Chapter 1
Introduction

1. The significance of the Study

During the last 50 years, Thailand has entered a drastic change in her population structural. During 1960-2010, population size in Thailand has doubled from 26 million persons to 66 million persons. It is remarkable that Thailand has entered a transition to aging society from the median age of 20 years to 35 years. In addition, most of population 80 percent had once resided in rural (non-municipal) area has reduced. Currently, almost 50 percent of the population is residing in the urban (municipal) area.

Population change was driven population policy since 1970. The policy was designed to tone down the population growth in order to achieve a balanced economic development and growth path. The population policy in the past had applied for a 'Family Planning Program' as main policy instrument among others. The Third National Economic and Social Development Plan (1972-1976) – The Sixth National Economic and Social Development Plan (1987-2000) had set population growth targets in line with the target of the economic and social development plan.

The family planning measure had been effectively reduced the 'Total Fertility Rates, TFR)[1]. The TFP had declined from 6.3 in 1965 before the introduction of a family planning measure to 1.6 persons in 2010 respectively. The population growth rates have decreased from 3 percent per year during the last 50 years to be merely 0.5 percent per year at present. As a result of lowering total fertility rates and death rates, Thailand has entered an undeniable aging society.

The Population Projection Committees under the NESDB has applied the Population and Housing Census of 2010 of the National Statistical Office, Thai Government as a basis (excluding the non-Thai nationals in Thai households and those undocumented persons) to project population trend during 2010-2040. The projection is for various levels; the national (2010-2040), regional (2010-2035), and provincial (2010-2030) level. It also included the national population as well as municipality and non-municipal or the rural population at all level (2010-2035) respectively[2].

[1] Number of average children at birth per a fertile mother

[2] The NESDB population committee has applied a 'Cohort component method' for national and regional population project. The 'Ratio method by age, gender and area' is applied for projection of municipal population. The 'Single year age' population 1-100-year-old was attempted. Assumptions on 'Total Fertility Rates", 'Death rates", "Migration" between regions and "Urbanization Trend" are clearly explained in NESDB (2013).

The NESDB has found that the population projection is quite stable at 64-66.4 million persons in the next 30 years. This is a result of TFR's declining trend towards the threshold of 1.3 persons in 2040. It is noted that the population growth rate may be approaching zero percent per year. As a consequent, the population with age 65 year, approximately 9 percent of total population in 2553 will increase to 14 percent in 2021, and 20 percent in 2031 respectively. In addition, it is clear also that within the next 30 years most of the population will reside in the urban area.

The changing population trend has called for a policy to increase population quality rather than numbers by a family planning program. In order to shift economic structure away from labor-intensive towards an improvement of labor quality and productivity, less reliant on unskilled-skilled migrant labor from neighboring countries. Instead, the population policy should turn to human security policy, and plan for stable income with a higher quality of life for the aged population.

The ADB in her publication on the "Infrastructure for a Seamless Asia" in 2009[3] has pointed out high investment demand for Asia's economic infrastructure (power, water, and sanitation, transport, and telecommunication) from 2010 to 2020. The costs of hard and technical infrastructure for Asia are estimated to be 8 trillion USD approximately. Following the Sustainable Development Goals (SDGs) and updates on a social and economic environment of the region, the ADB has extended the estimate for the period from 2016 to 2030. An updated figure on the demand for hard and technical infrastructure needs in a report "*Bridging the Gap: Infrastructure Needs in Asia*" in February 2017, has pointed large gap of infrastructure needs. It has provided strong policy recommendations as a basis for financial needs for investment.

JICA has started in consultation with the ADB to conduct a research on *Asia's social infrastructure demand* from 2016 to 2030 to complement ADB's demand estimate for economic infrastructure. Social infrastructure, such as school and hospital, is a key capital investment to maintain social services and secure economic development of the region where the population is expected a rise. The domestic public financial gap of these public investments in each Asian country would be enormous.

The financial burden derived from infrastructure investment does not finish at the stage of construction but continue for the long term. A new infrastructure investment requires subsequent expenditures in later years such as the costs of operation and maintenance, rehabilitation and replacement at the end of the facility's lifecycle. The problem of finding out *a financial source* for infrastructure renovation would be crucial

[3] ADB (2009) cited the methodology by Fay and Yepes (2003).

to developing country where domestic saving is still lower than needs. Besides, some countries such as Thailand are facing with aging trend following Japan. Thailand will be facing population aging in the next decades. Thailand is ahead of other Asian countries, Thailand has a declining birth rate owing to declining total fertility rates and declin ing death rate owing to health standard improvement in the last decades. The longevity of population was owing to better public health services.

Approaching aging society, Thailand may need a new type of social infrastructure. Not only the housing and health services and facilities for the aged citizens but also Thailand would need a new supply of skilled labor supply via capable human resource investment to compensate for the declining saving capacity of the household. This comprehensive social infrastructure investment would be the crucial policy of Thailand as well.

2. The Objective, Scope, and Methodology of the Study

The purpose of this research is to estimate the investment demand of Asia's social infrastructure up to 2030: with special reference to the case of Thailand. This is to find appropriate research methodology on social infrastructure demand estimation and forecasting to be learned by other Asian countries.

The gap of demand for social infrastructure in Thailand is defined as infrastructure *other than* the physical or hard infrastructure which has been estimated and forecasted excellently by ADB. Here, it would cover less heavy engineering oriented physical infrastructure like transportation and communication systems, energy generation system, environment protection and prevention and the like. Rather, we concentrate on physical infrastructure which would serve as facilitation of human capital investment, health system at large not only buildings and hard infrastructure but may be inclusive of machinery and technologically advanced facilities. We would like also interest in the housing demand and affordability of low-income households as a basis for welfare improvement of households as well.

The scope of research thus covers mainly the social infrastructure for education and health system in Thailand. In addition, we would also estimate the demand for low-income housing needs and affordability to serve for the long-term urbanization in Thailand. In our research, we have the intention to add estimation on the demand for government facilities alongside with the urbanization and decentralization in Thailand as well. This is to serve for the decentralization of service provision from the central and regional government to local government in the coming decades.

2.1 Review of Conceptual Framework and Methodology

Two methodologies namely the "micro" and "macro" approach as a primary guideline by JICA in the estimation and forecasting of social infrastructures.

Table 1.1: Two Approaches by JICA Recommendations

	Overview	Pros	Cons
1. "Micro" approach	Build up each year's demand by multiplying the projected number of the beneficiary (e.g. student for school, potential patients, low-income households need for low-cost housing) by official construction standard (e.g. square meter per student)	Once, micro level of parameters are obtained from engineering estimation and accounting cost formally, we can arrive at a model case for social infrastructure investment as well as the cost of investment in a static period.	Since engineering parameter is quite general, it may be applicable to other Asian countries. However, the 'unit cost' may need inter-country indexation. This can be applicable to other Asian countries after all.
2. "Macro" approach	Project each year' s demand (dependent variable) by regression and/ or system estimation. The main variable is demographic/ economic factors (independent variables)	Model estimate applies hypothesis testing procedure to test the validity of model to be used for future need of social infrastructure and its cost of investment in dynamic time.	The Econometric model for social infrastructure needs of schooling, housing and health services consumed cost of time in data collection and model estimations.

Note: This is guideline given by JICA for our research.

2.1.1 Macro-Economic Approach

ADB (2009) has released method of multiple regression model by Fay and Yepes (2003) in the infrastructure estimation using multiple regression model, The multiple regression model of is based on the least squares method (OLS) with the explanatory variable of infrastructure stock of each country / year as explanatory variable, per capita income, ratio of agriculture and manufacturing industry to GDP. Its validity is verified by an F test.

$$\mathrm{IJ}(\mathrm{i},\mathrm{t}) = \alpha_0 + \alpha_1 \mathrm{IJ}(\mathrm{I},\mathrm{t}-1) + \alpha_2 \mathrm{y}(\mathrm{i},\mathrm{t}) + \alpha_3 \mathrm{A}(\mathrm{i},\mathrm{t}) + \alpha_4 \mathrm{M}(\mathrm{i},\mathrm{t}) + \alpha_5 \mathrm{D}(\mathrm{i}) + \alpha_6 \mathrm{D}(\mathrm{t}) + \xi(\mathrm{i},\mathrm{t})$$

Where;

IJ (i,t)	= demand for infrastructure stock of type j-th in country i-th at time t;
IJ(I,t-1)	= the lagged value of the infrastructure stock,
y (i,t)	=income per capita of country i-th;
A(i,t)	= share of agriculture value added in GDP of country i-th;
M(i,t)	= the share of manufacturing value added in GDP of country i-th,
D(i)	= a country fixed effect,
D(t)	= a time dummy;
ξ (i,t)	= error term.

It is worth a trial to add the population density and the ratio of urbanization (proportion of the urban resident population in the total population) as an explanatory variable to the above regression model to replace the country fixed effect D(i). Furthermore, if we can collect standard price deflator of construction materials and equipment it may be feasible to estimate the monetary value of social infrastructure investment overtime to 2030.

2.1.2 Review of the Micro-Economic Approach

(1) Estimation of the new construction cost of public facilities

In Japan, maintenance cost and replacement investment in public facilities of local government are based on the projection of the population (e.g., number of children) and infrastructure stock quantity according to government standards such as the "Ministry of Education, Culture, Sports, Science, and Technology". In Thailand, the stock quantity is not easy to access for intonations.

(2) Estimation of renewal expenses of public facilities

In Japan, experiences on estimation methods of renewal costs are being accumulated, mainly from local public entities, against the background of the old infrastructure and aging problems of public facilities. The replacement of buildings, equipment, interior and other after the end of useful life of 60 years follows the Regional Comprehensive Development Foundation guideline. They are obtained from the "Public Facility Update Cost Calculation Software" with relevant infrastructure stock by relevant aging.

(3) Estimation of maintenance cost of public facilities

In Japan, the local governments have followed the guideline of the 'Administrators of public facilities' based on the "Lifecycle cost of FY 2005 building supervised by Ministry of Land, Infrastructure, and Transport".

Nemoto (2011) has proposed a method to estimate the renewal investment demand in line with the declining birthrate and aging society. The study by Foundation Building Conservation Center (2015) has provided comprehensive recommendations on (1) factors which reduce real demand based on 'Effective utilization, (2) shrinking supply of infrastructures investment as result of procurement of liabilities and capital. The study has pointed out important issues on (1) the discipline of private funds raising (2) the consolidation of facilities for multi-functional usage, with proper infrastructure management for a long lifespan, wide area cooperation for effective use.

Based on the above survey, we may summarize the benefit and cost of micro and macroeconomic approaches in the case of Japan and others as follows:

Table 1.2: Comparison of Benefit-Cost between the Micro-and Macro-Economic Approach

	Benefit	**Cost**
Micro approach	It is feasible to calculate the necessary stock build-up in each year for each social investment. Estimated investment demand at the present moment (t) is possible.	The volume of data required is relatively large. The lack of detail data in Asian countries may be a bottleneck.
Macro approach	It is efficient in analyzing the trend (elasticity) of the numerical value over a certain period of time。	The past stock of social infrastructure was assumed to be in line with the observed or *ex-post* demand. It is costly to attempt to model dynamic stochastic model where future demand *ex-ante* is not observable.

Source: reviewed from JICA's document

The macro method is based on (1) official statistics obtained from a database of international institutions and other governmental websites. It may help to collect data by questionnaire survey in Asian countries, (3) the micro estimation if properly modeled may be a good starting point to carry out in other Asian countries. This is based on *pro-rata* assumptions level *of development* as shown by on the per capita income and

demographic dynamics. In our study, Thailand is selected as a case study to be the benchmark for latecomers, Asian countries.

Definition of Demand (A Case of Japan)

Investment demand in any one year for a specific infrastructure in a specific area can be defined as follows:

$$\textit{Infrastructure Investment Demand} = \{\textit{New Investment Demand[1.1]} + \textit{Maintenance Management Investment Demand[1.2]} + \textit{Update Investment Demand[1.3]} + \textit{Large Scale Refurbished Investment Demand[1.4]}\} \quad (1)$$

In the education and medical sectors, it is necessary to estimate demand for multiple forms of infrastructure with different maintenance/maintenance unit prices (Education: Basic education facilities and higher education facilities, medical care: primary medical facilities and secondary and tertiary medical care Facilities), it will construct several expressions according to the form of infrastructure.

Estimation methods used for new investment demand, maintenance investment demand, renewal investment demand, large-scale renovation investment demand are as follows:

[1.1] New Investment Demand

For a specific infrastructure in a specific region, new investment demand in any one year can be derived from the following formula:

New investment demand [**1.1**] = Construction unit cost (**cost per square meter area**) × **new demand amount** (**square meter area**) (2)

The construction unit cost can be estimated by examining the public utility unit price of the government. They are the standard price in the relevant area, or the contractual/actual unit cost derived from the multiple public works projects in recent years.

It is noted that the 'units of demand amount' other than 'square meter area' such as a number of schools, number of classrooms, number of hospitals, and number of beds can also be considered as proxies. The new demand *volume* can be derived from the following equation:

New demand amount = ***Induced demand by population increased in the relevant year*** × ***predetermined coefficient (official maintenance stand)*** (3)

The increased number of population in a studied area is an induced demand for infrastructure. In the education system, they are the increased number of students which induce the demand for education schooling and facility.

The demand for the facility based on past trends such as the number of outpatients and hospitalized patients seems to be positively correlated with the degree of maintenance of public insurance, the prevalence rate of non-infectious diseases caused by aging and income improvement, etc. In medical services, the rising number of in and outpatients has induced demand for beds and pre-cautionary facilities for NCD illness in modern life.

The process of urbanization and migration in the large urban cities will induce the demand for housing and urban infrastructures. For the government, it is to raise the welfare of the urban poor by dwelling provision for low-income people. The local government office building, as well as modern OA facilities, is induced by urbanization. Here, in Thailand, the declining in central government civil servants can be replaced by local government officials and privatization of services.

In Thailand, we intend to estimate the demand according to the increase in the number of *beneficiaries*, in order to satisfy the demand under constraints including policy measures to resolve the constraints in the policy recommendation. As for the predetermined coefficient, it is based on the official standards some may be replicated by other Asian countries.

[1.2] Maintenance investment demand

For specific infrastructure in a specific region, the maintenance demand investment demand in any one year can be derived from the following formula:

Maintenance Investment Demand [1.2] = ***Maintenance unit cost (Maintenance management cost per square meter area)*** × ***Existing stock (square meter area)*** (4)

[1.3] Update Investment Demand

For specific infrastructure in a specific region, demand for renewed investment in any one year can be derived from the following formula:

Update investment demand [1.3] = renewable cost per square meter area[4] x updated demand amount (square meter area) (5)

Update demand quantity can be derived from the following formula:

Update demand amount = existing stock amount[5] ÷ useful life (6)

[1.4] Large-scale refurbished investment demand

For a specific infrastructure in a specific region, large-scale investment demand in arbitrary one year can be derived from the following formula:

Large-scale renovation investment demand [1.4] = maintenance cost (maintenance cost per square meter area[6] × large-scale renovation demand amount (square meter area) (7)

The type of facilities to be estimated is basically based on the three pre-school education facilities, primary and secondary education facilities, and higher education facilities. However, whether modeling is reasonable or not is to examine the types of educational facilities in the country and re-examine. Schools in a form that has a low share of school statistics or that cannot be fitted to the above ISCED classification (e.g., special support schools, technical colleges, vocational schools for disabled people) are not subject to this estimate.

The guideline of the induced demand by population and prescribed coefficient (official maintenance standard) in the estimation of the new demand amount of the education sector, in line with the equation (3) is as follows:

Table1.3: The Morphology of Infrastructure, Beneficiaries and Coefficient: Education

Morphology of infrastructure	Number of beneficiaries	A predetermined coefficient
Preschool education facility	The population of target age × Arbitrary ratio based on past enrollment rate trend etc.	Establishment standard of the model country concerned
Primary/secondary education facilities	The population of target age (compulsory education, assumption that 100% will go to school)	Establishment standard of the model country concerned
Higher education facilities	The population of target age × Arbitrary ratio based on past enrollment ratio trend and GDP per capita etc.	Establishment standard of the model country concerned

[4] same as that adopted in equation (2)
[5] same as that adopted in equation (4)
[6] same as that adopted in formula (2)

2.1.3 Healthcare (medical services facilities)

The specific scope of the facilities covered by this estimate is for hospitals (psychiatric hospitals / general hospitals), general clinics (beds) among facilities type in the medical facility. This is a survey conducted by the Ministry of Health, Labor and Welfare of Japan. Note that the dental clinics are excluded from the fact that the number of hospital beds is negligible even in Japan.

Based on the type of hospital bed, adopted categories of psychiatric bed, infectious disease bed, tuberculosis bed, sick hospital bed, general hospital bed, it is possible to estimate medical demand represented by the number of functionally used hospital beds in Japan.

Table1.4: The Morphology of Infrastructure, Beneficiaries and Coefficient: Health

Morphology of infrastructure	**Number of beneficiaries**	**A predetermined coefficient**
Needs for infrastructure: hospital and facilities	A total number of patients with a probability of in-out patients in the population projection by age as demanded. It is managed by UCS.	the cost standards of the UCS model in Thailand. The 'Capitation cost per person' is paid to health provider (Ministry of Health) by demander (patients), managed by the UCS.

However, in the model country like Thailand, the situation is somewhat different from Japan and other Asian countries. Thailand had launched a universal health care services or formally 'Universal Coverage Scheme (UCS)' for those who could not access to health care services in the mainstream. Middle to high income obtains health care services through the private provision with market prices. The government's civil servants and military are treated from government budget as part of rewarded benefits in serving country. The employees are caring from the social security fund a joint payment between tri-party. The universal health care has served for the rest 60 percent of the population who could not reach the mentioned health services. The universal health care service's cost was paid through government budget in terms of capitation of demand or patient number not the hospital beds from the supply side. We will try to estimate the investment cost of social infrastructure mixed between supply and demand models. Such that, other Asian countries will be able to find an appropriate model for own country.

2.1.4 Low Income Housing Needs

In Japan, "low-income housing" refers to *public housing* of prefectures and municipalities. In addition to this, public *rental housing* supplied by Urban Renaissance Agency etc. existed and played the role of housing supply etc., in urban areas of the high growth period. Currently, it plays a role as a *safety net with* the aging of current residents and an increase in the relatively low-income group, but it is different from the original "low-income house".

Table 1.5: Comparison of Low Income Housing Provision by Selected Countries

Country	Japan	Indonesia	Malaysia
Object	Public housing (prefecture, city village)	Rusunawa and Rusunami	Program Perumahan Rakyat (PPRS and PPRM)
Right form	Lease	Lease, sale	Lease, sale
Maintenance standard	Public housing improvement standard	(Pedoman Teknis Pembangunan Rumah Sederhana Sehat, (403/KPTS/M/2002)	Standard (Perumahan Kebangsaan Bagi Perumahan Kos Rendah Rumah Pangsa, CIS2)
Target income class	Revenue till 25% or less (originally hierarchical), revenue quartile 40% or less (discretion hierarchy)	Household monthly income 4,500,000 Rp or less	Household monthly salary less than 2,500 RM

In Asian countries, policy instruments such as *a sale* of public housing rather than the rent of public housing, allocation of low-income housing development obligation to private developers, and housing finance are mainly used JBIC Development Institute proposed by Kitano, Naohiro et al. (2001). Therefore, even if estimating housing demand for low-income people, it is highly likely that measures to reduce the *financial gap* are *not* only dependent on the provision of public rental housing (the public possesses housing as stock).

In addition, estimating the demand of public housing in Japan estimates the number of households of the policy objectives of the public housing (original hierarchy and discretionary hierarchy) based on estimates of household numbers etc. in the medium to long-term as about 30 years, among them, *"household with less than annual salary poverty"* is estimated. However, this household with less than annual poverty annual income is included *even if it resides in private rental houses*, and it does not necessarily indicate the necessary number of public housing.

In Thailand, low-income housing was mainly planned by the National Housing Authority of Thailand, Ministry of Human Security and Social Welfare. The HHA has compiled land bank in her hand but the problem is the overall funding of housing construction and post finance. The post finance is provided by both the Government Housing Bank and the general Commercial Banks. The NHA has provided 732,249 low-income housing during 37 years (1973-2010). The current government housing policy has launched housing policy aiming at house price of 242,200-2,600,000 baht (the suburb of the BMR and some urban area in provinces). Housing for aging people would be planned for 10 percent of each project.

The target low income has been set at household income less than 15,000 per month in 2003 and adjusted to be less than 40,000 in 2016 for house price not exceeding 740,000 baht a house. The post finance is taken care by finance and banking in general.

It should be noted that numbers of housing supply were provided by the private sector in various forms. This is because most of population and household resided in the rural area for 40 years now. However, recent population and housing census have indicated that population changes and resettlement of Thais toward the urban cities. Rural area and localities have turned to district municipalities and township municipalities over the years from now. It is expected that the urban area will be expanding with both high-middle-and low-income communities living side by side. The demand for housing in various forms would be rising. The cost of land in an urban city may exclude low income from housing services in the center area despite their workplaces would be located there. Demand for labor by urbanites would still be high despite automation. Some work has to be done by low-income workers still. Thus, it would be costly for the low income to commuting from the sub-urban area if transportation system is not properly provided. Therefore, it is a crucial role of the public in the provision of low-income housing. The needs for various types of housing would be necessary. This can be owned, leasing, renting and freely use in short period as a safety net for the urban low-income people.

2.1.5 Government Buildings

In Japan, the definition of the government building in this estimation is a facility for the central government and local public entities to perform the necessary duties to provide public services to citizens. "Law for the construction of public office facilities" means "buildings used by national institutions to handle their affairs, and used by

schools, hospitals and factories, prisons and other storage facilities. For local public bodies, "office" and "branch office, branch office, branch office" generally refers to "government building" under local autonomy law. In addition, according to the provisions of the Constitution, local governments are supposed to set up parliament, and there is a space for Congress to occupy.

In addition, in local autonomy law ordinarily, local public bodies are said to establish public health centers, police stations, and other administrative agencies. In the statistics on the size of the "government building" of the municipality, there are statistics that are limited only to the *"space mainly used for office"* and statistics including other spaces including parliament and civic interaction spaces.

The concept of the number of beneficiaries and prescribed coefficients (official maintenance standards) in the estimate of new demand in the government building, in equation (3) is as follows:

Table1.6: The Infrastructure, Beneficiaries and Coefficient: Government Building

Morphology of infrastructure	Number of beneficiaries	A predetermined coefficient
The government building	The ratio of the number of civil servants per population based on the total population x past trends etc.	Establishment standard of the model country concerned

3. Conceptual Framework in Thailand Case Study

In the current study, we will apply the guideline mentioned above for our projection of needs, where it is appropriated. The research team has also developed own methodology in line with the above-mentioned guidelines.

In the case of Thailand, we would apply national survey data such as 1) The Household Expenditure Survey (SES); 2) The Labor Force Survey (LFS); 3) The Database from the Ministry of Education; and 4) The National Housing Authority (NHA) etc.

The dynamic population projection based on the Population Census 2010 by the NSO and NESDB (2013) would be our main starting input into our model forecasting. The parameters in our model are estimated using standard econometric method for several surveys done by the National Statistical Office (NSO) mentioned above. Thailand was a case where the population is facing an aging trend with lowering Total Fertility Rates in the next decades.

The model for social infrastructure needs would be developed in our study. Later, the sample model may be a guideline for other Asian countries. The social infrastructure need is subjected to the result of rehabilitation and replacement cost of infrastructure. As Thailand is facing *'a middle-income traps'* syndrome, it is challenged on how to rehabilitate, repair and maintenance of existing infrastructure which is deteriorating over time. However, the most important is to estimate *the need for new social infrastructure in Thailand* to be a basis for sustainable growth in the coming decades.

The methodology guideline in this research can be shown by either schematic flows and/or mathematical model. All projection starts from official population projection series by NESDB, the Thai government. The demand for schooling, low-cost housing and health care services and government buildings are designed as follows:

1) Under the trend of population change in Thailand, household demand for education and schooling can be projected from the supply-side. The number of students in schools at every level was determined by multiplying the 'enrollment ratios' with the population at each particular age profile. WaPattanapong, Pramote Prasartkun and Suriporn Panpoung ed., (2013) has applied single year age population to proposed population policy implications. The average five-year age population group is used to represent enrolled population to compare with the single year age population by NESDB.

2) As Thailand is trying to get out of a "Middle Income Trap" syndrome, key determinants would be both physical as well as human capital development. She would need solid structural adjustment on the production side away from labor-intensive in each sector. We intend to take in to account demand-side estimation and projection as well. Thus at equilibrium, we would project the demand for labor by skills (occupation-education) by sector of production. The demand for labor by education was later translated into the demand for schooling by disciplines investment.

3) The demand for healthcare services and hospital facilities and physicians and other human resources depends on the aging structure of a population. The model would predict the number of the patient of non-communicable disease (NCD) and other patients. The translations of demand for health services into physical infrastructure and cost-effective investment will be done by our designed model.

4) The housing need and affordability of low-middle income in Thailand has been main government policy. It is officially serviced by the National Housing Authority of Thailand. Middle-high income housing demand has been taken care by private housing market at large. In our study, we applied the SES database to estimate

the demand for housing by income class. Some income class will be able to afford only 'rent-a-house' rather than a mortgage. The demand for housing for aged citizen may need new vision how to apply new technology for the amenity of aged people and how to design community for senior-new breed family living nearby in the same community.

5) The infrastructure demand for government building will be estimated by applying database on how the social capital stock (the case of government building) is estimated by NESDB. We will apply a model starting from population resettlement under the dimension of 'Urban-Rural'.

The social capital investment although can remedy some welfare's problem *ex-ante* but most of developing countries are facing tendency of an aging society with low saving rates. This would not sufficient to service the social capital investment debt. The gap of social infrastructure needs would be constrained by low domestic saving and capacity constraint to generate income growth. The social policy like this is hard to find a solution *ex-post* without accessibility to international resources. How to quantify the financial solution to relax this financial constraint is however beyond the scope of our study.

4. Organization of Report

In chapter 2, we will describe the economic development and growth of Thailand as a basis for the estimation and report. The sources of growth from the supply side is concentrated for further prediction of input demand for production of human capital and health as well as housing and government services

Chapter 3 describes Social Infrastructure Needs and Its Determinants at the macro level. A regression analysis together with a counterfactual macro-economic model simulation and forecasting will be used to project the gross investment needed for total social infrastructure for human capital development and welfare improvement for low-income housing. This is a methodology developed by this study.

Chapter 4 provides a micro approach in a projection of social infrastructure needs in the education system and their facilities. Here also we have benchmarked Thai education system with international standard i.e., PISA report and come up with the projection for social infrastructure need as well its 'cost saving' owing to shifting of importance from physical alone towards human capital investment. We have added the similar demand and its cost saving in the case of public services by applying data from

the Office of Civil Servant Commission (OCSC).

Chapter 5 we have applied data from the health service system in Thailand, known as the 'Universal Coverage Scheme' (UCS). It is the demand side approach to the health services. It may be one of the successful implementations in the world. Although, we will also describe the drawback of excess demand of UCS where social investment cost on the supply side could not match with expectation. The projection of social infrastructure need is projected from the population structural change towards the ageing cohort, and stochastic drift by the Non Communicable Disease (NCD).

Chapter 6 provides an insight into our approach methodology of 'Low Income Housing Needs and Affordability' model for Thailand. The demand projection is to qualify the level of needs for future urbanization and communities' welfare improvement.

Chapter 7 provides an overall conclusion on our methodology and results. This will be a basis for a further application by the other Asian countries.