

# THE APPLICATION OF GIS TO THE SCHOOL MAPPING IN BANGKOK

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## ABSTRACT

In Bangkok, primary and junior high schools are under the jurisdiction of several ministries and Bangkok Metropolitan Administration (BMA). Due to this complicated jurisdictional structure, school planning has never been implemented in cooperation with all the related agencies. School databases are scattered all over the agencies, and those are not integrated into digital format together, thus comprehensive school location analysis using GIS has never been carried out.

From 2002 September, the compulsory education will become nine years from the current six years. In accordance with this government policy, it is an urgent subject to construct school buildings in order to meet new students' demand; however, the procedure of locating new schools is not smoothly and effectively executed because of the complex jurisdiction system

This study collected the available non-spatial school related data from all the ministries and BMA, and developed database integrated into GIS data to analyze the current school distribution. From the findings of this study, the current haphazard school allocation could be interpreted easily by GIS analyses. The application of GIS to the school mapping is very useful to find the appropriate sites of locating new school buildings efficiently and rationally. is very useful to find the appropriate sites of locating new school buildings efficiently and rationally.

## INTRODUCTION

In particular, among developing countries, the correlation between the adults with higher level of educational attainment, and individual earnings, employment opportunity in the urban labor markets and agricultural productivity is significantly positive. Education affects development through various dimensions of cognitive competence: literacy (reading and writing), numeric, modernity, and problem-solving behaviors (Lockheed and Verspoor, 1990). Therefore, it is very important to provide inexpensive public schools in every village.

In Bangkok, school planning has never been implemented in cooperation with all the related agencies. School databases are scattered all over the agencies, and those are not integrated into digital format together.

This paper focuses mainly on public primary and lower secondary schools. As a process to display the school sites in this paper, GIS is mainly used for analyses, which, in developing countries, only few GIS projects are successfully applied and utilized for decision-making. This paper indicates the problems of current existing schools in Bangkok and future problems in accordance with the government policy, which from 2002 September, the compulsory education will become nine years from the current six years. It is an urgent subject to construct school buildings in order to meet new students' demand; however, the procedure of locating new schools is not executed smoothly and effectively, partly because

of the complex jurisdiction system. Therefore, this paper tried to demonstrate how important to integrate all the data together and apply GIS to analyze the school mapping .

## **THE ADMINISTRATIVE SYSTEM OF THAI EDUCATION**

Many categories of government institutions under various agencies at all levels are responsible for Bangkok's educational system. The responsibility for the operation of public primary schools is under the Ministry of Education (MOE) through the Office of the National Primary Education Commission (ONPEC), Ministry of Interior (MOI), the Bureau of Local Education Administration, and the Bangkok Metropolitan Authority (BMA). There are also some demonstration schools of various universities (Satit) under the Ministry of University Affairs (MUA), and Rajabhat Institutes under MOE (Cresswell, 1999). ONPEC is primarily responsible for the management and administration of public primary schools throughout Thailand, which accounts for over 90 percent of the total number of those in Thailand. There are over 31,000 public primary schools under ONPEC while Bangkok has only 38 ONPEC schools and the rest are mainly under BMA (431 schools). MOE through the Department of General Education (DGE) and ONPEC mainly offers lower secondary education. This complicated administration system in Bangkok disrupts the efficiency and speed of school improvements. Many scholars pointed out this complexity; for example, Fry (1999) described the current administrative system of Thai education as a maze of complexity with four different ministries involved in managing.

Due to the complexity of the educational administration in Bangkok and the whole Thailand, and the political movement of decentralization, Royal Thai Government policies regarding educational decentralization have been articulated in various legal and planning documents. For instance, National Education Act (NEA), 1999, stipulated that MOE, MUA and the National Education Commission must be integrated into a new 'Ministry of Education, Religion and Culture' by August 2002.

This new ministry will decentralize educational administration and management power to each educational service district and each educational institution. The 1999 Act regarding "Decentralization of Power to Local Organizations" specified that government work; for example, educational management and public services will be shifted from the central to local agencies and will be operated by the municipalities, the Tambon Administration Offices (TAOs), the Pattaya special administration zone, the Provincial Administration and the BMA. After this integration, the educational administration will have only two levels, central and local which are simplified from current many levels- ministerial, department, provincial, district, and group. The new ministry will divide all Thailand into 295 education zones. Each Zone will cover about 100 schools with approximately 150,000 to 200,000 populations. Zoning will consider population density, transportation, and communication convenience.

The number of total public and private primary schools has decreased, conversely the number of public lower secondary schools strikingly increased from 5,661 in 1993 to 7,911 in 1996 in line with government's lower secondary level expansion policy in Thailand. It is estimated that the enrolment ratio at lower secondary education is about 75.8 percent, which is a remarkable increase from 39.8 percent in 1990. (Official of the National Education Commission, 1999)

Primary education has been compulsory in Thailand since 1921 (Ministry of Education, 1976); it has been compulsory for six years (from six year old to 11 years old) since 1978 (UNESCO, 1994). In response to the numerous literatures and views on the significance of education, at the World Conference on Education for All (EFA), held in Jomtien, Thailand in 1990, governments adopted the World Declaration on Education for All and agreed on a 'Framework of action to meet basic learning needs.' (UNESCO, 1998). Different EFA implementation strategy is required in different countries, for instance, in Thailand, for promoting the 'Basic Education for All', the government aims to increase lower and upper secondary school enrollment rates to 95 and to 70 percent respectively (UNESCO, 1994). In reference to Education for All, Thailand's National Scheme of Education, B.E. 2535 (1992) stated that compulsory education should be accessible to all and provided free of charge and secondary level education is stipulated as basic education in order to provide education services for all. However, the deadline for enforcing the additional three years of compulsory education in the lower secondary school was not specified until the NEA 1999 (Office of the National Education Commission Office, 1999). The NEA 1999 states that Education will be compulsory for nine years (six years in primary and three years in secondary education) and this action should be implemented within three years of the enactment date (by August 20, 2002).

Thus, currently BMA, MOE and other related ministries are making an effort to provide sufficient lower secondary education for all. ONPEC maintains school buildings and educational equipment for lower secondary education, and provides trainings for primary school teachers so that the surplus teachers from primary schools can be shifted to lower secondary schools. The extension of education is an urgent issue; therefore, occasionally, lower secondary schools are established attached to the primary schools, instead of using new locations. There are even worse cases where lower secondary school pupils are stuffed into primary schools' units for the temporary solution to get out of a difficult spot.

#### **GIS APPLICATION FOR PLANNING IN BANGKOK**

Cities in developing countries have attempted to utilize their database by using GIS for a decade. It is estimated that more than 90 percent of information required for a city's administration contains a spatial component, such as parcels of land, road networks, emergency services, garbage collection and recreational areas. The quality of planning and decision making process are strongly influenced by the data availability and data completeness. Eighty percent of time and costs occupied in developing GIS is allocated to database acquisition and integration (Thomson and Hardin, 2000).

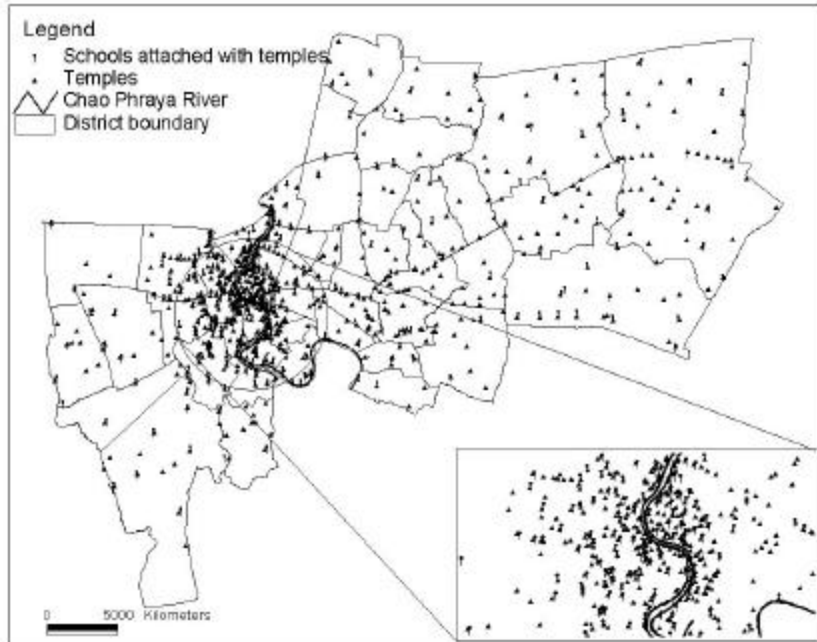
However, in developing countries, GIS data, and spatial information data is not available, or not open to the public. Unlike the United States, where the GIS is popularly utilized and its data is publicized to everyone, very few developing countries allow the public to obtain spatial data for free of charge. In this study, first, to collect and integrate related school data was troublesome. Next is to find a GIS shapefile that provide school sites was difficult. Some missing schools were added lately

Bangkok has a relatively high-quality urban mapping system due to The Bangkok Land Titling Project conducted by the Royal Thai Government, the World Bank, and the Australian International Development Assistance Bureau for developing a national land system. After years from this project, in order to develop GIS data and land information system in Bangkok more, the Bangkok Land Information System (BLIS) was carried out from 1989 to 1991. At the beginning, Metropolitan Electricity Authority (MEA), the Metropolitan Waterworks Authority (MWA), the Telephone Organization of Thailand (TOT), the Department of Lands (DOL) and the BMA were involved in this project with the assistance of Australian technical aid. Although nearly a decade has passed since the initiation of the BLIS project, only a few remarkable GIS related projects were shown by BMA, although BMA extensively recognizes GIS as a useful technique for decision-making (Bishop et al., 2000)

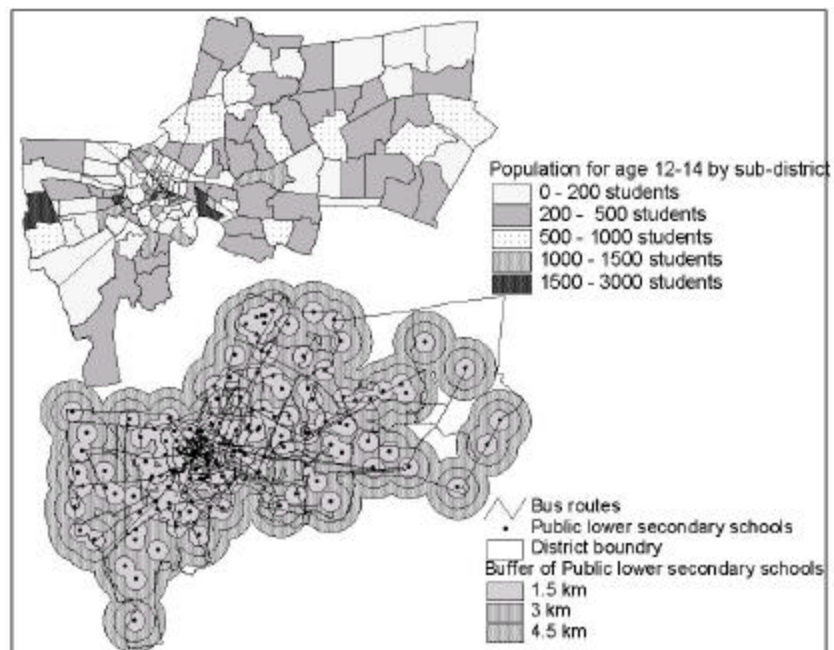
#### **SCHOOL LOCATION ANALYSES USING GIS**

One of the interesting features of Bangkok or Thailand is that there are many Buddhist temples, commonly called 'Wat,' situated, especially along the Chaopraya River densely. These temples' estates properties are utilized for providing schoolhouses (See Figure 1).

Nearly 90 percent of national population believes in Buddhism in Thailand. Buddhism has fundamentally affected the Thai education for a long time. In the old days, temples were generally located at the center of villages, and monks were the navigators who imbued both knowledge and wisdom to children. In 1932, 70 percent of primary schools could be found in temples (Ministry of Education, 2000). In year 2000, 58 percent of BMA schools (250 schools out of 431 schools), 53 percent of ONPEC schools (20 out of 38 schools), 25 percent of MOE schools (29 out of 116 schools), and non-school for Rajabhat and Satit schools are located inside temple lands. This statistics indicate the fact that until today, the social custom that students learn in the temple has been strongly remaining, although there are no implications of temples to schools.



**Figure 1: Distribution of Temples and Schools inside Temples Plots in Bangkok**



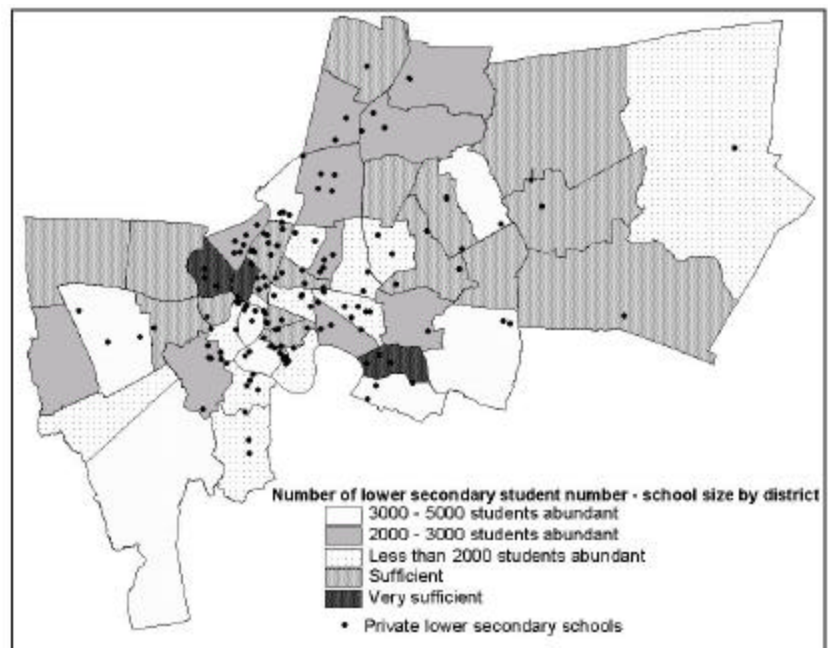
**Figure 2: Buffer of Public Lower Secondary Schools and Population for Age 12-14 by Sub-district in Bangkok**

This paper applies the “School Mapping” technique, which means the location planning of educational institutions. This technique identifies the sites where educational facilities need to be located. Using GIS for displaying, you can clearly identify the area where there is a lack of schools. In India, the maximum walking distance to schools from children’s houses is set to be less than 1 kilometer for lower primary level education and three kilometers for upper primary level (UNESCO, 1991). In Sapporo, Japan, city planning regulations indicate that primary schools should be located within 500 m and 10 minutes walking distance from the residence and for lower secondary schools are within 1,000 m and 15 minutes walking distance from their houses. In Thailand, Educational policy and planning are organized by the

Office of the National Economic and social Development Board (ONESDB), the Office of the National Education Commission (ONEC) and the Budget Bureau under the Office of the Prime Minister. Nonetheless, there are no specific regulations or requirements for school locations, and Building Coverage Ratio and Floor Area Ratio. Only few common rules, such as not near factories, warehouses, landfills etc., are stipulated for school planning. This loose enforcement of school planning regulations has also become one of the factors that triggered the random school distribution regardless of the consideration for demand as explained in the following.

In this study, we cannot analyze school location according to the indicators, hence, we estimate the demand and supply by sub-district wise. With respect to the gap between the actual number of school age pupils and the average public primary school capacity by district, the fringe area has a better situation than that of the inner area, offsetting the insufficient number of private primary schools. On the other hand, the fringe area urgently needs more public lower secondary schools, given that the population density of the lower secondary school pupils are quite high in Nong Khaem district and some areas in the Nong Chok district (See Figure 2 and Figure 3).

Private schools are mainly concentrated in the inner area. Thus, children in the fringe area to attend out of district public and private schools are burdened in terms of physical, financial and travel time, and particularly the poor are vulnerable. To analyze the accessibility of the existing school networks in physical terms, four indicators should be considered such as, distance to be traveled, travel means used, time of journey, domicile of pupils (UNESCO, 1991). Consider the school trip from the fringe area to the lower secondary schools out of Nong Chok district. The official population of grade four to grade six in Nong Chok is approximately 4,200 (Year 1999). In Nong Chok, there are three lower secondary high schools under BMA and two of it under MOE. The total capacity of lower secondary education is about 3000 students. Taking account of the unregistered population, more than 1,500 targeted students are abundant, and need to go to the out of district schools for continuing their education. It takes more than one hour by public buses to go to the middle area where many lower secondary schools are. Transfer is required, and the cost of bus trip is at least 14 baht per day. The bus runs only the two main roads, hence, if transportation fees from students' residence to bus stops on the main road are included, low-income household need to bear the considerable amount of burdens to continue the education. Cresswell (1999) estimated in Thailand that 'the total time and money cost to a village household of sending a child to a public lower secondary school in town can amount to an increase of almost four times the cost of his/her primary education. If the child fails to be admitted into a public school, which normally selects students by means of a competitive entrance examination, the cost of going to a private school would amount to more than half of their total annual income'.



### **Figure 3: The Gap Between the Number of School Age Pupils and the School Capacity for Public Lower Secondary Schools by District in Bangkok**

In the present situation, obviously, the number of lower secondary schools is insufficient to cover the demand; consequently, children out of lower secondary school catchments are compelled to face with inconvenience or lose the opportunity to access the education.

#### **CONCLUSION AND RECOMENDATIONS**

By August 2002, all the schools should be ready to accommodate the children in their school districts as the need advocated from the government policy to extend the compulsory education from grade six to grade nine. After examining the current school situation in Bangkok by GIS, this paper found out some restricted access to education and unbalanced school distribution in the some area of Bangkok.

Using GIS, the distribution of schools with detail characteristics (students number, school size etc) and relationship between school and population density, transportation network etc., can be clearly illustrated. Therefore, integrating all the school data and converting it to the digital format will make us easily and efficiently do present condition analyses or simulation on future school building planning. In addition to this, creating the database that can be linked to features in GIS is very significant, since the features without detail attributes cannot help us do further analyses.

At this point, as a first-aid treatment, government and municipality have constructed some lower secondary schools within the primary school plots or crammed all the students into the original primary school buildings. However, in order to provide equal opportunity and standard service of education, firstly, the supply side, namely the government and municipality, must estimate the school demand thoroughly to allocate schools sufficiently and equally. Without the appropriate supply of lower secondary schools, the objective to implement nine years compulsory education is likely to end up with the meaningless strategy. In order to accomplish this aim, GIS is a very useful tool to analyze the school-planning situation. Besides the simplification of educational administration, and expansion of compulsory education, enforcing the clear school planning policies, and creating the digital database that can be used in GIS, will have more positive influence on improving school services and qualities for the current and future children.

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