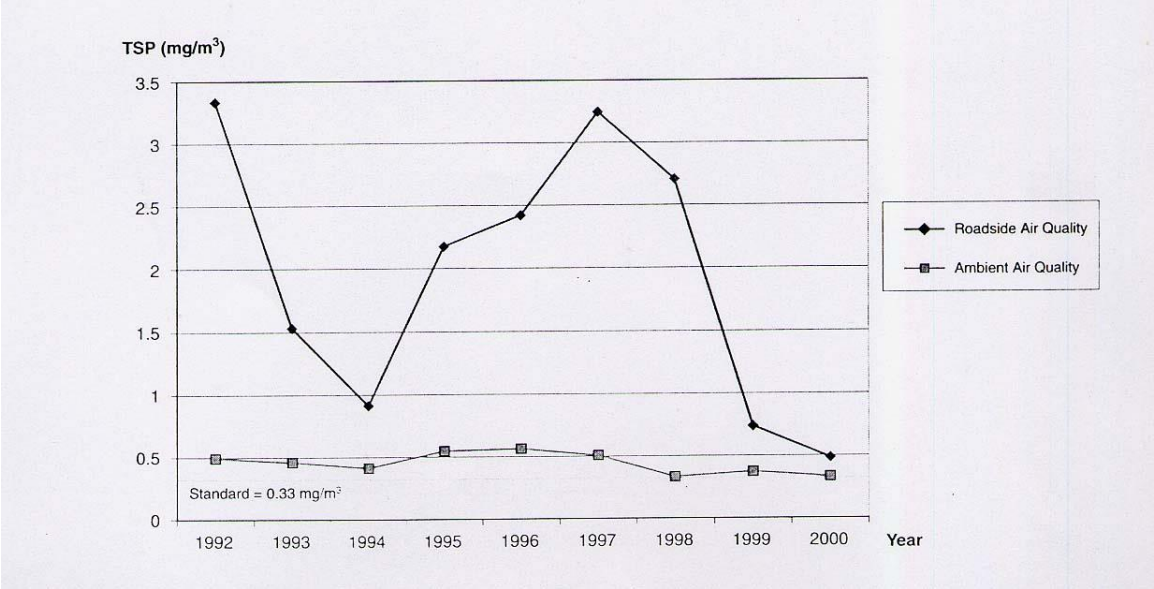
Figure 7
Number of Motor Vehicles Registered in Bangkok: 1994-2000



Source: Land Transport department, Ministry of Transport and Communications, 2000

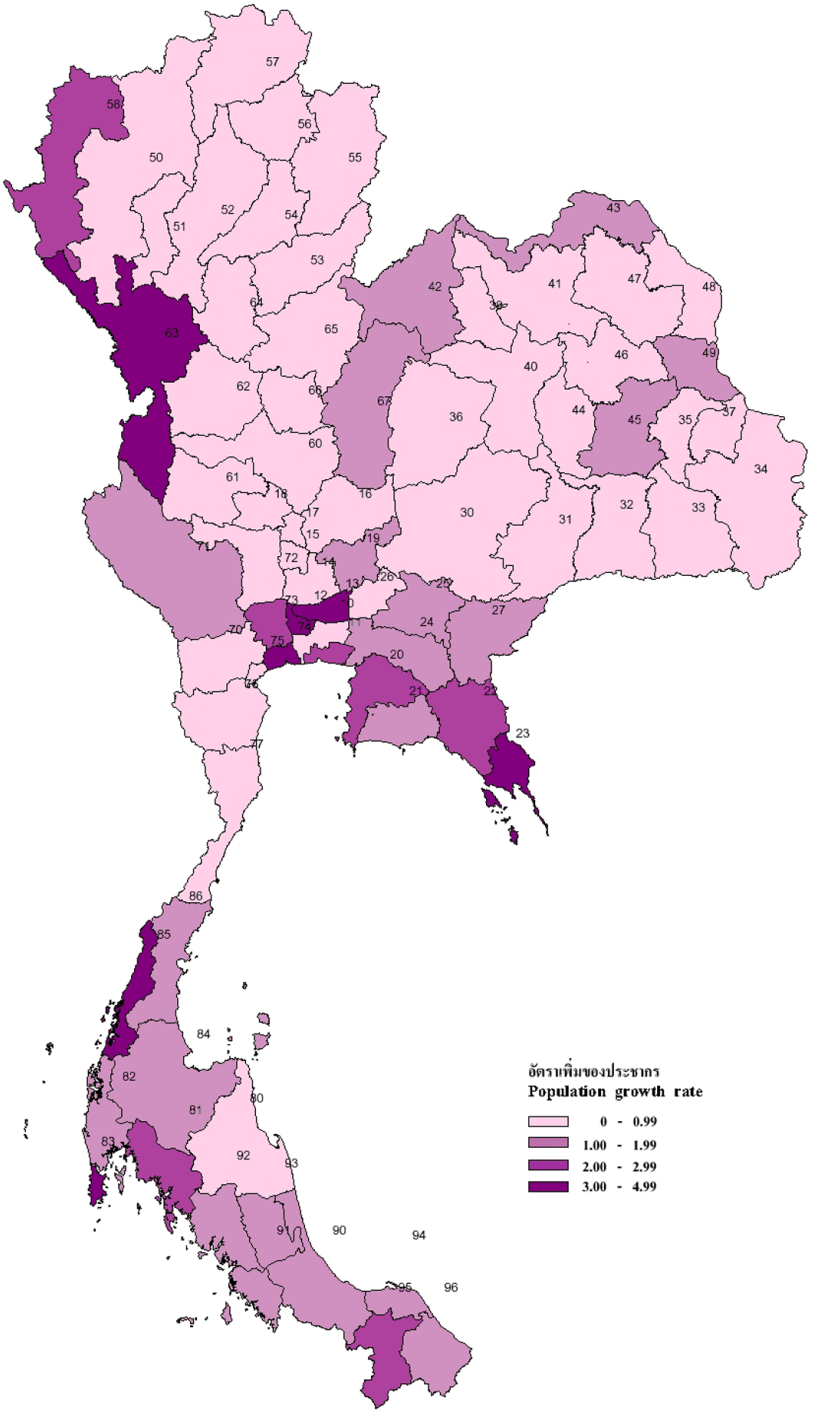
Figure 8

Average Bangkok's total suspended particulate (TSP) concentration, 1992-2000



Source: Pollution control Department, Ministry of Science, Technology and Environment, 2000

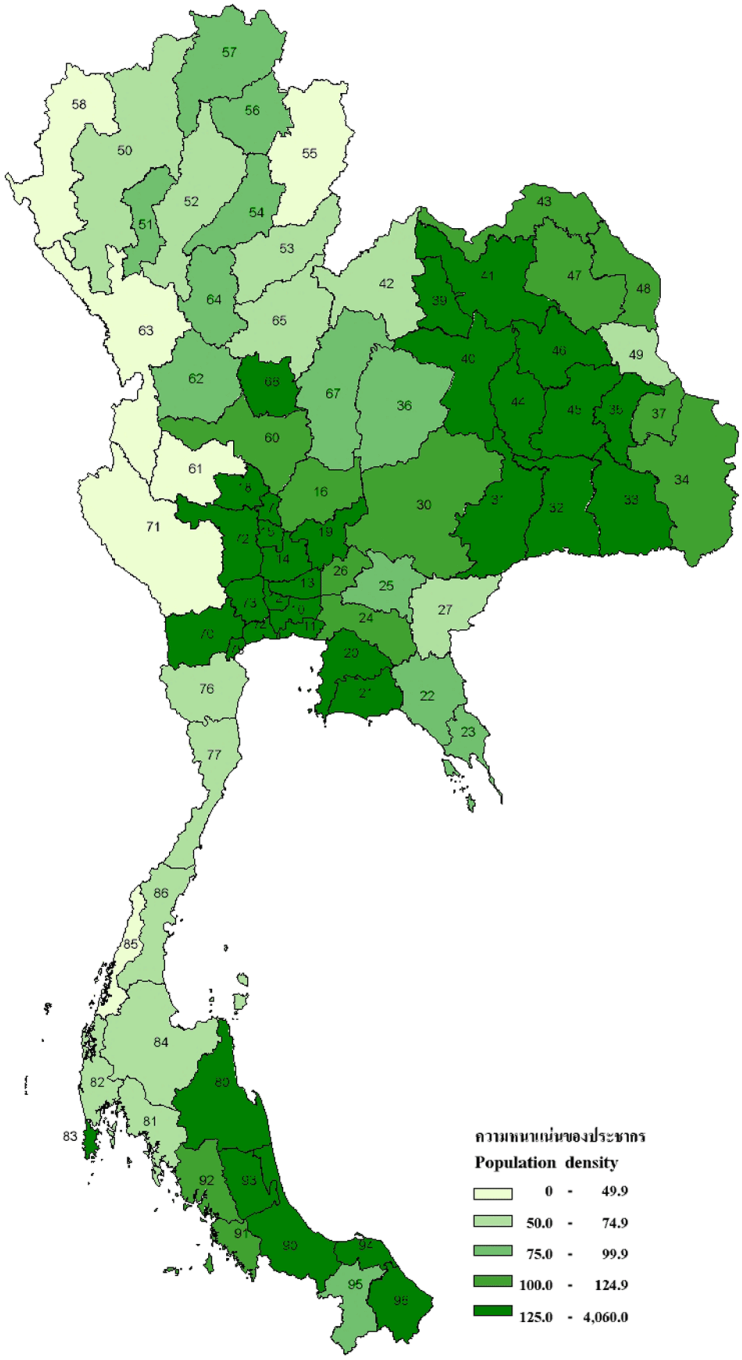
Map 1: Growth Rate of Population by Province in 2000



Source : The 2000 Population and Housing Census, National

10. Bangkok
11. Samut Prakan
12. nonthaburi
13. pathum Thani
14. phra nakorn Si Ayutthaya
15. Ang Thong
16. Lop Buri
17. Sing Buri
18. Chai Nat
19. Saraburi
20. Chon Buri
21. Rayong
22. Chanthaburi
23. Trat
24. Chachoengsao
25. Prachin Buri
26. Nakorn Nayok
27. Sa Kaeo
70. Ratchaburi
71. Kanchanaburi
72. Suphan Buri
73. Nakhon Pathom
74. Samut Sakhon
75. Samut Songkhram
76. Phetchaburi
77. Prachuap Khiri Khan
50. Chiang Mai
51. Lamphun
52. lampang
53. Uttaradit
54. Phrae
55. nan
56. Phayao
57. Chiang Rai
58. Mae Hong Son
60. nakhon Sawan
61. Uthai Thani
62. Kamphaeng Phet
63. Tak
64. Sukhathai
65. Phitsanulok
66. Phichit
67. Phetchabun
30. Nakhon Ratchasima
31. Buri Ram
32. Surin
33. Si Sa Ket
34. Ubon Ratchathani
35. yasothon
36. Chaiyaphum
37. Amnat Charoen
39. nong Bua Lam Phu
40. Khon Kaen
41. udon Thani
42. Loei
43. Nong Khai
44. Maha Sarakham
45. Roi Et
46. Kalasin
47. Sakon Nakhon
48. Nakhon Phanom
49. Mukdahan
80. nakhon Si Thammarat
81. Krabi
82. Phangnga
83. Phuket
84. Surat Thani
85. Ranong
86. Chumphon
90. Songkhla
91. Satun
92. Trang
93. Phattalung
94. Pattani
95. Yala
96. Narathiwat

Map 2: Population Density by province in 2000



Source : The 2000 Population and Housing Census, National

10. Bangkok
11. Samut Prakan
12. nonthaburi
13. pathum Thani
14. phra nakorn Si Ayutthaya
15. Ang Thong
16. Lop Buri
17. Sing Buri
18. Chai Nat
19. Saraburi
20. Chon Buri
21. Rayong
22. Chanthaburi
23. Trat
24. Chachoengsao
25. Prachin Buri
26. Nakorn Nayok
27. Sa Kaeo
70. Ratchaburi
71. Kanchanaburi
72. Suphan Buri
73. Nakhon Pathom
74. Samut Sakhon
75. Samut Songkhram
76. Phetchaburi
77. Prachuap Khiri Khan
50. Chiang Mai
51. Lamphun
52. lampang
53. Uttaradit
54. Phrae
55. nan
56. Phayao
57. Chiang Rai
58. Mae Hong Son
60. nakhon Sawan
61. Uthai Thani
62. Kamphaeng Phet
63. Tak
64. Sukhathai
65. Phitsanulok
66. Phichit
67. Phetchabun
30. Nakhon Ratchasima
31. Buri Ram
32. Surin
33. Si Sa Ket
34. Ubon Ratchathani
35. yasothon
36. Chaiyaphum
37. Amnat Charoen
39. nong Bua Lam Phu
40. Khon Kaen
41. udon Thani
42. Loei
43. Nong Khai
44. Maha Sarakham
45. Roi Et
46. Kalasin
47. Sakon Nakhon
48. Nakhon Phanom
49. Mukdahan
80. nakhon Si Thammarat
81. Krabi
82. Phangnga
83. Phuket
84. Surat Thani
85. Ranong
86. Chumphon
90. Songkhla
91. Satun
92. Trang
93. Phattalung
94. Pattani
95. Yala
96. Narathiwat