

5. CASE STUDY OF BANGKOK

5.1 Geography and Climate

Bangkok, which is mega-city of South-East Asia, has been the capital of Thailand already 221 years. Thailand is a democratic monarchy in the hearth of South East Asia and it shares borders with Burma, Laos, Cambodia and Malaysia. Bangkok is located to the fertile Central Plains of Thailand, which is very rich rice growing region. BMR is extremely flat, extensively irrigated, and very rich agriculturally. The city is situated on the banks of Chao Phraya River, which is highly navigable river and gives a good access to the open seas. The center of Bangkok is about 50 river kilometers north of the Gulf of Thailand (MWWA 1969, Cummings 1999).

Bangkok lies in the humid tropics and lasts hot throughout the year. There are three main seasons in the region: the cool season (November to February), the hot season (April to May), and the rainy season (June to October). These seasons are depending on the monsoon rains in any given year and they have a strong effect on habitant's lives. The average annual rainfall in Bangkok region is 1,482 millimeters (Thailand in a Nutshell 2001, Thadanithi 1998).



Picture 5. 1. View of Bangkok.

5.2 Economy

Thailand was affected with the South East Asian's recent economic crisis. However, the economy process is recovering today and now the economic in the whole country has an annual growth of six per cent. One of the reasons for this economy boom is manufacturing export goods rather than relying simply on agricultural production. There are also many other important factors as fiscal policy, direct foreign and domestic investments, well educated labor force and the growth of tourism. Thailand's major products are jewels, gems, garments, computers and integrated circuits. Country's major trading partners are the ASEAN, USA and EU (TDRI 1990, Thailand in a Nutshell 2001).

During the last decade, half of the total national economic growth in Thailand was due to activities in Bangkok and its vicinity. Bangkok is the center for industrialization and the country's foreign trade. The city is the center of Thailand's distribution network and the largest consumer market. Export industries are also located in Bangkok due to the port facilities. Unlike other cities in the developing countries, commercialization is a major factor for the growth of Bangkok rather than industrialization (Brookfield and Byron 1993, Thadanithi 1998).

5.3 Population

The population of Bangkok has increased slowly in the past until year 1975. After this, in last 25 years, the city has changed a lot due to the international effect. The population of the city was only 1,5 million before Bangkok became a destination for American servicemen during Vietnam War. The U.S dollars attracted rural poor and development began. The city grew more than 8.5 million in 25 years. This is nearly 15 percent of the country's population and 40 times the size of any other city in Thailand. Today 69 per cent of urban population in the country is located in Bangkok (Cummings 1999).

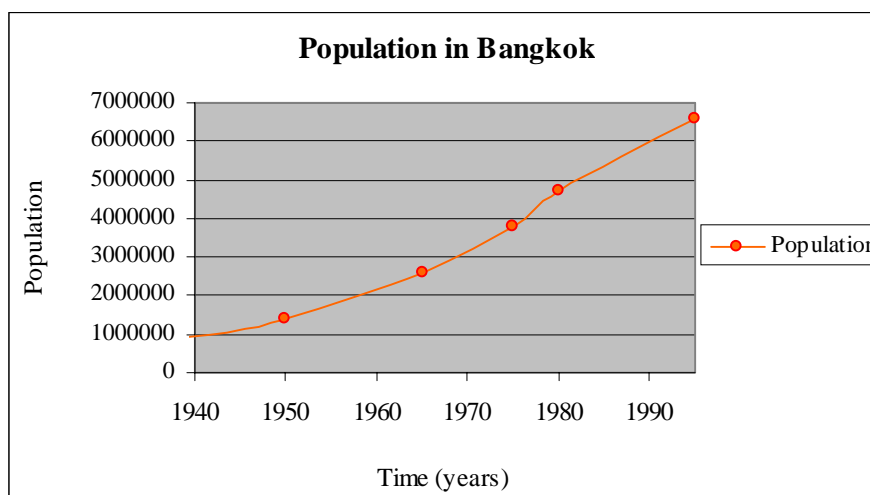


Figure 5. 1. Population in Bangkok.

The population of Bangkok City is nowadays about 10 million but it is projected to increase to 12.6 million by year 2010. In extended BMR the population was 12 million in year 1990, and it is

estimated to be even 17 million by year 2010. This shows that the Bangkok suburban is growing faster than the city center. The population density in the city is 3,700 persons per km², which is highest rate in Asia (TDRI 1990).

5.3.1 Urbanization

In the past Thailand had among the lowest levels of urbanization in Asia but nowadays Thailand is about to enter a period of rapid urbanization. It is estimated that between 1990 to 2010 the net increase in rural population in Thailand will be 0.3 million, while urban population will increase by 15 million. Because of this fact it is possible that Thailand will reach the urbanization level of 60 to 70 per cent by 2025, even the urbanization is at present around 27 per cent (TDRI 1990, Awang et al.1994, Pernia and Alabastro 1997).

5.3.2 Migration

Over-population in Bangkok is mostly caused by uncontrolled migration from rural areas. Due to strong urban pull and rural push people continue to move in Bangkok. In Bangkok migrants have more work opportunities and better facilities than in rural areas. Migrants work normally with production, sales and service. In Thailand males are more likely to migrate to Bangkok than women. The migration is mostly concentrated in educated people or young adults, between 15-29 years (Thailand in a Nutshell 2001, Bilsborrow 1998c).

About one third of all internal migration to Bangkok is temporary and these flows are dominated by males. Migration can also change with seasons, economic trends and the amount of work opportunities. For example, when economy collapsed in 1997 many people moved back to the countryside and sold their cars, which on the other hand helped Bangkok's traffic and population problems. Anyway the economy bounced back in 1999, and the again the migration started to increase the population of Bangkok as well as the problems (Thailand in a Nutshell 2001, Bilsborrow 1998c).

5.3.2.1 Push and pull factors

The main push factors for people to move to Bangkok are deforestation, loss of biological diversity, soil erosion, flooding, constructions, waters shortages and other natural resource related problems. Most of the reasons are somehow connected with the environment or economy. For example the northeastern region in Thailand is losing population because of poverty, few economic opportunities, and declining in potential earning from agriculture (Suphapodok and Chueyprasit 1994, Awang et al.1994).

Bangkok is a big commercial center and attracts people. It seems very fancy and full of economical opportunities for poor people. Already the name of the city Khrung thep, "The City of Angels" reflects the positiveness and safety of the city. At least some part of this image is true because the possibility for poor people to have better level of living is higher in Bangkok than in rural areas (Sajor 2001).

5.3.2.2 Policies to reduce migration to Bangkok

For the last two decades, the policy of Thai government has tried to reduce the migration flows to Bangkok. Migration is seen as the main factor deteriorating the environmental and social situations associated with the rapid population growth. Until the early 1990s the main policy was to develop growth centers in each of the main regions of Thailand to invite people move to them instead of Bangkok. In 1992, policies were also adopted to hold back seasonal migration to Bangkok by work and training schemes during the dry season in areas of high seasonal out-migration (Bilsborrow 1998c).

5.4 Water resources

5.4.1 Water supply

Domestic and industrial water supplies in the BMR are provided by combination of groundwater and surface waters. In the outlying areas of Bangkok water supply systems are mainly groundwater-based while the systems supplying central Bangkok area are undergoing a transition from the groundwater based system to fully integrated, surface water based system of the future. This is very important to the city because the use of groundwater is already over the supply. The water supply has become fragile in the city, because groundwater aquifers in and around Bangkok are gradually depleted and surface waters (rivers) have become unsuitable, due to industrial and domestic wastes. At least 100.000 persons are estimated to obtain water straight from canals and waterways that are grossly polluted by human waste and industrial effluent (TDRI 1990).

MWA is responsible for pipe water supplies in Bangkok and surrounding towns. Despite considerable expansion of the distribution system in last years, the MWA is still able to supply only 43 per cent of the area and 66 per cent of the population under responsibility. Public, or piped water, is lacking particularly in the urban fringe of Bangkok. Growing sources of demand for pipe water in BMR include domestic, commercial and industrial establishments (TDRI 1990).

5.4.2 Demand of water

During the 1980s the water demand for MWA in Bangkok was 282 million cubic meters per year. The demand grew at the rate of 8 per cent annum, to 2.1 billion cubic meters per year by 2000. Biggest part of this used water is discharged for BMR industries and households. The whole country's water demand is 53 billion cubic meters per year, but even 90 per cent of this amount are needed for irrigation. The demand is estimated to grow to 70 billion cubic meters per year in the next 10 years mainly due to expanding irrigation and tourism (TDRI 1990, Pattanee 2001).

5.4.3 Waste water treatment and sanitation

The problem is striking in Bangkok where the development of sanitary and water supply facilities cannot match the rapid industrialization and population growth. In the Chao Phraya River, which is the main surface water source in BMR, the water quality has been increasingly deteriorated since more population has settled along it and used the river as a sink to discharge domestic and industrial

wastes. The main pollutant sources to Chao Phraya River are factories, households and restaurants (Dai 1997, Klemmensen et al.2000).

The existing household water treatment capacity in Bangkok serves only about 2 per cent of the people. Normally the wastewater from most households is deposited to septic tanks, cesspools, and then discharged storm water drains. The domestic effluent accounts 75 per cent of the pollutants discharged into the Chao Praya River (BOD load), while factories account only 25 per cent. Among the non-industrial sources household effluents account for over 54 per cent of the pollution, restaurants markets, hospitals, hotels, dormitories are responsible for 46 per cent (Klemmensen et al.2000, Kasarda and Parnell 1993).

Most of the factories in Bangkok use old and heavily resource-demanding machinery. In Thailand there are 76.000 companies, which are registered as polluting factories. Still only 10 per cent of these factories have wastewater treatment and the biggest part of them are concentrated in the Bangkok region. Although large factories are required to install water treatment facilities, this does not apply for many medium and small sized plants which normally discharge their effluents straight to rivers and water bodies (Klemmensen et al.2000, Kasarda and Parnell 1993).

5.4.3.1 The quality of water

The water standards are dependent on the needed purpose: natural beauty, coral conservation, tourism, domestic or industrial use. The inner Gulf of Thailand, nearest to Bangkok region, is declared as an industrial zone and the water standards for it do not have standard for chromium, zinc, nickel or copper. The standardization makes production and pollution much easier for the companies and similarly deteriorates the quality of the seawater (Klemmensen et al.2000).

The quality of water in Bangkok central area Klongs is less than satisfactory. The water is black with pollution and unable to support marine life. The canals are suffering from oxygen deficiency and they often give off offensive odors. The result of water quality monitoring in Chao Phraya River showed (during the dry season) that at least the lower part of the river is in crisis. DO was lower than the recommended standard for household purposes. Also BOD did not meet the standards and either faecal choliform bacteria, mercury, heavy metals, or chemical fertilizers (Ross and Pongsomlee 1992, Dai 1997).

5.4.4 Flooding

The location of Bangkok is bad for flooding. The city is located to deltaic plain of the Chao Phraya River, which suffers flooding during the monsoon season. The main reason for this is that the ground levels in the city rank only 0.5 to 1.7 meters above mean sea level. Other reason is that natural drainage system and irrigation canals have been filled as a part of the malaria eradication program and to make way for roads. Due to this and poorly maintained storm sewers, the remaining canals cannot cope with the runoff on an ever increasing impervious surface area. Dikes, pumps and water gates are already under construction in eastern Bangkok to provide protection for the people in flooded areas (Awang et al.1994, Thadanithi 1998, Klemmensen et al.2000).

5.4.5 Subsidence

Unlimited exploitation of aquifers can lead to land subsidence. In 1982, groundwater extraction from deep aquifers in Bangkok equaled 1.4 million cubic meters per day, far exceeding the estimated safe limit of 600 thousand cubic meters, through natural recharge. As a result of this, piezometric levels in the wells have been declining rapidly and the ground level has subsided by more than 0.5 meters. Some parts of the city subsidence have been 10 centimeters per year. Overuse of groundwater supply is worst in central and eastern Bangkok (Kasarda and Parnell 1993, Awang et al.1994).

In Bangkok the total groundwater use is 2 million cubic meters per year, where from industry uses 1.5 million cubic meters. Furthermore industry may use as much as 1.6 million cubic meters in unreported underground pumping. Industries heavy reliance on groundwater is due to lack of access to piped water, unreliability or insufficiency of the piped water supplies and the lower cost of groundwater. The private cost of groundwater pumping is 2 baht per cubic meters while average rate of pipe water is 6 baht per cubic meter (Sajor 2001, TDRI 1990).

Subsidence is not the only problem when considering groundwater pumping, salt-water intrusion has become one of the major problems of groundwater. The rapid lowering of the water table by excessive extraction of groundwater has caused the shallow aquifers in Bangkok to become contaminated by salt water from the nearby ocean (UNEP 1997).

5.4.6 Water resources management

In the past, Thailand did not pay much attention on water resources management. Water had been plentiful supply and one could have easily obtained almost any amount of water from the rivers, lakes, canals and rainfalls. Most of water programs were then dedicated to water resources development. Such a trend continued even when the population had rapidly increased over the past few decades and economic activities had significantly expanded. Today the quality of water in Bangkok is mainly controlled by environmental laws and end-of-pipe-solutions. The controlling is inadequate and the financing is too low. For example, Thailand spends less than 0.24 per cent of the GNP on environmental protection, compared to 1.2 per cent by OECD countries (Pattanee 2001, Klemmensen et al.2000, TDRI 1990).

Environment and water problems are also controlled by EIA. The government demands EIA for constructions, industries and projects, which are though to be hazardous for environment. Because of corruption and social relations the per cent of EIAs which are done is not so high. Corruption is very high in Bangkok and South East Asia. For Example in Philippines 10 per cent of country's GDP is going to corruption (Laaksonen 2001).

5.5 Environment

Environmental deterioration in Bangkok is caused by:

- High development without adequate provision of mass transit and inadequate road network has led to traffic congestion.
- High water demand without adequate municipal water supply and inappropriate price structure has led to excessive groundwater pumping and consequent land subsidence.

- High development and population growth without adequate drainage and sewerage have led to flooding and water pollution.
- Industrial development without adequate pollution control, investment and enforcement has led to increased air, water and solid waste pollution (TDRI 1990).

5.5.1 Solid waste

Total daily production of solid wastes in BMR is about 5.400 tons. Even domestic sources are the main producers of solid wastes industrial plants produce big part of the total amount, 40.000-60.000 tons of hazardous wastes yearly. Almost 84 per cent of the population in Bangkok have service of solid waste disposal. This means either door-to-door or block collection. If there is no disposal system available, uncollected thrash is generally thrown into vacant plots while some are directly dumped to canals and rivers (TDRI 1990).

Bangkok relies principally on open dumping or open burning for solid waste disposed. Only 40 percent of solid wastes are decomposed. The small budget of BMA limits the improvement of the inefficient decomposing plants. The toxic wastes require special treatment before being released into the environment. Unfortunately the existing regulation relating to toxic waste disposal is not enforced effectively (TDRI 1990, DESIPAPD 1995, Ross and Pongsomlee 1992).

5.5.2 Lack of infrastructure

City planning in Bangkok is very poor, which has resulted to a city where factories and buildings were constructed without prior plans for utilities and services. Infrastructure in BMR is an severe threat to continuing economic expansion. Roads, telecommunications, water and sewerage supply and transportation are already responsible for considerable economy losses in the form of congestion and pollution costs. When industrialization and urbanization grows in the future the adequate infrastructure will be more and more important. There are three major routes to Bangkok, towards east, north and west. Urbanization is highest near these routes. Between these routes the infrastructure is very poor, although the entire region suffers from inadequate infrastructure (PDA 2001, TDRI 1990).

5.5.2.1 Housing

In Bangkok there are over 2 million households and from these about 235.000 households are situated in slum and squatter settlements. The total slum population in the city is more than 1.3 million and the growth rate is 2.4 per cent annum. Due to high growth rate the amount of slum population will be even higher in the future. The people living in the slum areas cover a big part of the city's population, even 11 per cent (Ross and Pongsomlee 1992).

Slum areas are homes for poor people, migrants and refugees from environmentally bad areas. For example floods and highway constructions have forced many people to move to Bangkok. Many slum areas are based in the government's land and are illegal. This makes habitants future unsafe and gives unsure feeling for them (Laaksonen 2001).

5.5.2.1.1 Organization of slum area in Bangkok

Samakee Phattana Community, Rom Klan, Bangkok (Laaksonen 2001).

People who are living in Rom Klan are mostly migrants from the poorest North- Eastern region of Thailand. Their housings are non-permanent because the land is owned by government. Still there have been 498 housing units in the area for 1500 people, already for 9 to 10 years.

Facilities

Electricity to the area is bought from neighborhood village, which buys it from the government and sells it by higher price. Gas is bought and used for cooking. Solid waste collection is organized and it costs 20 baht per month (about 0,5US\$). Hired people collect solid wastes and take them outside from the area, where municipality is disposing it. Many of the people in the area have non-permanent job and unemployment is high, even they have moved to the city for better job opportunities.

Water

Water supply is either bought from vendors or groundwater is pumped from the community's own wells. Flooding is big problem in the area due to a swampy ground and pond to where the wastewater is discharged. Wastewater is conveyed straight to the near pond without any treatment. People also use the water from the pond for irrigation, playing and fishing, which gives a big health risk especially for children. Anyway the wastewater treatment is planned to be true in near future.

Organization of community

This community is very organized partly because habitants are from the same origin and they have feeling of togetherness and cooperation. The community has its own leadership-habitants have chosen 30 committee members, which determinates about water supply, solid waste collection, and electricity matters. The community has also made plans for the future about wastewater treatment, drainage, solid waste and tap water. Also small health center is planned with volunteers and twice a week doctor visits. The education will be organized by training courses and clubs, for example sewing club.

This community has become so arranged since community has known the problems, and outside NGO has given the ideas, not funds to tackle with the problems. This kind of co-operation is good as it forces people to work for their rights. Anyway all cooperation is essential, for example birth certifications are provided by the near hospital. The major part in this organization is still the effort of its own habitants. They have elected the committee for 4 years period to organize the problems occurred in the community. Many problems are solved with co-operation among the habitants. For example safety in the region is based on mutual co-operation.

5.5.2.2 Traffic

Bangkok has seen the rise of the traffic problems, especially during peak hours. Traffic congestion in the city is a problem due to uncontrolled automobile growth, low fuel prices, lack of effective mass transit system, inadequate road networks and private car oriented traffic system. The number of vehicles has reached to over 2 million cars and 900.000 motor cycles. Traffic speed in the inner

zone of Bangkok during the peak hours is only 8-5 km/hour. The economic losses in Bangkok due to traffic jams are high, 275 million \$ (Suphapodok and Chueyprasit 1994, Awang et al.1994).

About 80 per cent of the air pollution from the traffic is coming from the public transportation, mostly busses. The use of public transportation is enormous more than 5 million trips are made by public transport daily. Most of the busses are in very bad condition and pollution is visible. Private cars are mostly new and in good shape because they are very expensive and only rich people can afford them. Long-Tail boats, which work as ferries in the Klongs, are also in bad shape and their engines are highly polluting (Laaksonen 2001, UN 1995).



Picture 5. 2.The Bangkok traffic in daytime, when the congestion is lowest.

5.5.2.2.1 Air pollution

Levels of carbon monoxide and oxidants in the Bangkok air are twice the amount recommended by WHO. Also Nitrogen dioxide levels are too high. Both of these particles are harmful for human health, they affect visibility, irrigate lung tissue causing long-term disorders and cancer. Air pollution is highest in the early mornings, when the traffic conditions are heavy and the air is calm. Noise levels in the city are also all above the internationally accepted level of 70 dBa (Ross and Pongsomlee1992).

