App. Envi. Res. 38 (1): 61-73

Applied Environmental Research

Journal homepage : http://www.tci-thaijo.org/index.php/aer

Integrating Human Health into Environmental Impact Assessment: Review of Health Impact Assessment in Thailand

Phayong Thepaksorn [1,*], Wattasit Siriwong [2], Sathirakorn Pongpanich [2]

[1] Trang Research Center for Occupational Health, Sirindhorn College of Public Health, Trang, 92000, Thailand
[2] College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand
[*] Corresponding author: Email: phayongthep@gmail.com, Phone: 0-8875-31547

Article History
Submitted: 5 December 2015/ Accepted: 19 February 2016/ Published online: 23 March 2016

Abstract

The objective of this paper is to review the integration of health impact assessment (HIA) into environmental health assessment (EIA) or EHIA, existing legal requirements for health risk analyses, and lessons learned for integrating HIA within EIA processes. The authors undertook literature searches for EHIA practices through academic publications, reports, and websites of public organizations and related agencies in Thailand. We examined and synthesized the HIA system development, regulations, and examples of integrated EHIA.

In conclusion, the implementation of EHIA still faces many obstacles, especially in such complex sector policy environments. The uncertainties, lack of evidence base, and challenges in implementing EHIA within the prevailing political and cultural contexts constrain decision-making and remain under-developed. Methodologies and tools have to fit with the available data and resources. The EHIA evaluation requires analytical validity, relevance, stakeholder engagement, and public involvement. The review resulted in the following recommendations to increasing Thailand's EHIA capacity: 1) develop tools and guidelines for implementation in each project types; 2) train EHIA experts and conduct EHIA courses to build capacity; 3) ensure meaningful participation of private sector and the public; 4) bring together all parties in the debate, and build consensus through community participation and the upholding of environmental justice including EHIA communication; and 5) work to ensure strong public participation and political engagement.

Keywords: Environmental impact assessment; Health impact assessment; Health determinants

Introduction

Attempts to integrate health impact assessment (HIA) into environmental impact assessments (EIA) or EHIA have made only gradual progress in Thailand over the past decade. Initially, the strong fundamental support under the Thai Constitution and the 2007 Thai National Health Act played a crucial role in conserving environmental quality and mitigating human health risks [1-3]. The HIA Division of the Ministry of Public Health (MOPH) has worked hard to protect public health through undertaking HIAs and supporting technical approaches across sectors at both local and national levels since 2002[4]. In terms of environmental legislation, the Ministry of Natural Resources and Environment (MONRE) has been responsible for building a legislative framework broadly similar to those in developed countries such as Canada, Australia, and New Zealand [5]. More recently, the Office of Natural Resources and Environmental Policy Planning (ONEP) developed technical guidelines for incorporating HIA into EIA reports. Specifically, EHIA requires health information and evidence relating to quality of life values to evaluate the linkages and potential impacts of any development on the physical, mental and spiritual health of vulnerable groups, and finally to inform the final approval decision for the project.

In Thailand EHIAs are undertaken at different stages or levels, for example on the project proposal or operational stages, and at local, national, or even international levels, such as for some mining projects, industrial estate expansion projects, and trade agreements in commodity supply chains [3, 6-8]. All these HIAs have contributed to an increasing level of awareness and concern among affected populations on health issues according to health determinants, including social, environmental, cultural and political influences on population health [9-11]. Therefore, HIA can assess and add value to strategic policy and planning decision-making processes for project or program operation approval processes.

Human health has been incorporated as a factor in Thailand's environmental protection legislation since 1992.The most important relevant legal instruments are the Enhancement and Conservation of National Environmental Quality Act (1992), the Factory Act (1992), Public Health Act (1992), Hazardous Materials Act (1992), and the Enhancement of Energy Conservation Act (1992). At present, EIAs are required for 36 types of projects, including most public infrastructure projects (dams, power plants, waste plants, public transit projects), mining, chemical, oil and gas operations, metal works, cement production, pulp processing, and sugar processing [5].

This paper reviews the current status of EHIA and the requirements of enacted laws according to MONRE. Then the authors discuss HIA practice and its integration into EIA, existing legal requirements for health risk analyses, and lessons-learned for integrating HIA within the overall EIA process. Finally, the authors discuss lessons learned from the country's experiences and the role for public health in shaping policies and decisions made using EHIA.

Methods

A literature search was conducted of published material using search engines, hard copy documents, and websites of responsible public organizations and agencies in both Thailand and overseas. Details of EHIA activities were obtained from published literature and websites and by personal communication with the primary authors. All projects recently submitted through ONEP have been accessed online or via hard copies [5]. The key features, characteristics and details of each EHIA were extracted and determined. A total of 693 projects were submitted for EHIA approval between 2009 and 2015. These are divided into nine categories: 1) community services and housing; 2) mineral and mines; 3) industry; 4) energy and power plants; 5) petro-

chemical industries; 6) urban and transportation;, 7) water resource development and agricultural projects; 8) oil refineries; and 9) petroleum drilling rigs. From the total number of submissions, EHIA projects completed in Thailand from 2013-2015 were selected for study. Second, 34 studies proportionate to each category were reviewed, including 15 EHIAs for community services and housing projects, 8 for minerals and mines, 5 for industry, 3 for petrochemical plants, 2 urban and transportation projects and one water resource development and agricultural project [5].

1) HIA in EIA requirements, Policy and Process

In Thailand, the EIA process was endorsed as far back as 1981, and has since been extensively used as a tool for environmental planning and management and for screening project development proposals. Under the Enhancement and Conservation of National Environmental Quality Act (1992), MONRE has promulgated the type and size of projects or activities requiring EIA. However, EIA reports were prepared with a focus on assessing environmental impacts, without a significant focus on health impacts and health disparity. Later, new legislation was enacted under the Thai National Health Act (2007), giving potentially affected communities the right to request that a discrete HIAs be conducted on a project proposal, and for the community to be involved in the HIA process [1]. The EHIA process is intensive requiring public hearings, public reviews and independent assessment. In addition, it must consider other existing environmental protection laws such as the Factory Act (1992) and the Hazardous Substances Act (1992).

The EHIA requires a report for any project or activity which may seriously affect the community in changing in condition or utilization of natural resources, production, transportation and storage of hazardous substances, or discharge of waste and health threatening substances from construction and production processes. The EIA report requires a technical assessment based on environmental impact assessment and monitoring methods, and must also provide recommendations for prevention and mitigation of potential or actual impacts to the environment and natural resources [5].

2) Integrated HIA in EIA: Examples and Practice

The HIA has been promulgated as a part of EIA process, focusing on an approval mechanism that assesses potential impacts of mega-projects on environment and human health. Overall, there are five categories of HIAs in Thailand [4-5]: 1) HIA in EIA (general guide- lines for specific industries covering 36 types of businesses and industry sectors); 2) HIA for healthy public policy (health promotion for disabilities and under-represented groups); 3) HIA for local organizations and communities (agricultural chemical use, water management and irrigation, and waste management); 4) HIA for legal regulations (Article 67 of the 2007 Constitution of Thailand, Articles 11 and 25 of the National Health Act (2007); and 5) HIA for National Assembly and HIA collaboration and networks (Table 1).

After HIA in EIA was promulgated in the 2007 Thai Constitution, EIA submissions incorporated a HIA section. The descriptive characteristics of projects with completed EHIA reports submitted to MONRE since 2009 have been documented and are summarized in Table 2. A total of 693 projects were submitted [14], including 402 community services and housing projects (58.01%), 119 energy and power plant projects (17.17%), 74 industrial projects (10.68%), 53 mineral and mine projects (7.65%), 18 petroleum geology and survey projects (2.60%), 16 petrochemical projects (2.31%), and 11 urban and transportation projects (1.59%). The owners and authorized bodies are required to operate under the specified regulations for environmental con-

trols (e.g. covering water quality, air quality, noise, waste management, etc.). However, the scope of this legislation gives little attention to health impact assessment, offering only brief generic guidelines for conducting HIA. Substantively, EHIA even today still lacks a body of knowledge and implementation guidelines for project developers and regulators alike.

Table 1 Descriptive characteristics and an overview of HIA system development in Thailand

HIA feature and characteristics	Descriptive focal points	Example projects	HIA core and key partners
HIA in EIA or EHIA*	General HIA guideline	-HIA guideline for specific industries	- Office of Natural Resources and Environmental Policy and Planning (ONEP) -Department of Disease Control, MOPH
HIA for healthy public policy	Health policy involvement	-HIA for health promotion for disabilities -HIA for Thai-China-Free trade agreement in produces supply chains	-Health Public Policy Foundation -Policy stakeholders
HIA for local administrations and communities	Community health impact assessment	-HIA for agricultural chemical use -HIA for water management and irrigation -HIA for waste management	-Department of Health, MOPH -Selected local governments
HIA for legal mechanism and enforcement	HIA in Constitution of Thailand, 2007 (Article 67)	-HIA in National Health Act, 2007 (Article 11 & 25)	
HIA in National Health Assembly	Supporting projects	-Mab Taphut industrial estate -Suvanabhumi airport	-National Health Commission -WHO
HIA collaborating network	National & international levels	-Educational training and capacity building -HIA in Southeast Asian Countries -HIA conference	-Higher institutes and universities -HPP academicians and researchers

* This study focusing on EHIA and obligation by ONEP

MONRE, as the responsible body overseeing the development and implementation of the legal mechanism for EHIA, has specified four main elements for integrating human health into EIA practices: the physical environment, the biological environment, natural resource utilization and quality of life. Many environmental, social, and health problems relating to new project developments have been reported and consciousness has increased sharply over the last

30 years. Activist groups and local communities have mounted strong protests and in some cases attempted to prevent or delaying construction of projects that may affect the local environment or human health [6-7,14]. There are various forms of pollution, degradation of natural resources and social impacts that increase the health burden, as illustrated by projects such as the expansion of the Mab Ta Phut Industrial Estate and the Kwaenoi dam project [12]. However, the EHIA is still incomplete and fails to cover important aspects. Progress in developing guidelines for incorporating HIA in the EIA were proposed in 2007. The approach for assessing EHIA included principles for conducting HIA, the scope of study, health risk assessment methodology, risk management and risk mitigation, and monitoring health impacts. In cooperation with the Department of Disease Control and Department of Health of MOPH, the guidelines have been supplemented over time to provide greater detail on health impacts, risk assessment methods and the procedure for assessing health impacts. Also, an integrated database on HIA has been enhanced to cover EHIA.

Thailand has made significant progress in development of HIA into EIA, with the Office of Natural Resources and Environmental Policy and Planning (ONEP), MONRE playing a vital role for promulgating EIA and submitting EIA reports. However, significant challenges remain in implementing HIA into EIA, and tools and practical guidelines are still needed to clarify effective implementation, especially in such complex policy sectors as agriculture or environment. The uncertainties, lack of a robust evidence base and technical capacity all constrain effective implementation of HIA in Thailand's complex political and cultural contexts [5]. Technically, it is also difficult in some cases to demonstrate health outcomes of the EHIA approach due to confounding factors. For instance, health outcomes are frequently multifactorial, which complicates the unequivocal identification of determinants.

A wide range of issues remain as points of concern for EHIA that necessitate development of specific guidelines for EHIA implementation practices, resource allocation, approaches to local communities and the formation and operation of an advisory committee. Topics requiring further rigour in the EHIA framework include the following:

Table 2 Type of project submitted EIA report, 2009-2015

Type of project	Example of project	No.	Percent
1. Community services and housing	Housing, condominiums, hospitals and hotels	402	58.01
2. Energy and power plants	Biomass and biogas power plants	119	17.17
3. Industries	Pulping industries, steel and aluminum industries	74	10.68
4. Mineral and mines	Cement factories, gold and cold mining	53	7.65
5. Petroleum geology and survey	Petroleum exploration and survey	18	2.60
6. Petrochemical industries	Petroleum production, polyethylene and plastic industries	16	2.31
7. Urban and transportations	Seaports, bridges, airports and railways	11	1.59
	Total	693	100.00

Source: Office of Natural Resources and Environmental Policy and Planning, The Ministry of Natural Resource and Environment http://eia.onep.go.th/group.php

1) Identification of health hazards faced by affected communities

2) Addressing mitigation measures on health impacts and quality of life

3) Identification of the point of health impact, high-risk groups

4) Format, methods, tools and timeline for determining existing environmental and health information/data relating to historical environmental impacts on people's quality of life, future trends and chances of accumulated environmental impacts

5) Determination of the probability of the project's potential health impacts, e.g. from pollution, psychological, social and health impacts from acute or chronic illness, stress, social disruption and accumulated health impacts

6) Assessment of impacts on health care deli- very and management systems, e.g. higher costs of health care and public health service systems

7) Application of good governance principles in assessment, risk management and impact reductions

8) Providing and building the capacity of organizations involving in EHIA

9) Creation of comprehensive guidelines for experts implementing EHIA

10) Provision of information to policy analysts to inform decision making (Table 3).

The review leads to several recommendations to enhance EHIA capacity. These are listed as follows:

1) Develop tools and guidelines for implementation in each specific type of projects in order to facilitate screening according to established scientific principles for assessing health impacts, so that the outcomes are scientifically credible and accepted by affected communities;

2) Train EHIA experts and conduct HIA courses in identification of the point of health impacts and risk groups, including format, method, tools and timeline;

3) Enlist participation of private agencies and companies in assessing health impacts, specifying affected groups and applying good governance principles and assessment;

4) Engage meaningfully with all stakeholders and ensure community participation and environmental justice, including effective EHIA communication;

5) Ensure meaningful public participation and political engagement for monitoring and evaluation of health impacts.

Existing EHIA tools and methods are still limited in their applicability within EHIA processes, given the methodological constraints and lack of fit with available baseline data and resources. EHIA evaluations require analytical validity, relevance and public participation in order to be accepted [1, 4-5], although in practice, many reports fall far short of fulfilling these requirements. In Thailand, the EHIA procedure should begin with an initial step to gather potential baseline data e.g. demographic and health and environmental data for the affected area and communities, with guidance from the Advisory Committee. The EHIA plan can then be assessed according to HIA protocols and practical guidelines [19-20]. This process allows key stakeholders and affected communities sufficient time to prepare and process information; a number of previous projects provided insufficiently detailed information about the projects and lacked meaningful community engagement (Figure 1). The scope of an EHIA requires the use of mixed methods (both qualitative and quantitative approaches). In recent years, there has been only one published EHIA guideline for water resource development project [13-14]. The guidelines for HIA approaches for water resource development projects include the use of integrated methods, ranging from checklists to multistep processes for analytical measurements. Importantly, EHIA implementation and policy development must ensure meaningful participation by stakeholders and affected communities. In addition,

further guidance is needed to identify HIA methods suited for evaluating specific types of projects. However, a greater level of stakeholder engagement at each step in the EHIA process inevitably prolongs the time frame and requires more resources. Who will pay for this additional cost is unanswered. In addition, strategies are needed that improve the visibility of health impacts and public health facility needs within affected communities.

Table 3 Type of projects submitted EHIA, reviewing and giving recommendations, 2013-2015

EHIA procedure/stage recommendations	Classification of EHIA projects*					
	Community services and housing (n=15)	Mineral and mines (n=8)	Industries (n=5)	Petrochemical industries (n=3)	Urban and transportations (n=2)	Water resource development and agricultural projects (n=1)
1.Screening on principles for assessing health impacts (public screening)						
1.1 Develop the specific guidelines for EHIA practices	+	+++	+++	+++	+++	+++
-Develop the specific guidelines for EHIA practices in each type of projects, etc. -descriptive characteristics of the project (infrastructure and engineering layout, type and quantity of all materials used, public utilities, public facilities and desired servicing, and step of procedure of project lifecycle						
1.2 Prepare resources, com-munity area and set the advisory committee	+	+++	+++	+++	+++	+++
-Data/basic information providing						
-List advisory committee and experts						
1.3 Identify health hazards of people living close to the project	+++	+++	+++	+++	+++	+++
1.4 Determine health risks to affected people and focus on people's quality of life that might be affected by the project	+++	+++	+++	+++	+++	+++
1.5 Address mitigation measures on health impacts and quality of life	+	+++	+++	+++	+++	+++
2.Scoping of the study(public scoping)						
2.1 Identify the point of health impact, worrying items of risk group, format, method, tools and timeline	+	+++	+++	+++	+++	+++
2.2 Determine existing environment and health information/data	+++	+++	+++	+++	+++	+++
2.3 Provide the past envi-ronmental impacts on peo-ple's quality of life, future trends and chances of accu-mulated environmental impacts	+++	+++	+++	+++	+++	+++
2.4 Determine the possibility of health impacts on:						
2.4.1 Project threats, e.g. pollution, psychological and social, e.g. waste and water management	+	+++	+++	+++	+++	+++

*Required +++ recommended +

Table 3 Type of projects submitted EHIA, reviewing and giving recommendations, 2013-2015 *(continued)*

EHIA procedure/stage recommendations	Classification of EHIA projects*					
	Community services and housing (n=15)	Mineral and mines (n=8)	Industries (n=5)	Petrochemical industries (n=3)	Urban and transportations (n=2)	Water resource development and agricultural projects (n=1)
2.4.2 Health impacts, e.g. illness, stress, social way of life changed, diseases, and accumulated health impacts	+++	+++	+++	+++	+++	+++
2.4.3 Health care delivery and management system, e.g. a higher cost of health care and public health service system	+	+	+	+	+	+
3. Assessing health impacts/ specifying affected groups						
Apply good governance principles and assessment	+	+	+	+	+	+
4. Risk management and impact reductions						
Provide/build the capacity of the organizations involving in HIA in EIA system	+++	+++	+++	+++	+++	+++
5. Reporting(public reviewing)						
Predict outcomes of the project on health determinants	+++	+++	+++	+++	+++	+++
6. Monitoring and evaluating of impacts on health						
Create guidelines for people participating in HIA in EIA systems	+++	+++	+++	+++	+++	+++
Provide information to policy analyst for decision making	+++	+++	+++	+++	+++	+++

*Required +++ recommended +

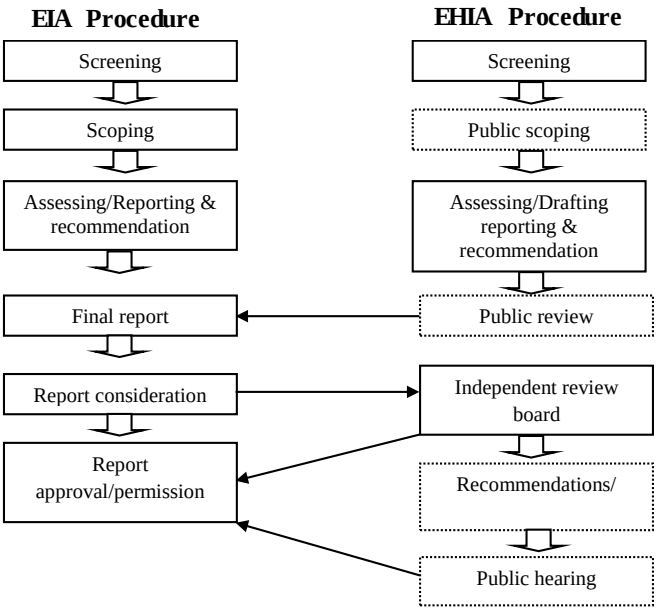

Figure 1 EHIA process in EIA flowchart (adapted from Chandanachulaka S, 2013)

The limitations of this review include the following: 1) no report projects have been reviewed that cover the follow-up stage; 2) there has been no assessment of health impacts among specified affected groups. We strongly recommend ongoing monitoring, evaluation and follow-up of health impacts by creating practical guidelines for people participating in EHIAs. Finally, it will be crucial to establish a mechanism to share information on an ongoing basis with policy analysts as a means of informing decision-making.

The development of EHIA guidelines for selecting appropriate HIA tools based on context and resources available for accessibility is required. The robustness of HIA would be improved if available data from public organizations and other stakeholders could be accessed and documented. To this end, public agencies such as MONRE, MOI and MOPH should set up a committee to consider the HIA database format and inter-connectivity.

There is also a need to improve standards in quantifying the effects of changes in health determinants, such as specific health impacts resulting from changes in personal, social, economic and environmental factors. It is important to build and maintain a comprehensive database that provides an inventory of HIA tools and guides the choice of HIA tools for any given project. Systematic reviews of health impacts for a range of policies and projects will also help in appropriate design of HIAs. Well-established HIA tools and methods used in developed countries such as in EU Member States, USA, Canada, Australia and elsewhere should be adapted for use in Thailand; indeed, a number of HIA tools and guidelines have recently been published as protocols, to facilitate their wider use among other countries. For example, a number of tools for health impact quantification have been developed using modeling techniques. Such examples of HIAs can be conducted at varying degrees of detail, rigour and formality, depending on needs and available computing resources. Some of these tools are generic, while others have been tailored to specific health determinants and diseases. For example, the DYNAMO software (a Dynamic Modeling for Health Impact Assessment) is a ready-to-use tool to project the effects of changes in risk factor exposure due to policy measures or interventions on disease-specific and summary measures of population health [17]. The INTRARESE/HEIMTSA program (Integrated Assessment of Health Risks of Environmental Stressors in Europe/Health and Environment Integrated Methodology and Toolbox for Scenario Assessment) uses a full-chain approach to track environmental health effects of policies, from their effect on emissions of pollutants (in air, soil and water) through changes in pollutant concentrations and associated changes in human exposure to health impacts, later aggregated as disability-adjusted life years (DALYs) [18].

To use such tools and approaches effecttively in Thailand, it is necessary to build human resource capacity and ensure credibility and legitimacy of public health officials in communicating with stakeholders and decision-makers. Therefore, it is important to train multidisciplinary teams in EHIA skills and educate community stakeholders about the EHIA process to increase HIA capacity and effectiveness. There are currently only 76 juristic persons (corporate bodies) licensed, registered and approved to conduct EIAs in Thailand for 1-3 years [15]. Most are private companies, with a small number of university professors. The license of one corporate body has been suspended for one year [15]. However, an increasing number of EHIA specialists and experts in the field will be needed in the future, necessitating its incorporation in tertiary educational curricula. At present, there are more than 10 HIA courses taught in Thai universities [16]. However, most are only elective subjects or taught as part of other subjects such as health promotion and environ-

mental management and public health policy; such courses mostly target the needs of medical, public health, nursing, and paramedical students. In addition to educational courses, vocational short training courses (3-4 days) are also available for health professionals and other interested persons, making extensive use of local case studies to teach specific aspects of HIA methods. It would be useful to broaden accessibility to these courses by providing online distance learning courses and case studies, such as is successfully done elsewhere (Canada, US, and UK) [16-18].

The private sector should be encouraged to participate and play a more active role in project development in Thailand, as is the case in developed countries [16-18]. In addition, further work is needed to examine how EHIA may gain additional political support and legitimacy within Thailand's current political and environmental context, partly through its integration as a regulatory process within the legislative framework governing public health and environment. For example, Canada and other countries have successfully integrated EIA and EHIA processes. A proposed pollution tax increment could yield benefits for the environment and local communities by encouraging private companies to take responsibly for mitigation of pollution and other unwanted health impacts. A number of barriers to adding HIA to existing regulatory EIA processes include adequacy of HIA predictions in a litigious EIA environment, political and legal challenges to changing EIA practices, and the need for additional human resources and budgets. It is primarily recommended to perform voluntary HIA pilot tests in Thailand to establish the legitimacy, credibility and usefulness of HIAs before considering further regulatory approaches (Figure 2).

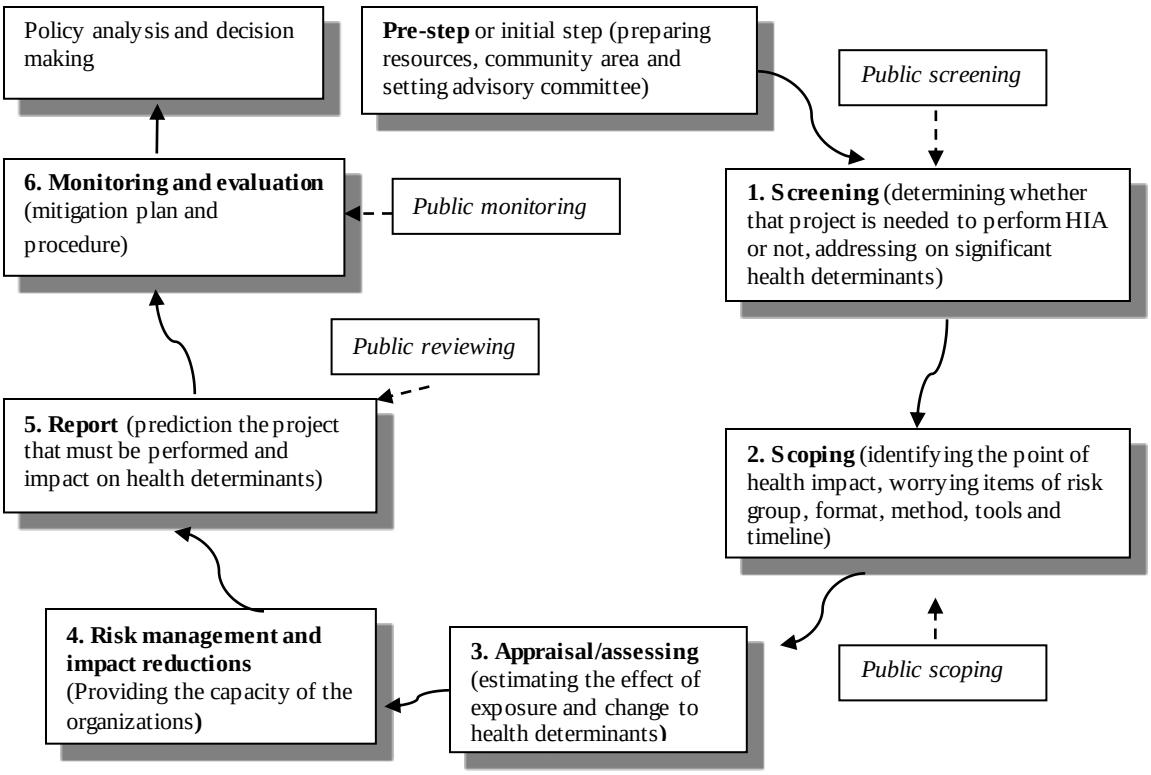

Figure 2 Framework for conducting EHIA (adapted from Thepaksorn P et al, 2015)

Transparent and meaningful engagement with impacted populations and communities is also a crucial requirement, promoting environmental justice and social equity, helping to identify locally-relevant issues, empowering communities, and ensuring transparency in decision-making. However, community involvement requires time and resources and may delay timely completion of the EHIA. In addition, local health baseline and disparities data may not be readily available and accessible. Available local-level data should therefore be integrated and connected, as has been achieved through development of a high performance hospital database application (HOS xP) providing electronic health care, a health surveillance database providing statistics from disease surveillance system, and air quality management by the Pollution Control Department. Given the critical importance of community engagement, additional best practice guidelines for community engagement in EHIA would be immensely valuable to practitioners. To supplement this, HIA practitioners should also receive training in skills for community involvement, covering topics such as cultural sensitivity and accountable listening.

EHIA therefore is a tool for local administrative organizations to apply in building a communal learning process on the quality of health, in presenting an option to protect and promote health, in advancing public health policies, and in encouraging local people to use their rights according to the Constitution and the National Health Act. There are several ways to apply EH IA for developing local policies and plans, e.g. in promoting occupations, reducing use of chemical pesticides, effective waste management and disease prevention and for preventing health hazards under the Public Health Act. Moreover, EHIA can be applied to other process and stipulated activities that may be hazardous to health, for example in setting criteria and conditions for engaging in such activities, and in considering license applications. In addition, EHIA can be used by local authorities as a decision support tool on other matters, such as in relation to Sections 67 and 287 of the Constitution or Section 11 of the National Health Act. The EHIA tool can also be used by local organizations and communities as "Community HIA" (CHIA). The process is linked to customs, traditions, and the ways of life and beliefs of local communities. Moreover, members of a community for sometime have tended to engage in consultations or reach conclusions before starting any activity. Also, the EHIA tool can be used for local agencies and communities in developing healthy public policy and capacity building. The approaches for assessing social and spiritual health impacts in local community could be benefits and fit to local settings.

The political support and public and non-public organizational alliances to build support for EHIAs are also crucial one. Participants in EHIA process and interactions with decisions with decision makers vary by organizations and projects. EHIA experts and planers can use EH IA to educate public health officials about constraints in planning, develop model timelines for EHIA process, and develop model agreement for governance of EHIA conduct. Finally, explore potential for various groups to take action on conducting EHIAs, such as health officers, academia, and consultants. For training planner and decision makers in EHIA, it is needed to target decision makers who can use EHIA results and consider methods to incurporate health into formal decision-making processes so that health officials will be at table, for example, developing briefings, seminars, short courses, and case studies about EHIA for planners and decision makers and create media attention to EHIA process and develop incentive for EHIA use, such as involving decision makers in the EHIA process, promoting EHIA as part of improved policy making, and motivating communities to request the EHIA process. In this regard, there is a need for improvement and

development of EHIA communication tools to better inform affected communities, stakeholders and decision makers on EHIA-related matters to diverse audiences that include planners, politicians, project developers, health agencies, media, community stakeholders, civil society groups and academics. Finally, guidelines on EHIA reporting formats are needed in order to facilitate later comparisons and evaluation, and create model EHIA report templates.

Conclusions

Implementation of EHIA in Thailand still faces many obstacles, especially in such complex policy sectors as public health and environment. The many uncertainties, lack of a robust evidence base and challenges in implementing EHIA in Thailand's political and cultural contexts all constrain the effectiveness of decision-making. Methodologies and tools have to fit with the available data and resources. The EHIA evaluation requires analytical validity, relevance, stakeholder engagement, and public involvement. This review has led to a number of recommendations related to building capacity among Thailand's EHIA stakeholders. These are listed below.

1) Develop tools and guidelines for implementation of EHIA for different project categories. Such screening tools may be employed to decide what level of EHIA is required (e.g. rapid or comprehensive health impact assessment), provide guidance in preparing resources, community area and establishment of the EHIA advisory committee.

2) Train EHIA experts and conduct EHIA courses to build human resource capacity for implementing and negotiating on EHIA-related topics. It is therefore important to train multidisciplinary teams in EHIA skills and educate community stakeholders to support the HIA process and enhance EHIA capacity and effectiveness. In addition, the EHIA practitioners should be trained in skills for community involvement such cultural sensitivity and accountable listening.

3) Encourage participation of private agencies and companies from the outset.

4) Engage with all stakeholders and ensure full and meaningful community participation and environmental justice, including transparent EHIA communication.

5) Ensure full public participation in political engagement, and create incentives for EHIA use, such as involving decision makers in the EHIA process, promoting EHIA as part of improved policymaking, and motivating communities to ask for EHIA process. Such measures would all be advantageous to support EHIA development in the country.

Acknowledgements

This study was partially funded by the Fogarty International Center, National Institute of Health (D43 TW007849).

References

[1] National Health Commission Office. Thailand Thailand's Rules and Procedures for the Health Impact Assessment of Public Policies. Chiangmai: Wanida; 2010.ress;

[2] Bureau of Technical and International Cooperation. Constitution of the Kingdom of Thailand. Bangkok: Secretariat General of the Administrative Court; 2007.

[3] National Health Commission Office. National Health Act 2007. The Government Gazette. 2007.

[4] Jindawattana A, Sukkumnoed D, Pengkam S, Chuenchit W, Mathurapote W. HIA for HPP towards healthy nation: Thailand's recent experienced. National Health Commission Office, Nonthaburi; 2008.

[5] Office of Natural Resources and Environmental Policy and Planning (ONEP). Guideline for Environmental Impact Assessment in Thailand [monograph on the

internet]. [cited 2012 Dec 20]. Available from: http://eia.onep.go.th/index.php

[6] Chatree Gold Mine.[monograph on the internet]. [cited 2012 Dec 10]. Available from: http://www.kingsgate.com.au/company/chatree-gold-mine.htm

[7] Map Ta Phut Industrial Estate. [monograph on the internet]. [cited 2012 Dec 10]. Available from: http://www.mtpie.com/home.php

[8] Wright J, Parry J, Jonathan J. Participation in health impact assessment: objectives, methods and core values. Bulletin of the WHO. 2005;83 (1): 58-63.

[9] Davenport C, Mathers J, Parry J. Use of Health Impact Assessment in incorporating health considerations in decision making J Epidemiol Community Health. 2006; 60:196-201.

[10] Mannheimer LN, Gulis G, Lehto J, Ostlin P. Introducing Health Impact Assessment: an Analysis of Political and Administrative Intersectoral Working Methods. European J Public Health. 2007:17(5):526-531.

[11] Joffe M, Mindell J. Health Impact Assessment. Occup Environ Med. 2007; 62: 907–912.

[12] Siriwong W. Situation Analysis and Review on Environmental Health: A Case of Health Impact Assessment in Thailand Chulalongkorn University Press, 2011:1-33.

[13] Ministry of Public Health .Health impact assessment guideline for water resources development project in Thailand. [monograph on the internet]. [cited 2012 Dec 10]. Available from: http://www.anamai.moph.go.th/download/download/HIA/HIA09092553/01.pdf

[14] Office of Natural Resources and Environmental Policy and Planning, The Ministry of Natural Resource and Environment (MONRE). Guideline for water resources development project, 2008.

[15] Office of Natural Resources and Environmental Policy and Planning, The Ministry of Natural Resource and Environment (MONRE).[monograph on the internet]. [cited 2016 Jan 30]. Available from: http://eia.onep.go.th/group.php

[16] Sukkumnoed D, Sabrum N, Nuntavorakam S. HIA development report 2007-2008 [monograph on the internet]. [cited 2012 Dec 10]. Available from: http://www.nationalhealth.or.th

[17] Lhachimi S,Nusselder WJ,van Baal P, Boshuizen H,Mylius S,Smit J. DYNA MO-HIA. Development of a Dynamic Modeling Tool to Assess Health Impact of Policies. Rotterdam: Department of Public Health: 2011.

[18] INTRARESE/HEIMTSA. Integrated Assessment of Health Risks of Environmental Stressors in Europe/Health and Environment Integrated Methodology and Toolbox for Scenario Assessment [monograph on the internet]. [cited 2012 Dec 10]. Available from: http://www.integrated-assessment.eu

[19] Kemm J. Health Impact Assessment: Past Achievement, Current Understanding, and Future Progress, Oxford University Press. 2013:244-249.

[20] Thepaksorn, P., Pongpanich, S., Siriwong, W., Boonyakarnkul, T. Chapman, S.R. Improving the use of evidence in health impact assessment for the roofing fiber cement industry. *Inter J. Health, Wellness and Society* 2015; 5(3):19-34.