

# STRATEGIES FOR SOLID WASTE MANAGEMENT AND LOCAL PARTICIPATION: A CASE STUDY OF PHRA NAKORN SRI AYUTTHAYA PROVINCE, THAILAND

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**Abstract:** The purposes of this research paper were to study the current situation, problems, and model of solid waste management, and to study the level of participation of local community to solid waste management, and to offer a strategic plan for solid waste management. This was a mixed research methods between quantitative and qualitative technique. A total of 400 samples were collected in the area of Phra Nakorn Sri Ayutthaya Province. The findings revealed that there was a huge amount of garbage and solid waste and the province was unable to handle it correctly, resulting in a gigantic backlog of untreated garbage and solid waste. The local community participation was inadequate and there was a need of support for the local government. In addition, the solid waste and garbage law need to be developed for the local community with a strategic plan.

**Keywords:** Local Participation, Solid Waste Management, Strategies.

## 1. INTRODUCTION

Solid waste problem in Thailand has been serious at a great extent due not only to household consumption but also to higher rate of industrial manufacturing of many international firms moving to the country seeking for lower production cost such as lands and labors, and avoiding countries of higher degree of environmental consciousness [1]. In response to the announcement of the National Council for Peace and Order regarding waste management planning, Pollution Control Department has been formulating the implementation plan for managing and solving solid waste problem to be applied in areas with high rate of effect; six provinces to name include Phra Nakorn Sri Ayutthaya, Lopburi, Nakorn Pathom, Saraburi, Pathum Thani and Samutprakarn. The draft act on local solid waste management to the Prime Minister's Office indicates 4 missions of solid waste management solution. The first mission concerns an elimination of accumulated solid waste in lands performing the waste disposal activity in these provinces. The second mission involves a creation of appropriate solid and chemical waste management model in order to increase a carrying capacity of waste disposal land for new coming waste. This mission has been done with an emphasis on the waste management habited from home where waste is originated, and use of waste recycling methods integrated with renewable energy-production technology. The last two missions look at issuing and enforcement of laws and regulation for solid and chemical waste management, and public education and discipline promotional campaigns with respect to sustainable waste management. The implementation plan was phased into 3 periods: urgent plan of 6 months, 1-year plan and 3-year plan [2].

Phra Nakorn Sri Ayutthaya is a province of Central Thailand region, with an area of 2,556.64 square kilometers, inhabited by approximately 800,000 people. Daily waste of over 796 tons is produced, those of which are food leftover, plastics and papers. Of this amount, only 563 tons of them can be eliminated; mostly in an improper method. An annual look gives that an amount of 585,717.90 tons are left untreated. There are 23 waste disposal lands; 20 of which belong to local administrative organizations and 3 of which belong to private companies. A gradual increase of economic activities is the main factor that causes over-wasted problem in many areas in the provinces, with a high degree of consequences for instance unhygienic solid waste management, accumulated solid waste, hazards, environmental pollutions, ecological problems and climate change. More than hundred millions Baht have been spent for solving this problem each year, yet it cannot be sustainably resolved. It must be taken into account that solid waste management and administration plan be commenced in cohesion and concurrence with the problems and capacity of the province [2].

## 2. LITERATURE REVIEW

### 2.1. Defining Strategy

Strategy is defined as a result of identifying vision, goal and objectives as part of long-term planning for development, which calls for common agreement and understanding towards directions among members, and decent and goal-oriented allocation of resources, for organizational achievement [3]. Strategic planning consists of an identification of strengths, weaknesses, opportunities and threats carried out in order to allow adequate extent of situational reality in respect of internal

management of finance, marketing, production, research and development, and external environment covering social, cultural, economic and technological changes that may hold back or encourage organization's activities [4].

## 2.2. Waste Disposal

The idea of waste disposal is part of environmental management, in which the scale of impacts diversifies from local to global level in a linkage manner. National waste problems can pressurize and restrain global economic growth. The Waste Management Act constituted in 1992 in Ontario conveys a dramatic increase of budget spent in waste management. However it has not mentioned alternative methods for managing waste in developing countries where the management is mostly top-down mannered and showing a lack of, or an insufficient local participation, albeit use of high technology which is highly cost [5]. It should be noted that a more sustainable way in managing waste is a serious implementation of 4 Rs including reducing, redesigning, replacing, and recycling.

Pollution Control Department categorizes hygienic and environmental friendly waste disposal into 3 ways: composting, incineration and sanitary landfill. Three main sources originating waste include community households, agricultural activities and industrial activities. Three types of waste are waste from foods, fruits, vegetables and other organic materials or bio-waste, dry waste and chemical waste. The procedure of waste management begins with waste generation, then storage, collecting, reuse and disposal. In developed countries, there have already been promotions and encouragement among public to pay more importance and management at the product life cycle as resolving from the root. Waste types can also be classified by sources for instance city waste, rural waste and industrial factory waste. City waste is sorted into waste in residential areas, business, construction, medication and biochemical sectors [6].

Sanitary landfill has the lowest cost when comparing to composting and incineration methods; the expense covers 23-40 million Baht for 10-15 tons of waste per day within in the area of 15-65 Rai of land, and 0.3-1.6 million Baht per year for operation, excluding land cost. The landfill method for 51- 100 tons of waste per day in the area of 70-125 Rai of land spends 42-50 million Baht with another 1.6-2.4 million Baht as an operation cost. The incineration method, nevertheless, is the most effective way with an ability to eliminate waste in residential areas for 70-90 percentage of the whole amount of waste, with a more limited use of land compared to the landfill method. The only downsides concern the fact that it produces air pollution and bottom and fly ashes from incombustible elements which require further abolition.

Effective recycling method depends on the stage of waste classification which includes reduction, reuse, repairing, recycling and rejection. Rejection refers to an avoidance of use of chemical materials and those hardly to be eliminated [7]. Integrative method of solid waste management with discerns of natural resource and energy preservation and environmental protection to achieve sustainability must be carried out within the idea of reduction, separation, reuse and recycling practiced in alternative ways, and safe disposal [8]. Waste recycling idea results in reduced waste amount to be eliminated, stored and transported, energy recovery, recycled waste usable in land reclamation, and creation of products from recycled waste [9]. Recycled waste bank is an example of how communities can initiate, starting from schools and local governmental offices, which can be one way to educate local people, especially youth group in managing waste. Effective waste management can lead to income generation into communities as well [1].

This paper initiated sustainable ways of waste management with an indication of strategy formulation and local participation, using a case study of Phra Nakorn Sri Ayutthaya Province. Previous studies found that effective solid waste management required local participation in making decision, with a linkage to operations of governmental organizations [10]. Moreover, by this practice, the studies concluded that uses of disposal lands could be decreased and people had more concern on their health and the environment [11]. Degree of local participation in waste management is diversified due to various factors for instance cooperation and opportunity open for creativity and innovation in solving waste problem in communities [12]. Education for local people is required to enhance their capability so that they can truly and willingly participate in waste management [13].

## 3. DETAILS EXPERIMENTAL

### 3.1. Materials and Procedures

The study utilized the mixed method with the qualitative and quantitative approaches, with a more emphasis on the qualitative data. Secondary study was carried out by reviewing related documents. Then, questionnaire was utilized in collecting 400 samples which were households' representatives in Phra Nakorn Sri Ayutthaya Province. This quantitative data was collected in order to grasp the degree of local participation in different aspects of waste management. The qualitative method used an in-depth interview, whose data was analyzed with the content analysis technique. The interviews were conducted with 10 key informants who were local representatives in different levels from both public and private organizations related in waste management. The survey of current problem, management model for

solid waste in different areas in the studied case was also taken part; the data was analyzed with the qualitative data collected from the interviews.

#### 4. RESULTS AND DISCUSSION

##### 4.1. Increase of Solid Waste in Phra Nakorn Sri Ayutthaya Province

The study found that there had been a gradual increase of solid waste in the province due to the residential expansion as well as to an ineffective and unhygienic waste disposal and insufficiency in waste disposal lands. Also, there has not been an implementation of recycling waste such as composting and biogas produced from waste. The finding obtained from the survey of current problems of waste management showed that the degree of the problem was very high due to an inadequacy of disposal centers, unhygienic and improper waste disposal, and slower flow of waste disposal. Moreover, there still is a lack of real local participation, cooperation across the concerned organizations and supports from local public. In the process of waste disposal found an ineffective waste separation and transportation, and a lack of available lands for waste disposal. Laws concerning waste management have also been found with less capability to reinforce in time.

##### 4.2. Solution for Managing Accumulated Solid Waste

The survey conveyed that there must be an immediate elimination of the accumulated solid waste in the areas with critical problem, a closure or an improvement of existing waste disposal lands. For new coming solid and chemical waste, reduction and separation must be seriously practiced from the sources where the waste is originated with use of disposal and waste to energy conversion technology to maximize benefits from waste. Local authorities should be empowered in issuing laws and regulations that cover the management of waste transport, elimination and separation. Moral and awareness building campaigns should also be launched for public concerns, whereas youth can be a central group of people who participate in managing waste in their own communities. Stronger punishment can be taken into account for those individuals and private companies that violate the waste management laws.

##### 4.3. Strategic Plan for Waste Management

The main strategies recommended in this study included the following: (1) an immediate elimination of the accumulated solid waste in the areas with critical

problem; (2) development of appropriate model for solid waste management that integrates waste to energy conversion technology through the whole chain; (3) Issuing of laws and regulations for solid and chemical waste management; (4) education for local people in terms of sustainable waste management, related laws and regulation, and promotion of local participation; and (5) initiation of sustainable development funds in local communities.

In respect to local participation in planning, the study found that most of people had chance to participate at medium level in most aspects. These aspects included the participation in brainstorming ways to eliminate solid waste in their communities (95.1 percentages), the participation in planning for community awareness promotional activities for household waste reduction (85 percentages) and for buying products produced from eliminable compounds (88.3 percentages). The overall local participation in operation presented that it was at medium level. Looking into different aspects, it found that the participation in encouraging and persuading neighbors to separate waste for high value added was at high level (80.5 percentages) to separate waste at home at medium level (75.2 percentages), to recommend neighbors to buy products produced from eliminable compounds at medium level (78.2 percentages).

The finding also revealed that the local participation in evaluation of community solid waste management was at low level. These referred to low degree of their participation in monitoring and evaluating changes of the community's solid waste amount (55.2 percentages), effectiveness of solid waste separation and reuse (89.5 percentages), and impacts of the community's solid waste on health and environmental conditions (90.3 percentages). Additionally, the participation in expressing ideas and solutions for the community's solid waste management was reported low level as well (95.2 percentages), as well as in the analysis of the data for future development plan (93.3 percentages).

The in-depth interviews with the key informants reported the solid waste management strategies to be formulated. Five main strategies formulated include local participation in solid waste management, moral and awareness building from the beginning of waste generators, establishment of learning centers to educate people about converting solid waste to value-added products and solid waste management areas of best practice, proper management for accumulated waste and application of waste storage system management innovation, and devising laws and regulations concerning solid waste disposal.

The findings of the current study agreed with the previous studies. Anusara et al. [1] investigated waste disposal strategies in Phuket, discovering that the majority of people did not practice waste separation before getting them disposed; this finding

also coincided with the study of Somsak Wongsiriwimol [14] with the case of local entrepreneurs in Nongpreu Sub-district, Banglamung District, Chonburi Province facing the over-wasted problem as a result of non-waste separation practice.

The previous studies involving the local participation in managing solid waste in communities revealed similar findings with this current study. The case study of Buriram Municipality reported that there was a lack of local participation especially in planning for solid waste management; though it reported the presence of the participation in building awareness of waste separation among youth [15]. Behavior of encouraging and persuading neighbors to separate waste for converting to value-added products was the significant finding in all related studies, such as in the study of Sasiwan Sukarat [16] and Sudawan Somjai [17].

### Future Studies

Next studies may raise an integrated approach in solid waste management system and new innovation for maximizing the most effective and valuable results by utilizing different study areas. Participatory action research is also recommended.

### ACKNOWLEDGMENTS

The author would like to thank the Research and Development Institute, Suan Sunandha Rajabhat University, Bangkok, Thailand for financial support. Also, the researcher would like to thank Dr. Kevin Wongleedee, Director of Institute of Lifelong Learning Promotion and Creativity for proof reading this research paper.

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