

TDRI

Quarterly
Review

Contents

Summary of the 2007 TDRI Year-end Conference on “Tackling Poverty: Liberalism, Populism, or the Welfare State” <i>by Kwanjai Lekagul</i>	3
Adaptation Strategies for Coastal Erosion/Flooding: A Case Study of Two Communities in Bang Khun Thian District, Bangkok <i>by Rawadee Jarungrattanapong and Areeya Manasboonphempool</i>	11
NEWSBRIEF	19



Thailand is now at a juncture where public debate is needed as to which path toward poverty reduction is best for the country to take; liberalism, populism, or the welfare state. See related article on page 3.

Summary of the 2007 TDRI Year-end Conference on “Tackling Poverty: Liberalism, Populism, or the Welfare State”

Kwanjai Lekagul*

For decades Thailand resorted mainly to a liberal economic policy in tackling poverty through economic growth. Conservative macroeconomic management, with the private sector playing a leading role, especially in international trade, was aimed at raising the country's income. Specific poverty- and income-redistribution policies were largely non-existent. Rural development was seen as a synonym for poverty reduction. In most of Thailand's modern economic history high economic growth actually led to poverty reduction. This growth-driven view of poverty reduction was not automatically accepted as it had been previously once the 1997 financial crisis occurred and poverty increased. The populist policies of the Thai Rak Thai (TRT) party quickly filled the gap, and became a huge political success that has lasted until now; no party can now afford not to have elements of populism in their policies. Thailand is thus at a juncture where public debate is needed concerning which path toward poverty reduction is best for the country to take: liberalism, populism, or the welfare State.

Therefore, the Thailand Development Research Institute (TDRI) in cooperation with the Chai Pattana Foundation and the Office of the National Economic and Social Development Board organized the 2007 Year-end Conference on “Tackling Poverty: Liberalism, Populism or the Welfare State” on November 10-11, 2007 at the Ambassador City Hotel, Jomtien, Chon Buri, Thailand. The conference was aimed at presenting comparisons of these three paths to poverty reduction from the perspectives of a philosophical foundation, general history and applications to Thailand, and their effectiveness in solving poverty as well as income-distribution problems. The objectives of the Conference were as follows: (1) to present research findings related

to the theme of the Conference; (2) to be a forum for intensive discussions and brain-storming among the participants who came from diverse backgrounds, including the public sector, the private sector, academia, the media and local communities; and (3) to enable the participants to draw up recommendations on appropriate strategies and policies related to the issues under discussion. Nevertheless, it is very important to remark that this Conference was not aimed at evaluating the policies of any of the political parties which were then campaigning, but rather presenting research on the impact of populist policies in the past in order to determine whether they had accomplished their goals. This Conference was also to recommend a concrete and sustainable way to address the poverty problem using the so-called welfare State system.



* Ms. Kwanjai is the Assistant to the President, TDRI.

Format and Themes of the Conference

In the morning session of Saturday November 10, the Conference started with a keynote address by Mr. Kosit Panpiemras, Deputy Prime Minister and Minister of Industry, and TDRI Vice Chairman of the Council of Trustees and the Board of Directors, on "Tasks for the New Government." This was followed by a research presentation on "Tackling Poverty: Liberalism, Populism, or the Welfare State" by Dr. Ammar Siamwalla and Dr. Somchai Jitsuchon, the Acting President, and the Research Director for Macroeconomic Development and Income Distribution, TDRI, respectively.

In the afternoon session of Saturday November 10, the Conference was split into two group sessions: one on Tackling Poverty by Using the Means of Credit and the other on Tackling Poverty by Using Education. In the morning session of Sunday November 11, the Conference was again split into two group sessions: one on Tackling Poverty by Means of Welfare State and the other on the topic Does Globalization Eradicate Poverty?

Participants

The Conference attracted approximately 400 participants from the public sector, the private sector, academia, non-governmental organizations, representatives from local communities, and the media.

Report of the Group Discussions

The group sessions were divided up according to the four previously mentioned group session topics.

GROUP 1 TACKLING POVERTY BY USING THE MEANS OF CREDIT

Generally, populist policies are aimed at solving the economic problems of the poor. However, there are two contradictory populist arguments on how to tackle poverty. The first argument holds that people become poor because they are indebted. Thus, the way to solve the problem, which the TRT government used, is to launch a debt moratorium scheme to suspend farmers' debts to the Bank for Agriculture and Agricultural Cooperatives (BAAC). The second argument holds that people become poor because their income is less than their expenses. Thus, it was recommended that more access to credit should be provided to the poor, such as through the establishment of the Village Fund by the TRT government. However, there were still some issues that remained unclear and needed to be discussed: Do the poor incur too much debt? and Does the scheme on using credit to reduce poverty cause the problem of debt overhang for the poor? This group discussion focused on issues such as the credit and economic problems of the poor, opportunities for them to access microcredit and



reduce poverty, and the impacts of the Village Fund on poverty reduction.

On the impact of credit on the economic problems of the poor, the study found that the debt service ratio of poor households was still relatively high. This indicates that the households do not have adequate income. Moreover, as the poor generally possess non-financial assets (such as house and land) rather than financial assets (such as gold, jewelry, and cash), they are thus more vulnerable to economic risks and need to obtain loans to solve their economic problems. However, because the poor tend to be rejected by general financial institutions, they need to get loans from other financial sources, such as specialized financial institutions (i.e., BAAC and the Government Savings Bank), governmental loan schemes such as the Village Fund, and informal financial sources. The study also found that households which get loans from the Village Fund face the problem of debt overhang. In this regard, the government has to be cautious about the implementation of the microcredit scheme. First, the scheme should have strict rules and regulations in releasing loans. Second, the scheme should focus on disseminating knowledge to the poor concerning how to use the loan to conduct business. Third, the scheme should improve its implementation by learning from other successful microcredit schemes abroad.

As for the opportunities to access microcredit and reduce poverty, the research found that the problem of income distribution is worsening despite the launch of the Village Fund and Debt Moratorium Scheme for Indebted Farmers. This is because the scheme did not release loans to the poor, but to people who are actually not poor. The study recommended further that, although credit is one of the key factors for running a business, the knowledge on how to use the money to do business is also important. Therefore, along with the financial aid scheme, the government should also focus on enhancing the business capabilities of the poor. For the financial

assistance scheme itself, the government should pay more attention to redesigning the framework and procedures of the scheme so that the real poor can access loans. Apart from these aspects, the government should stop injecting a huge budget into this populist scheme in order to gain political support because the scheme does not bring benefits to the society as a whole and can even destroy the specialized financial institution system as well as create a fiscal burden on the government itself.

With regard to the impact of the Village Fund on poverty reduction, the study applied the propensity score matching (PSM) and double difference (DD) techniques, which provide more accurate assessments of 2002 and 2004 data from Socio-economic Survey (SES) conducted by Thailand's National Statistical Office. It was found that the Village Fund had quickly and to a high degree accomplished its goal of releasing loans as targeted. Unfortunately, however, the impact of the Village Fund on reducing poverty has been insignificant. Moreover, 15 percent of the borrowers from the Village Fund had to seek loans from other financial sources, which generally charge a high interest rate of about 3.7 percent per month, to repay loans to the Village Fund. This shows that a one-year loan cannot help the poor in generating enough income to repay the loan. In sum, the microcredit scheme alone cannot help the poor to escape poverty. In order to improve the Village Fund, it is suggested that (1) the local community should revise the rules and regulations for better fund management, for example, the repayment period should depend on business activity; (2) there should be an evaluation system to monitor the implementation and results of the fund; (3) panel data collection on households should be conducted every year; and (4) in the future, a baseline survey should be conducted before launching this kind of scheme.

Group Discussion

It was widely agreed that the microcredit scheme could help in creating more channels for the poor to access credit, but could not reduce poverty. Moreover, it worsened the poverty situation because of the debt overhang problem. In this regard, the following were discussed and recommended.

1. It was remarked that the government should not intervene in the management of the Village Fund. Rather, local communities should play a key role in managing the fund and also solving their problems by themselves because local communities know best about the need, background and repayment ability of community members.
2. It was noted that farmers tend to be rejected when applying for a loan from specialized financial institutions or the government's loan scheme owing to the lack of a guarantor and guaranty. Therefore, it was suggested that local

communities should be involved in drafting the rules and regulations of microcredit schemes that suit their needs, background and repayment ability.

3. The management of the Village Fund should be enhanced by adopting the principles of good governance in its practice, encouraging women to participate in its management, and promoting management cooperation among the public sector, the private sector and local communities.
4. In many cases it was found that the poor needed to apply for a loan from the microcredit scheme for emergencies. Hence, it was recommended that a fund for emergency purposes should be set up separately in order to help the poor.

GROUP 2 TACKLING POVERTY BY USING EDUCATION

Education is a key factor in elevating the income of people, thus a series of governments has attempted to provide the people with sufficient education. The 1997 Constitution expanded compulsory education from four to 12 years. This requirement, in fact, was in place before the TRT Party came into power. Although it seemed that the TRT government had strongly supported a populist policy on education, such as through interest-free student loans which would help to improve the quality of life of the people at the grass-roots level in the long run, this policy was not implemented seriously. The group discussion thus explored analysis of the political economy with regard to the role of the State in education services, the impact of education on poverty reduction, the impact of compulsory education on poverty reduction, and the case of educational opportunities for underprivileged children.

Background

On the role of the State in the provision of education, four issues were addressed as follows: Is there any market failure in the provision of education? Does education services that are run by the market mechanism satisfy the society? What is the role of the State in subsidizing the provision of education? and What is the role of the State in education services? The study found that education should be considered as "private goods," as it brings benefits to the persons who invest in it. However, since education also creates positive externalities for the society as a whole and owing to the problem of incomplete information, especially in the credit market for study purposes, the State should thus subsidize and intervene in the provision of education. On the role of the State in subsidizing the provision of education, it was found that the policy of 12 years of free education and the student loan scheme were not sufficient for narrowing the gap in

opportunities between the rich and the poor. Therefore, the State should set up a policy for allowing different prices to be charged for the education of the rich and the poor or it should promote a scholarship or grant policy along with the student loan policy. On whether the State should play a role as operator in the provision of education services, three main questions were raised for further study. The first concerned whether the State should provide education services for all areas of the country or only the remote and poor areas, in which private operators are not interested. The second related to whether public educational institutions should cover all fields of education or only fields in which private operators are not interested. The third consideration was whether public universities should be privatized to become autonomous institutions.

With regard to the impact of compulsory education on reducing poverty, the study presented two main issues, that is, what we know and do not know about human skills development, poverty, and the Thai education system. On the first issue, the issue may be summarized as follows. First, people still believe that educational institutions should play a key role in the learning process, but they pay much less attention to roles of the family and the working place in that regard. Second, genetic factors and the surrounding environment both play important roles in skills development but in some cases poverty can overcome the effects of genes. Third, skills which contribute to people's success are cognitive and non-cognitive abilities, and the return to these abilities inversely relates to age. Last, the critical periods for developing cognitive and non-cognitive abilities are eight to 10 years and 18-20 years respectively. In sum, the return to investing in skills development is an inversion of age, that is, the earlier the age at which we invest in education for our children, the greater is the benefit that they will get in return. Thus, it is recommended that the investment in skills development for children should start at a young age. On the second issue concerning poverty and the Thai education system, the study found the following. The rate of Thai students entering institutions of higher education is gradually declining due to the problem of chronic poverty they face. For the parents, the study found that they are relatively poor; thus, they could not raise their children sufficiently well. In terms of teachers and school administrators, it was found that their qualities were not up to acceptable standards and they did not produce graduates that served the needs of the labor market. On educational resources in school, there has not been any research result particularly identifying what kind of resources should be improved and how to utilize all these resources efficiently. On teaching materials, there should be further studies on which teaching materials that were found useful abroad could help in the development of students. Therefore, as an education policy which is aimed at developing human skills would be a key instrument for reducing poverty, three pillars of policy are proposed as follows: the first is

market competition; it is recommended that market competition should be encouraged so that both schools and students would be able to utilize educational resources efficiently under clear and fair regulations. The second is improving access to education. The government should emphasize subsidizing education for underprivileged children in particular. The third is the family. Parents should be supported in raising their children better.

With regard to the impact of compulsory education on poverty reduction, that is, the case of educational opportunities for underprivileged children, it was found that workers with a compulsory level of education could not generate enough income to elevate their quality of life or to escape poverty. The poverty faced by orphans and the handicapped represents a hurdle for such children to enter school. It was also found that the enrollment rate of children and the financial aid extended for education in the northeastern region of the country was lowest. In this regard, it is recommended that the government should expand the provision of compulsory education for all children by increasing both the supply side (by subsidizing more the compulsory level of education for children in the northeastern region), and the demand side (by providing poor and underprivileged children with more scholarships).

Group Discussion

It was concluded that education is a key factor which promotes equality of opportunity in the society, and poverty is also the main obstacle to the accomplishment of one's education. Therefore, investment in education is a key strategy for reducing poverty. In this regard, the following points were discussed and recommended.

1. The basic problem which needed to be discussed further was how to manage the education system in order to reduce poverty, because not much research had been conducted in this field. It was also remarked that the way to manage the education system required an economic philosophy and a goal to which the society aspired.
2. Currently, the education system tried only to serve the needs of the labor market and thus ignored the importance of informal education. It was recommended that informal education should be emphasized along with formal education because informal education helped not only in developing skills for children, the family, and the community, but also in strengthening relationships among them and empowering the community. Moreover, the goal of education should not be to attract people into the formal education system, but rather to encourage people to live their lives

with the local knowledge that they had. It was also suggested that the key success of informal education was to open some spaces in the community where people could express and exchange their ideas and knowledge.

3. No conclusion was reached however on which approach—liberalism, populism, or the welfare State or a mixed system—was the best for managing the education system. It was thus recommended that further research should be conducted.

GROUP 3 TACKLING POVERTY BY MEANS OF WELFARE STATE

The welfare State system is a governmental mechanism which provides people with public services from the “womb to the tomb.” Under this system, the State collects taxes from the working-age population to spend on welfare services for children and the pension-age population; this is called “intergenerational transfer.” This system also provides assistance for the underprivileged such as handicapped people, orphans, and unemployed workers. Such welfare services cover education, health care, housing, unemployment aid, old-age pensions, and so on. Nevertheless, to become a welfare State, Thailand would have to pay a huge cost. This would mean that the working-age population would have to pay more taxes. Moreover, as Thailand has a narrow base of income tax payers owing to the large number of informal workers, the country would thus face problems with regard to increasing the collection of taxes. The group discussed whether Thailand was ready to change from a system of private intergenerational transfer to a public one. The issues would involve changes in the allocation method needed to close the deficit in Thais and the welfare State, informal workers and the welfare State, and the readiness of Thais to pay the cost of creating a welfare State.



Background

With regard to the changes in the allocation method for closing the deficit, the study explored the nature of labor income, consumption and the allocation method needed to close the deficit in children-youth and the elderly, and examined the changes needed in such an allocation method over time. The study found that for an average person the surplus period, during which the income from labor exceeded consumption, became shorter. A positive deficit, which occurs when consumption exceeds labor income, increases among children-youth and the elderly because children spend a long time studying, the elderly can retire early, and the consumption expenditure of both children and the elderly, such as on tuition fees and health-care services, increases. However, the surplus from the working-age population cannot increase at the same rate as the positive deficit. Therefore, the surplus in labor income needed to close the deficit decreases with regard to children and the elderly. Nevertheless, due to Thailand’s favorable age distribution, with a high proportion of the population in the working-age group, the aggregate surplus can cover a higher percentage of aggregate deficits. Unfortunately, this favorable situation cannot last long, as Thailand will become an aging society in the not too distant future. Moreover, for the elderly, the role of asset-based reallocation in closing the deficit has been declining and thus more reliance needs to be placed on private transfer. Although Thailand now has more public programs for the elderly than in the past, when compared with other countries, it has relatively fewer programs. Nevertheless, in the future Thailand cannot rely only on public transfers as this would cause huge burdens for the government. Other measures should also be implemented; for example, Thais might need to work longer and retire at older ages or build up more savings.

With regard to informal workers and the welfare State, it was found that in the past informal workers were considered as temporary workers or workers at the periphery of the economy. It was believed that, when the industrial sector had achieved its fullest capacity, all informal workers would be employed in the formal sector. However, the reverse is true. Despite the expansion of the industrial sector, workers in the informal economy still exist up to this date and have even gained a more prominent role in the economy in the current era of globalization. They can thrive well in a globalized world because they are very flexible in responding to various uncertainties arising from globalization. According to the study, although expansion of the informal economy increases employment and income, it also contributes to risks and vulnerabilities for informal workers. The study also found that the age of most informal workers is not exceeding 44 years old and their educational background is at the high school level.

Moreover, 80 percent of workers have dependants and more than 60 percent are indebted. Most of the workers experience problems with regard to working conditions, capital, and income. They thus need support from the government in terms of knowledge, capital, and marketing. It was also remarked that there are various types of informal workers and each type has its own characteristics and problems. Therefore, in order to set up a social safety net for these workers, a pluralistic model for welfare provision should be employed. Moreover, under this condition the welfare State may have some limitations. Thus, local communities should instead play a crucial role in the provision of welfare while the government plays a supporting role.

Regarding whether Thais are ready to pay the cost of a welfare State, it should be pointed out that it is quite difficult to clearly define what constitutes a welfare State, because it can be considered in various dimensions. However, to the general public, the welfare State implies the provision of welfare services, including social protection and social assistance, by the State. The degree to which the welfare State exists would depend on how much the State provides for social protection and social assistance. This would be reflected in the percentage of public expenditure on the welfare State compared with other public expenditures or Gross Domestic Product (GDP). The role of welfare State was twofold. First would be *ex ante* risk management or social protection which is aimed at protecting people from risks. Second would be *ex post* risk management or social assistance, which is aimed at helping people who experience hardship. Like countries in the Organisation for Economic Co-operation and Development (OECD), Thailand has various welfare programs. However, unlike OECD countries, most of these programs are not universal. Examples of welfare programs in Thailand are the provision of old-age pensions, a housing scheme for low-income people, and welfare services for labor, the handicapped, and households that have lost their breadwinner. For Thailand, the cost of welfare services in 2006 was about 2.3 percent of GDP, relatively much lower than that of Mexico. However, the question about whether Thais are ready to shoulder the cost of a welfare State depends on how many welfare services Thais would like to have. It is very important to note that people need to acknowledge that any welfare service comes at a high cost, for which the people themselves must be responsible.

Group Discussion

The following were discussed and recommended.

1. To tackle poverty, it would be necessary to combine the liberalism and welfare State approaches. However, the competition should be moderate and both the public and private sectors should together play important roles in the provision of welfare State services.

2. To identify welfare services, knowledge must be disseminated to the people, encouraging them to become self-reliant and promoting public participation in the management of welfare provision. As for the State, it should play a supporting role, such as assessing an overview of the welfare services situation, supporting personnel on welfare services, and providing welfare services which people on their own could not produce such as education and health-care services.
3. The welfare State system should be set up at both the local and the national levels as each level has different strong and weak points. For example, although the national welfare system could not serve the needs of local communities, its fund was large and had better risk distribution. At the local level, even though the fund was small, which naturally bore more risk, it could serve the needs of local communities. Currently, there are some welfare programs run by local communities. Hence, the government should play a role in supporting these programs by drafting a law to support programs legally, encouraging public participation in welfare services, and providing financial aid to these programs. As for the national welfare system, some loopholes in the system should be filled, such as preventing employers from avoiding their responsibility to provide welfare services to their employees, and revising the tax system in order to increase income equality in the society.

GROUP 4 DOES GLOBALIZATION ERADICATE POVERTY?

Since 1982 Thailand has continually opened its economy to the world by signing many free trade agreements (FTAs) at the bilateral, regional, subregional, and multilateral levels. A big jump into the whirlpool of globalization contributed to the havoc of the 1997 financial crisis. Despite this miserable lesson, the TRT administration still kept heading on this track and in some cases made even greater haste toward signing more FTAs. Today, as globalization has become fiercer and stronger, Thailand needs to consider how to join this speeding train while at the same time reducing the country's poverty. This group discussion covered globalization, income distribution and poverty reduction, globalization growth and regional disparity in Thailand from 1981 to 2003: a case study of the inland and coastal region, impact of foreign direct investment on employment, globalization and labor-market implications for Thailand, and the impact of the growth of tourism on the poor in Thailand.

Background

The school of economic liberalism believes that free trade enables a country to utilize its limited natural resources efficiently, thus contributing to economic growth and a reduction in poverty. However, economic growth is not the only key factor in reducing poverty; the market mechanism has failed to solve the problem of income inequality. In the past half decade, both developed and developing countries have increasingly joined the stream of free trade by lifting their barriers to international trade. Under FTAs in goods and services, inputs and consumers were relocated. This thus created many international business opportunities and enhanced the competitiveness of various sectors through innovations in products and production. This phenomenon is called globalization. Currently, globalization is increasingly being countered by many anti-globalization activist groups, who claim that there is a need to protect the underprivileged, prevent unfair trade, and preserve nationalism. As mentioned previously Thailand has continuously opened its economy to the world by entering into various FTAs. Under globalization, Thailand has experienced both positive impacts (high economic growth) and negative impacts (the havoc created by the 1997 financial crisis). However, it is time for Thailand to consider how to participate in the globalized world while at the same time reducing poverty at home.

With regard to the impact of globalization on poverty reduction, the labor market, and employment, the studies found that globalization produces positive impacts for an economy: it helps in reducing poverty, generating income, and increasing employment opportunities. However, at the same time, it contributes to a worsening of income inequality problems in the country.

Group Discussion

The following were discussed and recommended.

1. The State should understand the impact of globalization on the poor in order to know how to reap benefits from globalization for the poor and also to provide social safety nets and remedies for the poor who are adversely affected by globalization.
2. To reap benefits from globalization, Thailand should improve five areas: (a) improve the education and health-care systems, (b) enhance domestic competition and improve the environment for investment, (c) open up markets in developed countries, (d) provide social safety nets, and (e) establish macroeconomic stability.
3. To reduce poverty and increase income equality, the State should put this problem on a special agenda and come up with measures that incorporate social, economic and technological knowledge as well as the philosophy of a sufficiency economy.
4. Further research should be conducted on how to immunize the country from vulnerabilities due to globalization and on determining the specific measures needed to reap benefits from globalization in terms of generating income, creating jobs, and reducing poverty.
5. Because some types of poverty problems are very complex, specific measures and more involvement of non-governmental organizations, universities, and the media are needed.
6. Apart from research on the impact of globalization on poverty reduction, two other research projects were recommended: first, on the impact of information dissemination on poverty reduction. The research should focus on how information dissemination has had impacts on the poor in terms of lifestyle, income and expenditure. Second was the impact of globalization on natural resources and the environment. This research should explore whether globalization has contributed to the deterioration of natural resources, thus adversely affecting the lifestyle of the community.

REFERENCES

- Adis Israngkura. 2007. Globalization, income distribution and poverty reduction. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Ammar Siamwalla, and Somchai Jitsuchon. 2007. Tackling poverty: liberalism, populism, or the welfare state. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Anan Wattanakuljarus. 2007. Is tourism growth pro-poor growth?: a case of Thailand. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Ashvin Ahuja. 2007. The impact of education on poverty reduction. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Bawornpan Ashakul, and Worawan Chandoevwit. 2007. Impact of the village fund on poverty reduction. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)

- Chaiyasit Anuchitworawong. 2007. The opportunity to access micro credit and poverty reduction. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Kobsak Pootrakul. 2007. Credit and economic problems of the poor. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Mathana Phananimai. 2007. Changes in allocation method to close the deficit in Thais and the welfare state. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Narumol Niratorn. 2007. Informal workers and the welfare state. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Piriya Pholphirul. 2007. Globalization and labor market implications in Thailand. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Santi Chaisrisawatsuk, and Wisit Chaisrisawatsuk. 2007. Impact of foreign direct investment on employment. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Thailand Development Research Institute (TDRI). 2007a. Tackling poverty by using means of credit. Summary of results from group discussions of Group 1 at the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- _____. 2007b. Tackling poverty by using education. Summary of results from group discussions of Group 2 at the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- _____. 2007c. Tackling poverty by means of welfare state. Summary of results from group discussions of Group 3 at the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- _____. 2007d. Does globalization eradicate poverty? Summary of results from group discussions of Group 4 at the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Threetep Nopkhun. 2007. Globalization growth and regional disparity in Thailand from 1981 to 2003: a case study of the inland and coastal region. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Viroj NaRanong. 2007. Political economy analysis on the role of state in education service. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Waranya Teukul et al. 2007. The impact of compulsory education on poverty reduction: the case of education opportunity of underprivileged children. Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)
- Worawan Chandoevmit. 2007. Are Thais ready to pay for the cost of welfare state? Paper prepared for the 2007 Year-end Conference on Tackling Poverty: Liberalism, Populism, or the Welfare State, November 10-11. (in Thai)



Adaptation Strategies for Coastal Erosion/Flooding: A Case Study of Two Communities in Bang Khun Thian District, Bangkok*

Rawadee Jarungrattanapong^{**}
Areeya Manasboonphempool

1. INTRODUCTION

A rise in sea level has occurred globally, and a continuous rise in the level of the sea is one of the most certain impacts of global warming. One of the expected impacts of sea-level rise is inundation of coastal areas, which will have a negative impact on the livelihoods of the people living in those areas and on GDP. In Thailand, the impacts of coastal erosion, together with a relative rise in sea level owing to land subsidence as a result of excess groundwater extraction in the flat and low-lying areas of the Gulf of Thailand, which includes Bangkok, are expected to be significant. According to a Chulalongkorn University study, 11 and 2 percent of the coastline areas along the Gulf of Thailand and the Andaman Sea respectively are eroding at a rate of more than 5 meters a year. This is equivalent to 2 square kilometers of coastal real estate, valued at about US\$ 156 million, being lost each year (World Bank 2006).

Coastal erosion involves not only a loss of land, but also of roads, electricity systems, land devoted to aquaculture, and farmland. Thanawat (2006) finds that 30 coastline areas in Thailand have been prioritized as being the most severely eroded coastal areas in the country, namely “hot-spot” areas. The coastline in Samut Sakhon and Samut Prakan provinces, and Bang Khun Thian district of Bangkok, share the same coastline (Figure 1), and are included in the hot-spot areas. However, owing to budgetary and time limitations, this study focuses only on Bang Khun Thian district of Bangkok, which we think offers useful insights into the adaptation behavior of local communities to this situation. In addition, the Bangkok Metropolitan Administration (BMA) is planning to deal with the

coastal erosion problem in the Bang Khun Thian area; the planned action is still under study in deciding appropriate alternatives. However, the BMA study emphasizes engineering or infrastructure alternatives, which lack adaptive behavior at the household level. This study will help to fill the gap in the BMA study as it relates to the adaptation of households.

Bang Khun Thian is the only district in Bangkok province that is located on the coast; it has a coastline 4.7 kilometers long. The area located next to the shore is Ta Kam subdistrict where the total population and the number of houses are 38,699 persons and 16,956 houses respectively. A BMA study (2006) found that two village communities in Ta Kam subdistrict have been directly affected by coastal erosion, that is, villages number 9 and 10. In 2005, the total number of houses in those villages were 382 and 327 respectively (BMA 2006).

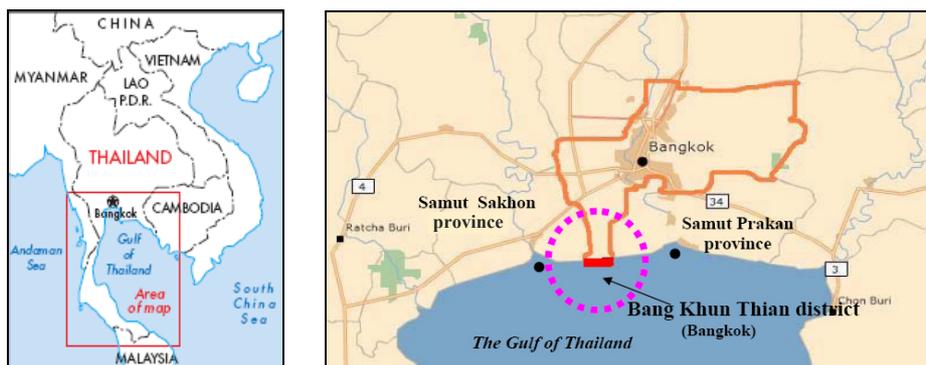
Coastal erosion is most critical in the village number 9, where the stakes marking the Bangkok boundary are already submerged (see Figure 2); the erosion is taking place at the rate of 20-25 meters of coastal land per year. During the past 28 years, coastal erosion has decreased the village’s shoreline, from 4 to 800 meters (Thanawat 2006).

The objective of the study is to determine the adaptation strategies of households and communities with regard to coastal erosion/flooding. The structure of this paper is as follows: Section 2 describes the geographical characteristics and economic activities in the study area. Section 3 describes the method of data collection. Section 4 presents important findings of the survey. Those findings emphasize the adaptation strategies to coastal erosion in the study area. The last section is conclusion and lessons learned from the study.

* This paper was prepared as part of the project on “Adaptation strategies for coastal erosion/flooding: A case study of the communities in Bang Khun Thian district, Bangkok,” with financial support from the Economy and Environment Program for Southeast Asia (EEPSEA). The authors would like to express their gratitude to Dr. Herminia Francisco and Dr. David James for their valuable guidance and comments.

** Ms. Rawadee and Ms. Areeya are Researchers of Natural Resources and Environment Program and Science and Technology Development Program, TDRI, respectively.

Figure 1 The Gulf of Thailand (left) and the Study Area in Bang Khun Thian District, Bangkok (right)



Source: World Bank, 2006.

Figure 2 Stakes Marking the Bangkok Boundary in Bang Khun Thian District, Bangkok



Source: Rawadee and Areeya, 2008.

2. DESCRIPTION OF THE STUDY AREA

2.1 Profile of Bang Khun Thian

The coastal area of Bang Khun Thian district is situated along the upper Gulf of Thailand and is bounded by Samut Prakan province to the east and by Samut Sakhon province to the west. The study area comprises 4.7 km of muddy coast; currently, no mangrove forest has survived, except for fringes along the shoreline. A number of shrimp ponds extend northward from the shore, as shown in Figure 3. Farmers' houses are located on a canal which skirts the shrimp ponds; the canal is also the main route that coastal communities use for transport and travel.

2.2 Economic Activities in the Study Area

The major economic activity in this area is coastal aquaculture, with the raising of shrimp and blood cockles being the main occupation. All the shrimp farmers in the study area use extensive farming techniques, requiring little management and investment. Based on this approach, the farmers, or more accurately

aquaculturists, impound wild larvae from the sea and then grow them to market size. The shrimp feed on naturally occurring organisms; thus, the farmers do not need to use feed or fertilizer to make the shrimp grow. Almost all the costs of this form of aquaculture are related to the construction and maintenance of dikes. Harvesting is done by draining the pond and collecting the shrimp in nets. However, the farmers harvest the shrimp in such a casual way that there is no exact harvesting period and the yields are uncertain. The most important factor in determining production levels in shrimp farming is the quality of water.

Owing to the decreasing yields from shrimp farming caused by water pollution and a decrease in the number of larval shrimp in nature, the farmers have been turning to raising blood cockles along with farming shrimp in order to maintain their earnings. Like shrimp farming, cockle farming requires little management, since cockles feed naturally on the nutrients in the clay at the bottom of the ponds. Farmers have only to impound larval cockles and wait for them to grow to market size, a process which takes about a year. Therefore, the production costs of cockle farming are related mostly to the cost of cockle larvae.

Figure 3 Aerial Photograph of the Coast in Bang Khun Thian District, Bangkok, Depicting Shrimp Ponds



Source: www.thaigooglearth.com, visited in October 2007.

2.3 Current Impacts of Coastal Erosion/Flooding

Over the past three decades, it has been claimed that more than 500 meters of the Bang Khun Thian coast have already been eroded; that level of erosion is equal to about 400 hectares of land when considering the total loss (Figure 4). The degree of erosion is more severe around the mouth of the canal. From an analysis of aerial photographs taken between 1952 and 1991, the rate of erosion was approximately 7-12 meters per year at the beginning, increasing to 33.1 meters per year in the period 1987-1991 (Isaraporn 2001). Further analysis of those photographs and of earlier ones reveals that the retreat of the coast was accompanied by a remarkable change in the shape of the coastline, i.e., from a regular, smooth coastline formerly to a very irregular coastline now (Winterwerp, Borst, and de Vries 2005).

Studies show that coastal erosion in Bang Khun Thian district is caused by a decrease in sediment yield, natural land subsidence, sea-level rise and the impacts of waves and storms (Winterwerp, Borst, and de Vries 2005; Thanawat 2006; Isaraporn 2001). Subsidence of

1 cm annually would result in an apparent coastal retreat of 5 meters per year (Winterwerp, Borst, and de Vries 2005). Thanawat (2006) estimates that the sea level in the upper Gulf of Thailand will rise by 10-100 cm in the next 50 years. When the effects of land subsidence are integrated into the calculation, the coastal area is projected to be inundated for about 6-8 km inland from the current shoreline during the next 100 years.

Important evidence that indicates the seriousness of the situation with regard to the inundation of the study area is the deserted old water-gates, which were once part of farmers’ shrimp ponds (Figure 5, left). Thus far, aquaculture ponds have retreated further inland, that is, farmers have had to abandon their water-gates when they become covered by water; they then build new ones and reconstruct some parts of the pond walls. As mentioned previously, the shoreline of the study area has also been affected by strong waves and storms, as shown in Figure 5 (right); strong waves cause mangroves at the shoreline to fall over when their root system fails to provide sufficient anchoring.

Figure 4 Map Shows the Inundated Area of Bang Khun Thian District, Bangkok



Source: BMA, 2002.

Figure 5 An Old Pond's Gate That Is No Longer in Use (left), Mangroves Fall Over Due to the Impact of Strong Waves (right)



Source: Rawadee and Areeya, 2008.

3. METHODOLOGY

This study was based on site visits, discussions with local people, a concise literature review, and a survey. Data collection began with a focus-group discussion with a former village headman and local people in the study area. The purpose of the meeting was to gather relevant information and determine the scope of some forms of adaptation options which have been undertaken in the study area. Also, a pretest of the draft questionnaire was carried out in order to check whether it was workable; 10 people were interviewed as a sample population in the pretest. The sample was chosen from households affected by coastal erosion/flooding and the ones who knew the details of adaptation strategies. A sample of 40 households was selected randomly. The survey was conducted in September 2007 using face-to-face interviews.

4. RESULTS OF THE SURVEY

4.1 Socio-economic Profile of Households

As mentioned previously, the total number of samples in this study was 40. There were a slightly larger number of female respondents; all of them were aquaculturists. The education levels of the respondents were as follows: primary school (57.5%) and secondary school (32.5%). In the past, wild shrimp larvae were plentiful, and the farmers earned a considerable income from shrimp farming. There was no incentive for people in this area to seek a higher education. The majority of respondents were heads of households (65%), and most of them (80%) were local people born in the study area. (Table 1)

The high average age of the respondents (about 47 years old) reflects the initial screening of the household members who knew the details of adaptation strategies. The average annual income of the households was about 468,278 baht per year or US\$ 13,625,¹ which

was triple the mean income of farm operators for the country as a whole in 2006² (National Statistical Office 2006). The average area of the aquaculture farms was 68 rai (11 hectares)³ per household (in terms of extended families). Most farmers (67.5%) owned their own farm, the average area of which was 49.5 rai (7.9 hectares) devoted to aquaculture. For the farmers who rented their farm (12.5%), the average area devoted to aquaculture was 79.8 rai (12.8 hectares). The average inundated area was 5.7 rai (0.9 hectare), which accounted for 8 percent of household farm area (Table 2).

Table 1 Socio-economic Profile of the Respondents, Bang Khun Thian District, Bangkok, 2007

Characteristics	Frequency (persons)	Percentage
Occupation		
- Aquaculturists	40	100.0
Total	40	100.0
Education		
- No formal education	1	2.5
- Primary	23	57.5
- Secondary	13	32.5
- Diploma/vocational certificate	1	2.5
- Bachelor's degree	2	5.0
Total	40	100.0
Status		
- Household head	26	65.0
- Spouse	10	25.0
- Daughter/Son	2	5.0
- Siblings	2	5.0
Total	40	100.0
Origin of people		
- Local people	32	80.0
- Non-local people	8	20.0
Total	40	100.0

Source: Rawadee and Areeya, 2008.

Table 2 General Characteristics of the Respondents, Bang Khun Thian District, Bangkok, 2007

Characteristics	Minimum	Maximum	Mean	Number of respondents
Age (years)	30	78	47.3	40
Household member (persons)	2	12	4.2	40
Household income (baht/year)	45,000 (US\$ 131)	1,528,000 (US\$ 44,457)	468,278 (US\$ 13,625)	40
Total area devoted to aquaculture (rai)	30 (4.8 hectares)	200 (32 hectares)	67.5 (10.8 hectares)	40
Area devoted to aquaculture (for farmers who own their own farm: rai)	30 (4.8 hectares)	90 (14.4 hectares)	49.5 (7.9 hectares)	27
Area devoted to aquaculture (for farmers who rent their farm: rai)	40 (6.4 hectares)	140 (22.4 hectares)	79.8 (12.8 hectares)	5
Area devoted to aquaculture (for farmers who own their own farm and also rent a farm: rai)	80 (12.8 hectares)	200 (32 hectares)	124.5 (19.9 hectares)	8
Inundated area devoted to aquaculture (rai)	0	18 (2.9 hectares)	5.7 (0.9 hectares)	40

Notes: 1. US\$ 1 = 34.37 baht as of October 2007. 2. 1 hectare = 6.25 rai.

Source: Rawadee and Areeya, 2008.

4.2 Adaptation Options and Cost of Adaptation

The aquaculturists in Bang Khun Thian district have been trying to protect their shrimp ponds for more than 30 years. The survey results revealed that all the adaptation strategies of the households were autonomous. It also found that households have individually adapted to the problems at hand. However, the households also acted as a group, led by the former headman, in requesting government assistance so that they could cope with the coastal erosion. Their action may be considered as one type of collective adaptation.

The households must take care of their protective structures by themselves. If one household does not apply/maintain such structures, a negative externality will be generated for the neighbors. Sometimes conflicts occur in the communities when neighbors cannot afford to pay the cost of maintenance and they let the breakwater gradually deteriorate.

In respect of the awareness of the local people concerning climate change issues, what the households know is that natural phenomena exist that are caused by global warming, which has become a hot issue in Thailand. However, they may not know many details about the impacts of global warming or climate change; most of the local people do not know that global warming has caused the sea level to rise. Households have responded to the impacts of flooding without considering the possible residual impacts from the potential rise in the sea level in the near future.

4.2.1 Adaptation Options

Efforts have been made to stop the processes of erosion; all the households have applied more than one option in this regard. In terms of the protective strategies, we observed that the households had tried to apply all types of adaptation if they could afford them, since each adaptation option has its own function. Unfortunately, our survey data could not explain the

adaptive capacity of the households. Nonetheless, what we observed during the survey was that most households frequently complained that they might not survive very long if government agencies would not do anything for them, as some households had borrowed money from their relatives and others had taken bank loans to pay for the adaptation costs. According to our survey data, the choices of adaptation did not depend on tenure characteristics. Some farmers who rented the land also tried to apply all the protective options that they could afford as long as they were profiting from the aquaculture farms. In other cases, landlords were the ones who paid for the adaptation costs. For this reason, many protective strategies have even been applied to rental land. The choices of household adaptation may be classified into three types of autonomous adaptation as follows:

(1) Protection: some households have applied hard structures in parallel with the coast in order to protect their aquaculture ponds. Examples of such structures are a stone breakwater (Figure 6, left), a bamboo revetment (Figure 6, right), heightening of dikes (Figure 7, left), and a concrete-pole breakwater (Figure 7, right). The function of such construction is to lessen the impact of waves and storms. In addition, some aquaculturists heightened the walls of their ponds and reinforced them by constructing bamboo revetments. Such protective methods function like a package, i.e., the individual options cannot substitute others but rather support other options. Among these, stone breakwaters are the most popular (Table 3). However, the construction of a stone breakwater involves some physical constraints. If the sea level in some areas is too low for navigating a large boat, it is impossible to transport the stone needed to build the breakwater. For this reason, some households did not use stone breakwaters to protect their land.

(2) Retreat: some farmers needed to retreat or move their ponds inland; thus, they had to build new water-gates (Figure 8) and reconstruct the dikes.

(3) Accommodation: some households had to rebuild/renovate their houses due to flooding (Figure 9).

Figure 6 A Stone Breakwater (left) and a Bamboo Revetment (right)



Figure 7 Heightening of Dikes (left) and a Concrete-pole Breakwater (right)



Figure 8 A New Water-Gate, Which Needs to be Rebuilt Every Time the Sea Encroaches Further Inland



New water-gate

Figure 9 Example of Rebuilding and Renovating a House



Source: Rawadee and Areeya, 2008.

Table 3 Number of Households Applying Each Adaptation Option

Adaptation options	Number of households applying adaptation options (households)	%
1. Protection		
- Stone breakwater	32	80
- Heightening of dike	26	65
- Bamboo revetment	19	48
- Concrete-pole breakwater	2	5
2. Retreat		
- New water-gate	29	73
3. Accommodation		
- Rebuilding/renovating house	19	48
Total	40	100

Note: all households applied more than one option.

Source: Rawadee and Areeya, 2008.

4.2.2 Costs of Adaptation

When asked how long they had been affected by coastal erosion, most aquaculturists could not indicate exactly when the adverse impacts first started. They would always say that they had been affected for a long time. To calculate the adaptation costs, it would be necessary first to calculate the costs for each household in the same period of time. Otherwise, we could not compare the costs among the households. It was easier for the aquaculturists to remember certain events than specific dates in calendar years. One event that they could remember very well was dedicating land to BMA in 1993. Therefore, we set this event as the baseline time for calculating the adaptation costs of all the households.

With regard to those costs, it should be noted that all the households chose more than one adaptation option, usually combining various options. For example, some aquaculturists built a stone breakwater to protect against large waves, but they also needed to heighten/reinforce their ponds' walls. The accumulated costs of all the adaptation strategies which the aquaculturists had to bear on their own for 14 years totaled 1,506,219 baht (US\$ 43,824) per household.⁴ The average costs that the aquaculturists had to expend each year for adaptations was 107,587 baht (US\$ 3,130) per household (Table 4), which accounted for approximately 23 percent of the average household income.

Table 4 Adaptation Costs of Households

Adaptation costs	Minimum	Maximum	Mean	Number of respondents
Accumulated adaptation costs from 1993 to 2007	78,556 (2,286)	4,035,725 (117,420)	1,506,219 (43,824)	40
Annual adaptation costs	5,611 (163)	288,266 (8,387)	107,587 (3,130)	40

Note: The figures in parentheses are values in US dollars: US\$ 1 = 34.37 baht in October 2007. All values are in 2006 prices.

Source: Rawadee and Areeya, 2008.

5. CONCLUSION AND LESSONS LEARNED FROM STUDY

Coastal erosion has become one of the most serious problems in Thailand in recent years. The impacts of relative rises in sea level due to land subsidence, climate change, or both are expected to be an inundation of coastal areas, which will have a negative impact on the livelihoods of local communities. The sediment yield in the upper Gulf of Thailand has been decreasing as a result of the construction of dams on upland rivers, while the land subsidence is caused mainly by an excess withdrawal of groundwater (Winterwerp, Borst, and de Vries 2005). In Thailand, 30 coastal areas have been identified as having the most severe degree of coastal erosion in the country, namely "hot spot" areas. Bang Khun Thian district in Bangkok province is located in a coastal erosion hot spot: the Bangkok boundary mark is already submerged. The rate of coastal erosion in Bang Khun Thian is approximately 20-25 meters per year, which means that the shoreline has decreased by 4 to 800 meters within the past 28 years (Thanawat 2006).

Two villages in Bang Khun Thian district, the main economic activities of which are shrimp and blood cockle farming, have been directly affected by coastal erosion. It was found that the households had applied autonomous adaptation for preventing coastal erosion/flooding. The household adaptation methods can be categorized into three types: (1) protection strategies, which consist of stone breakwaters, bamboo revetments, and the heightening of dikes, (2) retreat, for which farmers need to rebuild a new water-gate, and (3) accommodation, by rebuilding/renovating their houses in order to avoid the impacts of coastal erosion or flooding. It should be noted that all the households have applied more than one adaptation strategy.

In terms of the economic impacts of coastal erosion, the villagers have a non-negligible burden in terms of adaptation. Our survey shows that the annual adaptation cost is approximately 107,587 baht, or US\$3,130 per household,⁵ an amount which accounts for 23 percent of the annual household income. Furthermore, a number of aquaculture farms are inundated, indicating that they have lost their asset. The average inundated area is approximately 5.7 rai or 0.9 hectare per household, which accounts for 8 percent of the household aquaculture area.

Even though a protective structure has been provided by a local government agency, i.e., the BMA stone breakwater, it affords merely a temporary solution, which is not functioning very well now. Also, the villagers receive compensation for flooding from a national government agency.

What we have learned from this study is as follows:

1) The existing household adaptation, in which a household individually applies its adaptation, may not be the “right” solution. According to engineering knowledge regarding coastal protection, the protective structure needs to be built along the entire shoreline. If the protective structure is built along only some parts of the coast, the impact of waves and rising sea levels in other parts without any protective structure will probably be even worse. Since some households cannot afford the adaptation costs, this negative externality may affect their neighbors.

2) In the past, wild shrimp larvae were plentiful and the aquaculturists could make a considerable amount of money from shrimp farming. Also, there was no incentive for the farmers to attain a high level of education. However, wild shrimp larvae have become increasingly scarce in recent years. This situation has adversely influenced the production of shrimp farms tremendously and thus the earnings of the aquaculturists. Also, owing to their low educational attainment and lack of other professional skills, the aquaculturists cannot easily shift to other occupations. This is one of the reasons why those aquaculturists are willing to pay high adaptation costs for protecting their shrimp and shellfish farms. Fortunately, children in those areas are attaining a higher level of education than their parents did; hence, the next generation will have more opportunities for finding other jobs.

Currently, because the local government in each coastal area has the authority to take care of coastal erosion in the area, the strategies for coastal erosion protection in each area is planned independently. As previously mentioned, for the protective structures to be effective, they should be designed for the whole upper Gulf of Thailand. Therefore, solution of this problem demands collective decisions by the national government in dealing with these issues.

ENDNOTES

¹ US\$ 1 = 34.37 baht as of 2 October 5, 2007.

² The mean income of farm operators (mainly those owning land) is approximately 154,044 baht per year per household, or US\$ 4,482.

³ 1 hectare = 6.25 rai.

⁴ At 2006 constant prices.

⁵ At 2006 constant prices.

REFERENCES

- Bangkok Metropolitan Administration (BMA). 2002. *Map of Bangkok*. Bangkok: Department of City Planning. (in Thai)
- _____. 2005. *BMA Statistics*. Bangkok. (in Thai)
- _____. 2006. The project on coastal erosion protection: a case study of Bang Khun Thian district, Bangkok, Interim report. Bangkok. (in Thai)
- Isaraporn Ittaro. 2001. “Shoreline Changes at Bang Khun Thian.” Master’s thesis, Faculty of Engineering, Chulalongkorn University, Bangkok. (in Thai)
- Krung Thep Thanakom Inc. 2001. *Project on the Rehabilitation and Development of Coastal Areas in Bang Khun Thian, Final report*. Bangkok. (in Thai)
- National Statistical Office. 2006. *The 2006 Household Socio-economic Survey: The Whole Kingdom*. Bangkok: Ministry of Information and Communication Technology. (in Thai)
- Rawadee Jarungrattanapong, and Areeya Manasboonphempool. 2008. *Adaptation Strategies for Coastal Erosion/Flooding: A Case Study of the Communities in Bang Khun Thian district, Bangkok, Final report*. Singapore: Economy and Environment Program for Southeast Asia.
- Smit, Barry, and Olga Pilifosova. 2001. “Adaptation to Climate Change in the Context of Sustainable Development and Equity.” In *Climate Change 2001: Impact, Adaptation, and Vulnerability*. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change.
- Thanawat Jarupongsakul. 2006. Coastal Erosion in Thailand: Causes and Management. Research paper, Department of Geology, Chulalongkorn University. (in Thai)
- Winterwerp, Johan C., William G. Borst, and Mindert B. de Vries. 2005. “Pilot Study on the Erosion and Rehabilitation of a Mangrove Mud Coast.” *Journal of Coastal Research* 21(2): 223-230.
- World Bank. 2006. *Thailand Environment Monitor 2006*. Bangkok.

