

GENERAL ARTICLE

Evaluation of environmental health aspects of solid and hazardous waste management in accordance with the 2nd National Strategic Plan for Environmental Health 2012 – 2016 Thailand: A case study of Sakon Nakhon Province

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Abstract

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Environmental problems impact on people's health, and can lead to illness and death. co-planned The second National Strategic Plan for Environmental Health 2012–2016 was developed by Thailand's Ministries of Public Health and Natural Resources to address these problems. This study investigated the overall operation of Sakon Nakhon Province's implementation of the National Environmental Health Strategic Plan 2, 2012-2016, using an evaluation methodology based on the context, input process and products model (CIPP). Participants were 103 health officers who worked in the province's Sub-District Health Promotion Hospitals. The data were collected by questionnaire and data analyzed using descriptive statistics: percentage, mean, standard deviation.

The results of study were as followed:

1. Context: Strategies for solid and hazardous waste management were being implemented according to the plan.
2. Input: There were inadequate numbers health officers for this task. They had limited environmental health knowledge and insufficient supporting budget and materials. In addition, an administration was rated at the moderate level.
3. Process: Forming of working groups, participatory planning, community participation and evaluation were all rated as low. Public health personnel satisfaction was rated as average.
4. Products: There was data center on local organization's waste management and standard waste management systems. However, waste management networks were less developed than expected. The learning center on solid and hazardous waste management was inadequate.

The study found the Second National Strategic Plan for Environmental Health 2012–2016 for solid and hazardous waste management was being implemented in Sakon Nakhon Province. However, there were many limitations needing to be addressed including participatory processes in waste management planning and implementation and better budget allocation and management.

Keywords: CIPP model, Environmental health development, solid and hazardous waste management

การประเมินผลการดำเนินงานอนามัยสิ่งแวดล้อม ด้านการจัดการขยะมูลฝอยและของเสียอันตราย ตามแผนยุทธศาสตร์อนามัยสิ่งแวดล้อมแห่งชาติ ฉบับที่ 2 พ.ศ. 2555-2559: จังหวัดสกลนคร

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บทคัดย่อ

ชกร เมธาวงศกร และ สมศักดิ์ พิทักษานุรัตน์ การประเมินผลการดำเนินงานอนามัยสิ่งแวดล้อมด้านการจัดการขยะมูลฝอยและของเสียอันตราย ตามแผนยุทธศาสตร์อนามัยสิ่งแวดล้อมแห่งชาติ ฉบับที่ 2 พ.ศ. 2555-2559 จังหวัดสกลนคร ว.สาธารณสุขพัฒนา 2561;16(2):73-84

ปัญหาจากสิ่งแวดล้อม ทำให้ประชาชนอาศัยอยู่ในที่มีสิ่งแวดล้อมไม่ปลอดภัย นำไปสู่การเจ็บป่วยและเสียชีวิตได้ กระทรวงสาธารณสุขร่วมกับกระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อมได้จัดทำแผนยุทธศาสตร์อนามัยสิ่งแวดล้อมแห่งชาติฉบับที่ 2 (2555-2559) จังหวัดสกลนครได้พัฒนาสิ่งแวดล้อมตามแผนยุทธศาสตร์ดังกล่าวเสร็จสิ้นแล้ว ผู้วิจัยสนใจประเมินผลการดำเนินงานดังกล่าวโดยใช้รูปแบบ CIPP Model กลุ่มตัวอย่างเป็นบุคลากรสาธารณสุขในโรงพยาบาลส่งเสริมสุขภาพตำบล จำนวน 103 คน การรวบรวมข้อมูลโดยใช้แบบสอบถาม การวิเคราะห์ข้อมูลใช้สถิติเชิงพรรณนา ได้แก่ จำนวน ร้อยละ ค่าเฉลี่ย ร้อยละส่วนเบี่ยงเบนมาตรฐาน ผลการวิจัยพบว่า

1. ผลการดำเนินงานในบริบท (Context) ของการจัดการขยะมูลฝอยและของเสียอันตราย สามารถดำเนินการตามแผนยุทธศาสตร์ดังกล่าว
 2. ปัจจัยนำเข้า (Input) จำนวนบุคลากรปฏิบัติงานด้านอนามัยสิ่งแวดล้อมมีน้อย มีความรู้ความสามารถในการดำเนินการจัดการขยะมูลฝอยและของเสียอันตรายน้อย งบประมาณสนับสนุนน้อย การสนับสนุนวัสดุอุปกรณ์ และการบริหารจัดการอยู่ในระดับปานกลาง
 3. กระบวนการ (Process) มีการจัดตั้งคณะทำงาน การจัดกิจกรรมตามแผนการมีส่วนร่วมและการติดตามประเมินผลอยู่ในระดับน้อย บุคลากรสาธารณสุขมีความพึงพอใจอยู่ในระดับปานกลาง
 4. ผลผลิต (Products) มีฐานข้อมูลเกี่ยวกับการจัดการขยะมูลฝอยและของเสียอันตรายที่ อบต./เทศบาล มีระบบงาน เป็นไปตามมาตรฐาน มีการพัฒนาศักยภาพบุคลากรให้มีความรู้ถูกต้องตามหลักวิชาการ มีเครือข่ายการดำเนินงานน้อยกว่าเป้าหมาย มีศูนย์การเรียนรู้ด้านการจัดการขยะมูลฝอยและของเสียอันตรายน้อย บุคลากรสาธารณสุขมีความพึงพอใจอยู่ในระดับปานกลาง
- โดยสรุป จังหวัดสกลนครสามารถดำเนินงานตามแผนยุทธศาสตร์ฯ แต่ยังมีข้อจำกัดที่ต้องพัฒนา คือ การมีส่วนร่วมในการดำเนินงาน และ การบริหารงบประมาณ

คำสำคัญ: การประเมินผลโครงการแบบซิปโมเดล, แผนยุทธศาสตร์อนามัยสิ่งแวดล้อม, การจัดการขยะมูลฝอยและของเสียอันตราย

Introduction

It is estimated that living in unsafe environments, e.g., related to air, water, soil and chemicals caused about 12.6 million deaths in 2016¹. South-east and East Asian countries have been collaboratively developing work plans around health and the environment since 2547 B.E. They have produced the “Charter of the Regional Forum on Environment and Health Southeast and East Asian Countries - Framework for Cooperation” for member countries to push for national plans on the environment and health giving precedence to promoting wide participation in the process at national and Asian country levels.²

Thailand’s environmental situation is effected by global dynamics and many internal factors, and after the implementation of the First National Environment Health Strategic Plan, 2009-2012, many environmental health problem have still not been solved. The Second Thai National Environmental Health Strategic Plan, 2012-2016 was declared on 20 May 2012 and all relevant agencies were actioned to use this plan as the operational framework on environmental health programs for the next five years. It integrates environmental issues and health clearly by its vision “Aiming at environmental health development in line with the context of Thai society and the world community for people’s better quality of life in an equal and equitable manner, through integrated efforts of all relevant sectors.” The plan’s objectives are; 1) to efficiently reduce environmental health problems and impacts, 2) to enhance the capacity for environmental management, 3) to create cooperation among agencies responsible for environment and health programmes.³⁻⁴ Disease prediction and health risk data found that air pollution caused increasing

numbers of patients with respiratory and heart system problems, and eye irritation.⁵

Sakon Nakhon Province’s strategic vision is, “Being a livable city and the hub of quality of life development coexistingly”. To propel work on health and environment the Livable Sakon Nakhon Network has devised the strategy called “Clean Green Network”. It is the condition of being healthy by the integrated cooperation of network agencies in planning and implementing a strategy to make Sakon Nakhon a sustainable livable city.⁶ In 2014, the strategy was changed to “Sakon Nakhon keeps sanitation and pay attention to environment”. Then in 2015, the strategy was changed again to follow government policy in implementing the National Environmental Health Strategic Plan 2, 2012-2016. Thus, the new strategy became “Sakon Nakhon, clean city, creates happiness”.

SakonNakhon Province has developed a strategic operational framework which has been propelled through the Provincial Public Health Subcommittee under the scope of the Public Health Act, 1992.

The Subcommittee, whose chairman is the Sakon Nakhon Province Governor, the duty to examine the environmental health and hygiene operations, to set policy, solve problems, command and assign missions to all relevant agencies at the provincial, district and local administrative level through to the provincial committee whose secretary is he Director of SakonNakhon Provincial Public Health Office. The Provinical committee enables practical work at district level, sub-district level and village and community level.

Systematic evaluation of the overall implementation program for completeness and effectiveness is a

necessary requirement of the National Environmental Health Strategic Plan 2, 2012-2016. Thus, this study was designed to use the CIPP model to evaluate Sakon Nakhon Province's implementation of the strategic plan. The CIPP is a systematic operation evaluation model focussed on the project Context, Input, Process, and Products.⁷ It can evaluate all phases of a project and plans, to find strengths and weaknesses, and then provide recommendations for troubleshooting problems in the next plan. The CIPP model has been used to evaluate strategic plans and their effectiveness in education⁸⁻¹⁰ and local government projects.¹¹⁻¹²

The researcher was interested in Sakon Nakhon Province as it had a format and operating system to systematically build participant networks. Thus, the researcher could study whether this harmonized with the Second Nationality Environmental Health Strategic Plan, 2012-2016.

This study aimed to 1). Assess the overall operation of Sakon Nakhon Province in implementing the National Environmental Health Strategic Plan 2, 2012-2 and 2). Study the effect, problems and obstacles in implementing the National Environmental Health Strategic Plan 2, 2012-2016 of Sakon Nakhon Province.

Methods

Study design and sample size

This was a program evaluation research project based on the CIPP model.

Participants were 103 health workers who worked in sub-district Health Promotion Hospitals under Sakon Nakhon-Provincial Office of Public Health. Sample size was calculated using Daniel's Formula¹³ as follows;

$$n = \frac{N\sigma^2 Z_{1-\alpha/2}^2}{d^2 (N-1) + \sigma^2 Z_{1-\alpha/2}^2}$$

The population included paid health workers, voluntary health staff and Sub-district Administrative Organization's staff, a total of 190 people. The average score of performance (\bar{X}) was 4.60, Standard Deviation (S.D.) was 0.73¹⁴ and the error (d) was 0.11. The required sample size was calculated as being 90 people using 95% confidence level. An additional 20 percentages were added to allow for attrition, e.g., for respondents who may not reply to the postal questionnaire, giving a total sample size of 113 people. Total questionnaires returned were 103, more than the minimum calculated sample size requirement of 90.

The 103 participants included sub-district health promoting hospital (90 respondents, 87.40%), district public health office (8 respondents, 7.80%) and primary care unit (PCU)(5 respondents,4.90%).

Research tools

A survey questionnaire was used in this research. The questionnaire was developed after initial research literature reviews to allow the researcher to understand relevant concepts and create the study's conceptual framework for working with the CIPP Model.⁷ The questionnaire contained five main sections as follows;

Part 1 Respondents' general information.

Part 2 Likert-scale-type¹⁵ questions for operational staff's responses to various phases of the CIPP Model, comprising Complex, Input, Process, and Product. Staff rated their satisfaction in relation to statements related to solid waste and hazardous waste management.

Statements were rated on a 5-point scale ranging from “Strongly Disagree” on one end to “Strongly Agree” on the other with neither “Neither Agree nor Disagree” in the middle. There were positive and negative statements that participants must answer with a single choice.

Choices	Positive statement	Negative statement
Strongly Agree	5	1
Agree	4	2
Neither	3	3
Disagree	2	4
Strongly Disagree	1	5

Questionnaire reliability was tested by Cronbach’s alpha coefficient method, yielding the following coefficients results; Context was at 0.87, Input was at 0.91, Process was at 0.94 and Product was at 0.95.

Part 3 (Process) An opened-end question gave participants the opportunity to express their opinions on problems and suggested solutions in a free-flowing manner.

Part 4 (Product) Products on the performance of the comprehensive environmental strategies.

Data collection

The questionnaires were distributed to the participants and collected by the researcher. To verify the accuracy and classification of the information data as recorded on Identification and Record data forms.

Data analysis

Descriptive statistics, frequency, percentage, means and standard deviation were used to present the data.

Ethical Review

This study was reviewed and approved by the Ethics Committee for Human Research of Khon Kaen University (HE 602101).

Results

The participants were female 55.30% and male 44.70%. Most were ≥ 43 years and over (53.40%). Demographic characteristics of participants are shown in Table 1.

Table 1 Distribution of participants by demographic characteristics

Demographic characteristics	Number	Percentage
Gender	46	44.7
Male	57	55.3
Female		
Age groups (years)		
≤30	22	21.4
31-36	12	1.7
37-42	14	13.6
≥43	55	53.4
$\bar{X} = 42.30$ S.D.= 6.54, Max=59, Min=24		
Marital status		
Married	63	32.0
Single	33	61.3
Widowed/divorced/ separated	7	6.8
Income (Baht / month)		
20,001 and below	23	22.3
20,001–30,000	20	19.4
30,001–40,000	25	24.3
40,001–50,000	31	30.1
50,001 and above	4	3.9
Education level		
Under graduate	3	2.9
Bachelor Degree	86	86.4
Master Degree	11	10.7
Position		
Academic public health professional	80	77.7
Public health professional	16	15.5
Nurses	7	6.8
Work place		
Sub district health promoting hospital	90	87.4
District public health office	8	7.8
Primary Care Unit (PCU)	5	4.9
Duration of work (years)		
≤12	74	71.8
13-22	12	11.7
23-35	14	13.6
≥36	3	2.9

Table 1 Distribution of participants by demographic characteristics (Conts.)

Demographic characteristics	Number	Percentage
To be advisor of director/Committee/Subcommittee/Working Group		
Ever	67	67
Never	36	36
Frequency of training		
1-2 times	71	71
3-4 times	17	17
5 times up	5	5
Never	10	10
Get awarded on solid and hazardous waste management		
Never	98	98
Ever	5	5
Source of information about solid and hazardous waste management		
Husband, Children, Relatives	94	94
None	9	9

Results of evaluated solid and hazardous waste management by CIPP model are shown in Table 2.

Table 2 Participant ratings on solid and hazardous waste management.

No.	CIPP Model	\bar{X}	S.D.	Level
1.	Context	3.69	0.80	high
2.	Input	2.96		least
	Human resource	3.23	0.73	moderate
	Budget	2.97	0.87	least
	Material and equipment	2.45	0.89	least
	Management	3.17	0.72	moderate
3.	Process	3.29	0.82	moderate
	Working group/ responsible man assigned	3.31	0.80	moderate
	Projects to drive the operation	3.33	0.81	moderate
	Operation to manage	3.20	0.79	moderate
	Operation controlling, assessment, advisory and report	3.26	0.85	moderate
4.	Products	3.23	0.84	moderate

Discussion

1. Context

Sakon Nakhon Province's framework for environmental development follows the 2nd National Strategic Plan for Environmental Health 2012 – 2016 with its vision statement “Healthy city with quality of life development center”. Sakon Nakhon Province pursues this vision through building healthy city networks with Clean Green Network” performance model (Clean= Hygiene, health behavior, Green = environmental balance, Network = all networks co-operate for development. All networks participate in brain storming, for performance and implementation with integration. Sakon Nakhon Province has special health volunteers for community environmental health management who cooperated with volunteers protecting natural resources and environmental issues.

Results showed health officers had high satisfaction with environmental health development ($\bar{X} = 3.69$, S.D = 0.80). It was high level because they considered the project's objectives could solve the problems of the province and the project's purpose was in line with the policy of their organization and receive organizational support. This was consistent with high satisfaction levels found in a project evaluation on the development of artesian basins for promoting clean drinking water for schools throughout the country.¹⁶ Similarly, in a study assessing “project blue sky” for no pollution, creating an office for natural resources and environment, Lampang provincial officers also gave high satisfaction levels¹⁷ as did Bangkok Healthy City Project Bangkok-Noi officers.¹⁸

The above results were different from a study about the environmental management performance

of local governments in Thailand where Sub-district Administration Organization (SAO) officer's satisfaction was only at moderate levels.¹⁹

2. Input

Human input components were rated as follows:

1). Human resource, health officers were satisfied at moderate level ($\bar{X} = 3.23$, S.D = 0.73). **2). Budget**, health officers satisfaction was rated as low ($\bar{X} = 2.45$, S.D = 0.89), mostly felt support by Sub-district Administration Organizations (SAOs) while the Ministry of Public Health and the Ministry of Natural Resources were seen as less supportive. Results were different to a study about environmental management performance of local governments in Thailand that found that Sub-district Administration Organizations (SAOs) officers were satisfied at moderate level ($\bar{X} = 2.97$, S.D = 0.87).¹⁹ **3). Material and equipment**, health officers satisfied at low levels ($\bar{X} = 2.45$, S.D = 0.89) and most felt supported by Sub-district Administration Organization officers. Results were different to a study on environmental management performance of local governments in Thailand where Sub-district Administration Organizations (SAOs) officers were satisfied at a moderate level ($\bar{X} = 2.77$, S.D = 0.79).¹⁹ **4). Management Satisfaction ratings** of performance with the 2nd national strategic plan for environmental health 2012 – 2016 and related community participation were at moderate levels ($\bar{X} = 3.17$, S.D = 0.72).

3. Process

Assessment of performance on implementing solid and hazardous waste management plans showed they mostly followed the 2nd national strategic plan for

environmental health 2012–2016; 1). They established working groups with responsibility for waste management. 2). they planned provincial health implementation projects in 2016. 3). They implemented a waste and hazardous waste management program by participation in the Sakon Nakhon Clean Up City Project. 4). A working group had been set up to supervise and evaluate the waste and hazardous waste management program's strategic plan by supervising, monitoring, evaluating and reporting the results of every operation. Output, there were different sub projects as follows: 1) Training for waste management in community project, 2) Forming a waste bank project, 3) A waste funding project, 4) A garbage waste collection training program, and 5) Forming of a waste management network, 6) A training program for village waste management teams. 7) Physical examination and risk screening project, 8) Training of entrepreneurs for surveillance of hazardous wastes disposal, 9) Promotion of community waste separation and management by community committee, 10) Officers training for separating patients' infected waste, 11) Promotion of separate disposal of hazardous wastes in community. 12) Health professional training for separating waste using safety method program. 13) Training to make fertilizer from waste disposal program 14) Project to build waste management networks in province. 15) Projects for separate disposal of hazardous wastes in temples and community schools. 17) The project to promote and support the implementation of 3Rs (Reduce, Reuse, Recycle) and clustering for waste management. Hazardous waste, 18) Clean house campaign and waste management.

However, performance for waste management found that some projects were not relevant to the national strategic plan and indicators of the plan because some projects did not follow with the national master plan. In addition, data systems about waste and management were not up to date. Health professionals satisfaction ratings with the waste management process were moderate ($\bar{X} = 3.29$, S.D = 0.82).

This project received support at all levels including district, sub-district and village and can apply in many areas. However it needs further distribution to all area of the province especially at community level. Previous research has shown projects should have appropriate policy objective goal and plan.²⁰ These results are consistent with a project evaluation on the survey and development of artesian basins in promoting clean drinking water for schools throughout the country. Officers in that project were satisfied with the process at a moderate level ($\bar{X} = 3.40$, S.D = 0.82).¹⁶ In the blue sky assessment project for no pollution, and to create economic community of natural resources and environment office, Lampang province officers' satisfaction was at were at moderate levels¹⁷. Similarly, study about environmental management performance of local governments in Thailand found that Sub-district Administration Organizations (SAOs) officers were satisfied at a moderate level ($\bar{X} = 2.85$, S.D = 0.68).¹⁹

These results were not relevant to a study about an assessment of Bangkok healthy city project Bangkok-Noi, Bangkok where officers 'satisfaction with process was at a high level ($\bar{X} = 3.60$, S.D = 0.93).¹⁸ In an evaluation of a solid waste community management project in Mueang Phan sub-district municipality Phan district, Chiang Rai provincial officers satisfaction with process was at a high level.²¹

4. Products

The results of the implementation products review were as follows: 1). There were databases on solid waste and hazardous waste in all Sub-district Administration Organizations (SAOs) / municipalities. 2). There were management system, and regulations for the control, monitoring and follow-up of hazardous waste management to achieve the standards in all sub-district / Districts. 3). Most of health officers were potential development in solid waste and hazardous waste management. 4). Waste and hazards waste management were 50% and there was reduced disease from water and food projects in Sakon Nakhon Province, 2014. 5). There were networks of solid waste and hazardous waste management in 50% of Districts. 6). There were community model of solid waste and hazardous waste management in each district. 7). There were learning centers for solid waste and hazardous waste management in each district. However, health officers only rated moderate satisfaction ($\bar{X} = 3.23$, S.D = 0.84). This project can achieve some goal policy but many points need continued improvement to develop solid waste and hazardous waste management in each area. These results were consistent with the assessment of project blue sky with no pollution, to create economic community of natural resources and environment office, Lampang province officers opinion about product were at moderate level¹⁷ and studied the performance of the environmental management of local governments in Thailand found that Sub-district Administration Organizations (SAOs) officers were satisfied at moderate level ($\bar{X} = 3.24$, S.D = 0.47).¹⁹ The Evaluation study of the Waste Management Project at Ban Wang Mor, Rongkwang Subdistrict Amphoe Rongkwang, Phrae Province

showed people could get benefit from solid waste and participate in solid waste management.²²

This results were not relevant to a project evaluation on the survey and development of artesian basins in the promoting of clean drinking water for schools throughout the country where officers satisfaction about product were at a high level ($\bar{X} = 3.81$, S.D = 0.79)¹⁶ Similarly, the assessment of Bangkok healthy city project Bangkok-Noi, Bangkok officers satisfaction about product were at a high level ($\bar{X} = 3.66$, S.D = 0.96).¹⁸ In the evaluation of the community solid waste management project in Mueang Phan sub-district municipality Phan district, Chiang Rai, provincial officers opinion about product was at high level.²¹

Product highlights for solid waste and hazardous waste management were as follows: 1) there were waste banks and a cremation fund 2). There were waste management networks (Sakon Nakhon healthy City). 3). All sectors participated to work together for solid waste and hazardous waste management. 4). People's interest in waste management increased due to benefits such as 4.1). There were savings for people in the community 4.2). People had income from selling waste. 5). There were model communities for waste management and safer communities.

Conclusion

The second national strategic plan for environmental Health 2012–2016 was implemented for solid and hazardous waste management in Sakon Nakhon Province However, there were limitations needing to be resolved including participatory processes and budget allocation and management.

Recommendations

The results from this study suggest that the province should increase budget, material and equipment provision and improve participatory processes for solid and hazardous waste management.

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