Integrated Municipal Solid Waste Planning and Management (IMSWPM) In Developing Countries: The Feasibility Analysis of a Case Study in the Municipality of Bandung

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ABSTRACT

This paper is the second of two parts. In this part, the results of the analysis and evaluation of the proposed framework on integrated municipal solid waste planning and management (IMSWPM) in developing countries in the Municipality of Bandung are presented.

Feasibility analysis for IMSWPM in Bandung was hindered by difficulties in quantifying benefits and requirements. In general, our analysis indicated that waste reduction initiatives will be feasible if strong political commitment from the government and funds for conducting public education are available. Source separation initiatives will be feasible if PDK-Bandung is willing to adapt its collection and transportation operation system in particular the collection vehicles. The scheme for employing both local community organizations and the municipal cleansing enterprise in service provision is feasible because it has been implemented and enforced by a municipal law. The feasibility of the proposed arrangement for sorting and recycling centres will be determined by the willingness of the municipal government of Kotamadya Bandung and PDK-Bandung to provide land and to acknowledge waste pickers' involvement. The feasibility of composting initiatives at household, community, and municipal levels will depend upon the availability of funds to create and develop markets for compost. Sanitary landfill as a safe disposal option is feasible if additional revenue can be provided for PDK-Bandung. The use of incineration, meanwhile, seems currently infeasible.

The sustainability of IMSWPM in the City of Bandung will be determined by several critical factors, such as stakeholders' agreement on the common interest(s) such as vision and mission, availability of sufficient resources (experts, money, support), capability of stakeholders in overcoming barriers to the implementation of IMSWPM, availability of enforcement mechanisms, and existing opportunities for the adoption and implementation of IMSWPM.

1. RESEARCH QUESTIONS AND OBJECTIVES

Two major research question pertaining to the potential of integrated planning and management of municipal solid waste in developing countries in general was defined as follows: (1) What is the potential for the integrated municipal solid waste planning and management approach adopted in the Municipality of Bandung, Indonesia? and (2) How can integrated municipal solid waste planning and management approach be promoted in the Municipality of Bandung, Indonesia? The main objectives of this research are: (1) to gather and present findings about problems of MSWPM, existing practices in MSWPM, emerging ideas about the integrated municipal solid waste planning and management (IMSWPM), and the opportunities for as well as barriers to the adoption and implementation of the integrated approach to MSWPM in the Municipality of Bandung, Indonesia; and, (2) to analyze and evaluate the potential of IMSWPM in the Municipality of Bandung, Indonesia.

2. RESEARCH METHODOLOGY

2.1. Research Paradigms

Creswell (1994) defined three schools of thought about the use of research paradigm: the purist, the situationalist, and the pragmatist. Proponents of the purist school argue that one paradigm should not be mixed with the other. The situationalists contend that a particular paradigm should suit a certain situation. And the pragmatists propose to use several paradigms in understanding social phenomena. The pragmatists use mixed methods to gather both qualitative and quantitative data. As mentioned in Creswell (1994, 185), according to Greene *et al.* (1989), the main purposes of the mixed methods are: "triangulating or converging findings, elaborating on results, using one method to inform another, discovering paradox or contradiction, and extending the breadth of the inquiry."

Based on this classification, this study on integrated municipal solid waste planning and management (IMSWPM) in developing countries falls more appropriately into the pragmatist group than the others. This is so because IMSWPM will be explored and evaluated using qualitative and quantitative data. Therefore, this study will use mixed methods to gather both quantitative and qualitative findings, from surveys, observations, interviews, and document analysis.

2.2. Research Purposes

With regard to the primary research objective, according to Mitchell (1989), any research can be classified into a hierarchy of description, explanation, prediction and prescription. In this regard, descriptive research is concerned with "what", "where" and "when" questions. Explanatory research focuses on the "how" and "why" questions. In other words, it seeks to explain causal relationships between variables. Predictive research tries to present events or behavior that will occur provided that certain conditions are met. Instead of dealing with "what is" or "what will be" issue, prescriptive or normative research strives to suggest the "what should be" situation.

Based on the above hierarchy, this study is aimed at exploring and describing the potential of the proposed integrated municipal solid waste planning and management (IMSWPM) approach in a developing country. The nature of this research is therefore descriptive and to some degree, explanatory and prescriptive. As mentioned in the literature review, research on the integrated approach to urban solid waste planning and management in developing countries has been lacking. Therefore, this study will explore, describe, and explain findings about IMSWPM and then evaluate them in order to consider the potential of the approach in an urban context in a developing country. In addition, this research is also prescriptive because it will present some recommendations to improve the existing practices in urban solid waste planning and management in developing countries.

2.3. Operationalization

According to the Oxford English Dictionary (1989, 224), a few meanings of the word "potential" are "possessing potency or power", "Possible as opposed to actual; existing in a latent or underdeveloped state, capable of coming into being or action", and "expresses potentiality or possibility". Therefore, exploring the potential of IMSWPM means to know the possibility of using this approach in the future due to its power or strengths.

In this study, the potential of IMSWPM will be viewed relative to two criteria. The first is the feasibility of this approach in the future. The second is the sustainability or the potential contribution of this approach for sustainable development.

2.3.1. Feasibility of IMSWPM

Two meanings of feasibility found in the Dictionary are "capability of being done, practicability" and "capable of being dealt with successfully in any way either in a material or immaterial sense." Feasibility indicates fitness or suitability and acceptability. Borrini-Fayerabend (1999) proposed several dimensions of feasibility for participatory management: legal, political, institutional, economic, and socio-cultural.

The feasibility analysis of IMSWPM is examined from seven aspects: ideological, technical (operational), legal, political, institutional, social, and financial. Ideological feasibility is concerned with the reasons for adopting the approach. Technical feasibility of IMSWPM is analyzed regarding the fitness of this approach to the existing practices in municipal solid waste planning and management (MSWPM), including waste reduction and reuse, source separation, service provision (collection and transportation), recovery and recycling, composting, and safe disposal. Legal feasibility deals with the fitness of IMSWPM with the existing laws, regulations, and government policies pertaining to MSWPM. Based on Borrini-Fayerabend's (1999) idea, political feasibility highlights the fitness of IMSWPM with the current political will, acceptance by stakeholders, capacity to enforce decisions, and the presence of specific phenomena, such as corruption and intimidation. Institutional feasibility analyzes the suitability of IMSWPM relative to the existing bodies and rules associated with MSWPM, inter-institution relations and their possible conflicts, and organizations of stakeholders. Social feasibility examines the appropriateness of IMSWPM with the public's attitude and acceptance of MSWPM. Financial feasibility refers to availability of financial resources to carry out IMSWPM. Included in this examination are opportunities for finding prospective funding sources in the future.

2.3.2. Sustainability of IMSWPM

The significance and necessity of considering sustainability in policy and planning have been suggested by many (Beatley, 1995; Drakakis-Smith, 1996; Luther and Borner, 1996; Davidson, 1996; Maclaren, 1996). Based on Wall's (1997) proposition, one valid question about the sustainability of IMSWPM is "whether and in what form IMSWPM might contribute to sustainable development?" In this study, therefore, the sustainability of IMSWPM is meant to address how this approach incorporates certain concerns of sustainable development and supports the achievement of some goals of sustainable development.

Three major aspects in any discussion about sustainability are economics, social, and environment. If IMSWPM is to be sustained, then it should be environmentally wise, economically viable, and socially just. Specific economic issues to be addressed by IMSWPM are income generation, poverty, living standards and consumption patterns, and the use of recycled materials. Included in the social issues are the satisfaction of basic human needs, participation, empowerment, and human rights and social justice. Environmental issues are concerned particularly with the protection of the environment through pollution reduction and conservation. The contribution of IMSWPM is expected to support the achievement of some goals of sustainable development.

2.4 Data Collection Methods

This study is a case study because it attempts to explore the potential of IMSWPM in one metropolitan region in a developing country, Indonesia. According to Babbie (1998, p. 282), "A case study is an idiographic examination of a single individual, group, or society. Its chief purpose is description, although attempts at explanation are also acceptable."

One particular method for collecting data that has gained attention in developing countries is the participatory approach such as the participatory rural appraisal (PRA). Through this method, the local people are more actively brought into discussions with the external observer to jointly gather facts and directly share experience from their lives. This kind of engagement has been successful for rural areas in developing countries and it has been adapted for urban areas as well. Although I recognize the advantages of this approach, I did not use it in this study for a variety of reasons. First, identifying and bringing together representatives of stakeholders in USWPM might not be easy, especially for a researcher who did not have enough legitimacy. This is particularly true in the case of government officials such as those in the central government in Jakarta. They were very busy and it would be difficult for a researcher to invite them all at the same time to discuss certain issues in MSWPM. Second, inviting various stakeholders at the same time even in Bandung would not only require support from credible persons but also financial support to arrange and conduct the meeting. Third, inviting residents at the same time also may not be easy. In sum, addressing the various issues surrounding MSWPM in the Municipality of Bandung using the participatory approach would pose a tremendous challenge for a researcher. As a result, I used interview surveys and questionnaires. These techniques have limitations, but they were practical for this study.

Layder (1993) suggested four types of data collection methods in field research. These include documentary materials, questionnaires, interviewing, and observation. These methods can produce both quantitative and qualitative data. All of these data collection methods are used in this study. Documentary materials were collected from various sources such as government institutions, private consulting firms, foreign agencies, and newspapers. Structured questionnaires were administered to households and university (undergraduate) students. Interviews were conducted with various respondents such as government officials, private sector employees, professors, representatives of waste pickers, neighborhood chiefs, members of non-governmental agencies, and representatives of foreign agencies. Observations were also conducted in many places relevant to the study such as temporary disposal sites, final disposal sites, community areas, public facilities (bus terminals, markets, train stations, public gardens).

2.5 Sampling

In this case study, samples were mainly drawn from these groups of respondents in the Municipality of Bandung, Indonesia. In addition, some interviews were conducted in Jakarta because the respondents, such as government officials and representatives of foreign agencies resided in that city.

Samples from the government departments and institutions, private consulting firms, a private contractor, one non-governmental organization, and foreign agencies were purposively selected. Respondents actively involved in MSWPM were chosen and interviewed. This was also used for the interviews with university professors. Some samples from neighborhood leaders were collected purposively, while some others were gathered randomly depending upon the purpose. Samples from households were conducted through stratified sampling based on two kinds of variables. The first variable was the availability of waste collection and transportation service provided by the local sanitation authority in the Municipality of Bandung. Another variable was based on wealth.

Households were divided into three groups: high-income class, middle-income class, and low-income class. The high-income class was identified through a few indicators, such as the location of home, and appearance of the home in which every house must be a permanent building and have a garage. The middle-income class was identified by the appearance of the home in which each house must be a permanent building but does not have a garage. And the low-income class was identified by location, and the appearance of the house in which every house must be very simple or semi-permanent and does not have a garage. This kind of stratification was used as an alternative to the low chance of expecting respondents to reveal their income during the interviews. Respondents in each class were selected randomly.

Sampling of university students was conducted at three universities: one government-owned university and two private universities. The selection of these universities was primarily based on their willingness to allow the distribution of the questionnaires. The total number of respondents for each group and the number of respondents for each stakeholder in every group for this study is shown in Table 1.

In term of the number of stakeholders interviewed, this study suffers from the lack of many non-governmental organizations which were interviewed. Two waste consultants in Bandung told me that there were not many non-governmental organizations that work in waste issues in that city. Those consultants argued that the economic crisis might have had an impact on the decreasing number of non-governmental organizations there. Recognizing this shortcoming, therefore, I suggest that further research should try to get more voices from non-governmental organizations.

Another weakness of this study may be concerned with the number of respondents. I did not follow any statistical guidelines in determining the number of the respondents. There are a few main reasons for this decision. First, the number of the population for each group of stakeholders was unable to be determined due to time and budget constraints. Second, rather than being concerned with numbers, I was more concerned about the credibility of the respondents who should be interviewed. Consequently, the number of respondents in many government agencies, for instance, was small. Third, the use of any statistically-based approach for determining the number of respondents might have resulted in a large number of respondents that would have been impossible within the constraining time and budget at that time. Last, randomness of the samples is also a shortcoming. This study did not use the simple random sampling method in order to save time and budget as well as because of a concern about its practicality.

Table 1. The number of respondents

Group of stakeholders	Stakeholders	Number of respondents	Total number of respondents in the group
Individuals	Households	362	789
	Chiefs of neighborhood units	60	
	Professors	12	
	Undergraduate students	346	
	Representatives of waste pickers	6	
	Itinerant buyers	3	
Foreign agencies	The World Bank	3	4
	JICA	1	
Government institutions	Municipal cleaning enterprise (PDK-Bandung)	6	53
	Municipal government of Kotamadya Bandung	6	
	District cleaning of Kabupaten Bandung	2	
	District government of Kabupaten Bandung	1	
	Planning Boards (Bappenas and Bappeda)	3	
	State Ministry of the Environment	4	
	Environmental Impact Management Agency	3	
	Directorate General of Human Settlements Development	2	
	Agency for Technology Assessment and Application	3	
	Department of Social Affairs	1	
	Department of Labour	1	
	Department of Education and Culture	2	
	Department of Parks (Dinas Pertamanan)	2	
	Department of Health	2	
	Department of Information	2	
	Department of Industry and Trade	1	
	Department of Cooperatives and Small Business Development	2	
	Department of Agriculture	2	
	Development Technology Centre-ITB	2	
	Market Enterprise (Perusahaan Daerah Pasar)	1	
	Police Department	1	
	Centre for Research in Environmental Studies ITB	2	
	Development Technology Centre, ITB	2	
Private Sector	Consulting firms	8	12
	Contractors	2	
	Waste recyclers	2	
NGO	NGO working on waste management	2	2
Total			860

2.7. Data Analysis

This study generated both qualitative and quantitative data. Qualitative data have been classified based on their similarities. Quantitative data have been tabulated and presented descriptively, and some were examined through non-parametric statistical tests. Both qualitative and quantitative data were used to analyze the feasibility of IMSWPM from its fitness and acceptability, and sustainability of this approach in terms of its potential contribution to sustainable development.

3. ANALYSIS AND EVALUATION

3.1. Feasibility of IMSWPM

3.1.1. Ideological

Ideological feasibility of IMSWPM deals with the rationale for adopting this approach. Several reasons for the necessity for integrated planning and management were mentioned in the literature review, including the need to tackle the complex problems in MSWPM (Halla and Mojani, 1999; Hoornweg and Thomas, 1999), the necessity for a holistic view in solving the various problems in MSWPM (UNEP, 1996 as cited in Hoornweg and Thomas (1999)), the need for achieving various objectives in MSWPM (Crutcher and Yardley, 1991; Poland, 1991; Ham, 1992), the dissatisfaction with narrowly-focussed management (Bowonder, 1987; Born and Sonzogni, 1995; Margerum and Born, 1995; Hooper, McDonald and Mitchell, 1999), failures in dealing with competing views (Bowonder, 1987; Hooper, McDonald and Mitchell, 1999), and the need to capture maximum benefits through coordinated action (Erbel, 1982; Lang, 1990; Mitchell, 1990a; Hooper, McDonald and Mitchell, 1999).

Findings about various problems about MSWPM in the Municipality of Bandung which result in environmental pollution due to household waste, the gap between increasing service demand and the capability of PDK-Bandung, inappropriate planning and management, lack of coordination among actors (stakeholders), lack of participation, lack of awareness and education, weak law enforcement, and difficulties in helping waste pickers. These problems involve various physical, technical, social, financial, institutional, political, and legal issues. In addition, the municipality also faces some challenges, such as the increasing production of waste due to population growth, urbanization, and industrialization; the need for disposing of waste quickly and properly; the increasing demand for satisfactory service provision; the need to increase public awareness and participation; the desire to have a

healthy city; and, difficulties in finding landfill sites. All these problems and challenges in MSWPM suggest the impossibility of PDK-Bandung being capable of tackling them alone. With regard to the complexity of the problems and challenges in MSWPM, IMSWPM is a suitable approach.

The growing dissatisfaction with narrowly focussed management is highlighted by the use of the conventional approach used by PDK-Bandung. First, PDK-Bandung uses the paradigm of "collect-transport-dispose". Second, PDK-Bandung has little interest in resource recovery or recycling initiatives. Third, PDK-Bandung still considers itself as the sole authority for waste management the municipality. Besides maintaining the cleanliness of the city, other issues should be addressed and each requires involvement and participation from others.

Another reason to adopt the integrated approach is a need to deal with competing views or conflicts. One example of a conflict is assisting waste pickers. There were two competing views about appropriate efforts to help waste pickers. The first was to change the waste picking occupation. This view was supported by the Department of Social Affairs and the Department of Labour. The second was that waste pickers should be recognized and their activities should be facilitated. This view was supported by the Environmental Research Centre (PPLH) -ITB, the Development Technology Centre (DTC) - ITB, waste recyclers, some consultants, and the World Bank. Therefore, IMSWPM is an appropriate approach to address this conflict. First, stakeholders expected that IMSWPM would provide them with a medium for resolving conflicts and gaining consensus. Second, the findings about waste pickers by the GTZ's consultant indicated that 32% of the respondents wanted to change their current occupation and 6% wanted to stay in the Municipality of Bandung as waste pickers or waste brokers (lapak or bandar). Therefore, the Department of Social Affairs and the Department of Labour can still provide training to waste pickers who want to change their occupation, while those who support waste pickers can help them conduct their activities in a more organized, safe, and healthier manner.

Stakeholders expected to capture various benefits from coordination of many aspects of MSWPM. They hoped that an integrated approach would become a medium for achieving some important objectives such as reducing the amount of waste generated and its impact on the urban environment; seeking integrated policies, planning and programs (activities); strengthening municipal institutions; fostering partnerships of stakeholders; reducing bureaucratic hurdles; and, mediating conflicts. These expectations are all in line with IMSWPM. In summary, based on the above analysis, IMSWPM is an appropriate approach to deal with the various problems and challenges of MSWPM in the municipality.

3.1.2. Technical (Operational)

Technical (operational) feasibility of IMSWPM is examined regarding the goodness between this approach and existing practices, including waste reduction and reuse, source separation, service provision or collection and transportation, recovery and recycling, composting, and safe disposal.

The Directorate General of Human Settlement Development (DJCK) with assistance of a local waste consulting firm has developed technical guidelines for waste reduction for households, markets, commercial establishments, industries, and streets. In these guidelines, households can achieve waste reduction by choosing or purchasing any product with less packaging, avoiding single use items, and avoiding the use of more plastic bags for packaging. These guidelines appear simple and technically should be easy to implement. Technical guidelines for waste reduction efforts in markets include selling products without plastic bags, giving a limited number of plastic bags, and encouraging buyers to bring their own reusable bags. These guidelines may not be easy to implement. This situation is almost similar for commercial establishments. They will unlikely refuse their customers' request for extra (packaging) bags. Nevertheless, with the current economic crisis, coupled with advances in computer and telecommunication technologies, the practice of waste reduction initiatives by offices toward an effective, efficient, and paper-less office perhaps is underway, in particular in the private businesses. Thus, the DJCK's guidelines for waste reduction by offices seem to be operationally feasible because they become a necessity for both governments and private businesses as they strive for savings in their budgets. Although DJCK had also prepared guidelines for waste reduction initiatives by industries, the Environmental Impact Management Agency (Bapedal) also has the mandate to promote and implement waste reduction for industries through the introduction of Clean Production principles with a particular focus on hazardous waste. One of the biggest handicaps for the implementation of Clean Production practices is that it is still based on persuasion. Industries are unlikely to be willing to follow those practices because they can cost them more to make adjustments to their production system. The DJCK's guidelines for waste reduction along streets are technically feasible because they only require the provision of different bins for dry and wet waste, as well as signs about laws for disposing waste at illegal places.

According to some stakeholders, such as DJCK, a waste consultant, and some professors, reuse has become traditionally conducted by households, in particular the low-income ones, in their daily lives, particularly during the recent economic crisis. In other words, reuse is operationally feasible because people have consciously done it based on their own will.

Separation of waste at source into dry and wet streams has not become mandatory for waste generators in the municipality. The municipal government only has an instruction encouraging residents to separate their wastes into organic and inorganic streams, and each desa or kelurahan to have at least one site for collecting the inorganic waste. This instruction is easy to understand and implement. One community in the municipality, for example, initiated voluntarily source separation to sort papers. The young men's organization led the initiative.

In general, practices of source separation by households into dry and wet streams as suggested by the municipal government DJCK are lacking. Source separation should be technically feasible if households have the freedom to provide their own bins for storing the inorganic and organic streams and the use of dual containers should not consume a lot of space in their homes. The use of standardized bags should not be endorsed.

Learning from the failure of a pilot project for residential source separation in Jakarta, the success of source separation by households in the Municipality of Bandung will be influenced by the willingness of PDK to adapt some of its collection vehicles to facilitate the collection and transportation of both organic and inorganic wastes. The role of community leaders such as Ketua RT or Ketua RW will be influential in persuading their members to practice source separation.

For some private businesses, source separation has been practiced to earn extra income. As an example, many large-scale private businesses continue to be the major providers of corrugated papers from their source separation activities.

The proposed IMSWPM acknowledges the importance of local community organizations and the local cleaning authority both in providing collection and transportation services. The idea of a partnership between the local government and the private sector in service provision is also emphasized. In the Municipality of Bandung, local community organizations at the neighbourhood levels such as RT (Rukun Tetangga) or RW (Rukun Warga) have been responsible for providing the primary collection and transportation service from householders to temporary disposal sites. Meanwhile,

PDK-Bandung as the local cleaning enterprise has been responsible for providing the secondary collection and transportation service from temporary to final disposal sites. Therefore, the scheme of involving local community organizations and the municipal cleansing institution in service provision fits well operationally with the existing practice.

Providing recovery and recycling sites as proposed by IMSWPM, although recognized as important by officials of PDK-Bandung, was not judged by them to be technically feasible in the future because of uncertainties in land availability and funds, although PDK-Bandung had informally allowed its waste collection crews to use two transfer depots as sites for sorting the Aqua plastic bottles.

DJCK has also developed technical guidelines for recycling initiatives by households, markets, commercial establishments, offices, and industries. The guidelines for households and markets are identical with those for source separation because DJCK argued that source separation should become the backbone of recycling activities. Commercial establishments and offices can support recycling efforts by using products than can be recycled. According to Indonesia's Agenda 21, commercial establishments and offices can also participate through purchasing products made from recycled materials. The DJCK's guidelines and Agenda 21's suggestion seem simple and easy to practice and should be technically feasible.

Household- and community-level composting initiatives in the municipality have been rare. According to the technical instruction of the municipal government, each household with spacious yards is urged to install a small-scale composter and each community area (Rukun Warga) should have at least one community-level composter. Household and community composting are technically feasible provided the requirements proposed by chiefs of neighbourhood units can be met such as the provision of suitable space, using appropriate technology, proper operation and management, consultation with the community, and supervision from PDK's officials.

Municipal-level composting has been practiced by PDK-Bandung using simple windrow technology. According to officials of PDK-Bandung, they have used this technology to produce compost demanded by plantation sites. The use of simple windrow technology is technically feasible because officials of PDK have the knowledge, skills and experience.

All three final disposal sites owned by PDK-Bandung have been designed and built as sanitary landfills. As a pilot project, TPA Pasir Impun has been operated as part of an integrated final disposal site. It uses a sanitary landfill and a small-scale incinerator. TPA Jelekong and TPA Leuwi Gajah have been operated as strictly landfills mainly due to constrained budget. This study would suggest a sanitary landfill could be operationally feasible because it can be operated by officials of PDK-Bandung, while incineration currently is not currently feasible because of the lack of competent staff. In conclusion, a number of practices proposed by IMSWPM are technically feasible; while some others not, but they can become operationally feasible in the future

3.1.3. Legal

The legal feasibility of IMSWPM was examined in relation to the existing laws, regulations and government policies pertaining to an integrated approach, waste reduction and reuse, source separation, service provision, recovery and recycling, composting, and safe disposal.

At the national level, the credibility for an integrated approach for MSWPM in Indonesia is provided in Indonesia's Agenda 21 which proposes integration of four areas: minimizing waste; maximizing reuse, recycling and composting; increasing service coverage; and, using environmentally-sound waste disposal. Also a policy of the State Ministry of the Environment advocates partnerships among governments, the private sector, and the public in environmental management, including waste management (KLH, 1995).

Several objectives and programs of Agenda 21 can be highlighted. First, improving community awareness and participation in waste reduction is considered a short-term objective, and public education to promote the use of products made from recycled materials and to participate in reuse at household level is a short-term program. Second, three possible actors for providing service are recognized. They include municipal cleaning authorities, private contractors, and local community organizations. Third, the role of waste pickers in recycling businesses is recognized. Fourth, the agenda suggests development and implementation of a marketing strategy to increase the markets for compost to different target users in agriculture, nurseries, plantations, and households. Fifth, it emphasizes the necessity for environmentally-sound waste disposal practices, using sanitary landfills, controlled landfills, and/or incineration.

Another policy at the national level had been prepared by the Directorate General of Human Settlement Development (DJCK) concerning 4Rs (reduce, reuse, recycle and replace). Besides emphasizing the importance of various initiatives in 4Rs by various actors, this policy also recognize the important role of recovery and recycling not only in reducing the amount of waste requiring treatment and disposal, but also in employment creation. Moreover, the policy also acknowledges waste pickers as an important actor in recovery and recycling businesses. The policy of the Department of Industry and Trade on the waste recycling industry was "inaction" because it lets recovery and recycling businesses exist and grow as long as they do not create problems for the environment, for instance, pollution.

The Department of Health has issued a policy regarding health standards for recycling, composting, and disposal activities. In this policy, controlled waste burning can be practiced by households, communities, or municipal cleaning authorities as a means of waste reduction.

At the municipal level, there has not been any municipal law or government policy passed which specifically recognizes the necessity for an integrated approach for MSWPM. The legitimacy for IMSWPM, therefore, is lacking at this level. Laws and policies for waste reduction and reuse were absent. The importance of source separation is only recognized in the form of persuasion as stated through an instruction from the city mayor. As mentioned previously, a municipal law has determined the arrangements for service provision by both local community organizations and PDK-Bandung. The role of private contractors has not been accepted by the municipal government. Unlike policies at the national level, the role of waste pickers has not been officially accepted by the municipal government, including PDK-Bandung. Composting receives support through an instruction from the mayor. However, this instruction is insufficient because it does not make composting mandatory for households and in particular communities. No laws have been specifically issued to deal with recovery and recycling. The municipal law which designates PDK's mandate emphasize the importance of environmentally-sound waste disposal practices at both temporary and final disposal sites. Based on the above analysis and evaluation, the legal support for IMSWPM in the Municipality of Bandung is weak.

3.1.4. Political

The political feasibility of IMSWPM is analyzed on four aspects: acceptance by stakeholders, political will and uncertainty, capacity to enforce decisions, and existence of specific phenomena such as intimidation. With regard to the acceptance by stakeholders, most stakeholders in Bandung and Jakarta, including officials of government institutions, representatives of the World Bank, professors, and an NGO, accept IMSWPM as an appropriate approach to manage wastes in metropolitan or large cities in Indonesia. A few respondents were pessimistic about this approach. Professors commented that IMSWPM is an ideal

approach because the Government of Indonesia in 1996 was just than promoting the ideas of integratedness ("keterpaduan") of policy, and partnership of stakeholders ("kemitraan") in many of its policies, including urban environmental management. They commented that it would take time to see whether these ideas would be implemented or they would just become political jargon. One senior researcher at the Development Technology Centre (DTC) of ITB was skeptical about IMSWPM unless government institutions were strengthened. Without integration, she believed policies and planning, and partnerships of stakeholders would not work.

Many stakeholders believe that the integrated approach is an appropriate approach to deal with the various issues surrounding MSWPM. They proposed various goals for the integrated approach, included maintaining or preserving the integrity and quality of the environment, adopting 4Rs (reduce, reuse, replace, recycle), promoting partnerships among stakeholders, facilitating coordination, supporting the use of appropriate technology, and supporting the creation of employment opportunities. All these goals are in line with IMSWPM.

The current political will for IMSWPM in the Municipality of Bandung is weak, although there have been some initiatives by the municipal government to address cleanliness, beauty, and social order. The previous mayor had tried to establish a team assigned with the task of designing a system which could integrate the informal waste picking activities and the formal waste collection system operated by PDK-Bandung. This idea is similar to what is proposed by IMSWPM as well as in Indonesia's Agenda 21. It was unfortunate, however, that the recommendations of that team were never implemented

The capacity to enforce decisions pertaining to IMSWPM is also weak. Poor law enforcement in environmental management, including waste management, has been a common problem throughout Indonesia. In the Municipality of Bandung, indiscriminate waste dumping occurs at drains, canals, rivers, and vacant spaces. The Police Department even mentioned the ineffectiveness of the municipal law for charging those throwing away wastes at illegal places. The health standards issued by the Department of Health for final disposal in order to protect the public's health were also often violated.

Waste consultants in Bandung mentioned the case of intimidation of waste pickers. They noted the exploitative relationship between waste pickers and their brokers in which the former usually have a low bargaining position in waste trading activities. Waste brokers set the price for the materials sold by waste pickers. Municipal government officials in Kotamadya Bandung disagreed with allowing waste pickers to scatter around the city to collect valuable materials. Municipal authorities conduct operations to catch beggars, homeless, and moving waste pickers and send them to prison. PDK-Bandung officially does not acknowledge waste pickers. In sum, the political feasibility of IMSWPM in Kotamadya Bandung is mixed because although there have been some positive signs, there also are some challenges or constraints.

3.1.5. Institutional

Following Borrini-Fayerabend's (1999) proposition, the institutional feasibility of IMSWPM is assessed relative to three aspects: existing bodies and rules for MSWPM; inter-institutional relations, coordination and conflicts; and, organizations of stakeholders.

Three major government institutions are responsible for solid waste in the Municipality of Bandung: PDK-Bandung, the Department of Parks, and the Department of Public Works. The municipal government has established the organizational structure, mandates, and rules for each institution. PDK-Bandung has not yet officially accepted an integrated approach to MSWPM, but it has begun to recognize the importance of this approach at a small scale through its pilot project of the integrated final disposal site.

According to the State Ministry for the Environment (KLH, 1995), one of the major constraints to environmental management in Indonesia is insufficient coordination capability within government institutions to deal with the various environmental issues. In the Municipality of Bandung, inter-institutional coordination has been practiced in many initiatives that deal with cleanliness, beauty and social order. The biggest coordination effort, the Adipura Award Success Team, involved fifteen institutions. The City of Bandung got an award for its cleanliness. Other coordinating teams established by the mayor have included those for K3 (clean, green, neat/order), GDN (national discipline movement), and Justice (Yustisi). The Department of Education and Culture was collaborated with the Department of Internal Affairs and with universities in conducting public education about cleanliness and health for the youth. Coordination among government institutions in MSWPM has worked well whenever it directly involved leadership from the mayor.

Of conflicts among institutions, three types were identified in this study. The first was between PDK-Bandung and the district government of Kabupaten Bandung concerning charges for final disposal sites. The dispute was eventually resolved at the highest political level between the mayor of the municipality and the bupati of the district government. The second conflict occurred between the Department of Parks and the Department of Public Works regarding coordinating cleanliness for the city. The former opted to follow the latter in order to avoid further poor working relationships between them. The third conflict involved those who supported waste pickers, such as PPLH-ITB and NGOs, and the municipal government institutions such as the Department of Labour and the Department of Social Affairs which both refused to acknowledge waste pickers. There was no reconciliation of this conflict. These findings suggest that conflicts related to MSWPM may not always be easy to resolve. When interviewed, officials of the Department of Parks, some professors, and waste consultants had the same comment that arrogance caused much trouble in cooperation and coordination among various actors.

This study identified five groups in IMSWPM: government institutions, the private sector, individuals, non-governmental organizations, and foreign agencies. Government institutions responsible for MSWPM have been regulated through government laws.

The role of the private sector varies. Some are actively involved such as waste consulting firms and waste processing factories or small-scale waste-related businesses, while others such as many private businesses voluntarily contribute to the greenness of the city through their donations, coordinated by the Department of Parks. The remarkable role of PT Aqua Golden Mississippi and PT Coca Cola Indonesia in sponsoring plastic recycling in Bekasi was not found in Bandung, although such efforts would be good for waste pickers in Bandung

Some professors stated that in general the public in the City of Bandung lacked awareness about environmental issues, including solid waste. This will become a major challenge for IMSWPM that calls for participation from the public, in particular households. Based on the interviews with the neighbouhood chiefs, they can have an important role in increasing awareness of and mobilizing their members because they are informal leaders in their community. The informal neighbourhood scheduled meetings are good media for disseminating messages among households. In addition, those meetings can be used to prepare plans and consensus to maintain cleanliness as well as to support proper waste management practices in their areas. In sum, the informal community organizations can be used for building households' participation in proper waste management practices which support IMSWPM.

In Indonesia, non-governmental organizations (Lembaga Swadaya Masyarakat (LSM)) have been well known for their persistent and brave role in criticizing government. In addition, they have been

reluctant to work with the government. As a consequence, in general, government institutions did not have good relationships with them. Leaders of NGOs in Jakarta in 1997 voiced their concern regarding governments' unwillingness to recognize their roles and participation in urban environmental management. This finding suggests that partnerships in IMSWPM that involves NGOs may be impeded by the reluctance or active opposition from the government.

A few foreign organizations have been involved in waste management in the municipality. The Asian Development Bank (ADB), for example, assisted and funded the design and construction of sanitary landfills owned by PDK-Bandung. Germany's GTZ worked to help waste pickers. The World Bank in 1999 facilitated the coordination of various stakeholders in the City Development Strategy (CDS) project. These findings indicate that there are opportunities to involve foreign agencies in various initiatives toward IMSWPM in Bandung in the future.

In conclusion, IMSWPM fits with the institutional arrangements in the municipality because there is no institution or organization that opposes this approach. In addition, some opportunities exist for involving various stakeholders in the partnerships in IMSWPM. Table 62 summarizes the analysis and evaluation.

3.1.6. Social

The social feasibility of IMSWPM was assessed by the level of acceptance by the public for implementing waste reduction and reuse, source separation, service provision, recovery and recycling, composting, and safe disposal.

The idea of separating waste into wet (organic) and dry (inorganic) streams proposed by IMSWPM, was supported by 49 out of 60 (82%) neighbourhood chiefs (Ketua RT), 190 out of 310 households (61%), and 330 out of 346 (95%) university students. Acceptance of source separation by neighbourhood chiefs did not depend on the availability of PDK's service in their areas. Households' support for source separation was not associated with their income. The students' support for source separation is independent from their origins.

Source separation has been practiced by households, for instance, by separating some valuable items such as clothes, bottles, papers, and newspapers, and then selling or bartering them with consumable items or children's toys. In Bandung, households have commonly been involved in these practices with itinerant buyers who go from house to house. According to some stakeholders, reuse is part of households' tradition. In Bandung, there are many well-known trading places for specific used items such as clothes, shoes, books, houseware, and electronics. However, findings about waste reduction by households were not available, although Indonesia's Agenda 21 recognizes the importance of promoting this idea to government institutions and households. In conclusion, based on the experience and willingness of households, source separation and reuse are socially acceptable, while waste reduction is still relatively unknown.

The scheme for service provision has been regulated through a municipal law in which the local community organizations are responsible for the delivery of the primary service from households to temporary disposal sites, and PDK-Bandung for the secondary service from the temporary disposal sites to final disposal sites.

There has not been any protest from the public about the scheme for service provision, regulated through a municipal law, involving local community organizations and PDK-Bandung. This finding suggests that the existing scheme can be accepted by the public in the municipality.

The provision of effective, efficient and reliable service has a close relationship with good waste disposal behaviour by households. Unsatisfactory or unavailable service provision has led to

waste burning and indiscriminate dumping into drains, canals and rivers. The results of the statistical tests indicated that waste burning by households is associated with income levels, and the availability of service in their areas. Chances for waste burning were higher in the lower-income households and for those without PDK's service compared to their counterparts with higher income and service available.

In recovery and recycling activities, the role of the informal sector has been widely acknowledged by many stakeholders. One of the major concerns in recovery and recycling initiatives is the role of waste pickers. Although their contributions have been recognized in Indonesia's Agenda 21, waste pickers still face difficult challenges from both the public and government officials. The results of the interviews with chiefs of neighbourhood units showed that 27 out of 60 (45%) refused to allow waste pickers to enter their areas for sorting valuable materials. One community area was even determined to reject waste pickers because some of them stole belongings. The results of interviews with households showed a similar finding that 157 out of 362 (43%) disagreed about giving consent to waste pickers to come to their areas. These findings support the idea of localizing and organizing waste pickers at certain sites to conduct their activities in order to avoid opposition from households and neighbourhood chiefs. In other words, recovery and recycling sites proposed by IMSWPM should be socially acceptable because they can become sites for waste pickers to conduct their activities. It should be noted that waste pickers who were interviewed had imagined this kind of place. In sum, the idea of recovery and recycling sites proposed by IMSWPM is socially acceptable because it prevents waste pickers from scattering throughout city and entering community areas.

Community composting received support from neighbouhood chiefs and households. The results of interviews with neighbouhood chiefs indicated that 42 out of 60 (70%) supported composting in their areas. It should be noted that support for composting from neighbouhood chiefs was not associated with the availability of PDK's service in their areas. Interviews with households showed that 287 out of 362 (79%) supported composting in their areas. The results of the statistical tests, however, revealed that households' support for composting was associated with their income level and the availability of service in their areas. There was a tendency that the lower the income level of households, the higher the percentage who supported composting. This may suggest that the lower income households with the lower chances for having satisfactory services were more concerned with composting because they viewed it as a means for disposing of their organic waste. Similarly, households without PDK's service might view composting as a means for disposing of their organic waste, resulting in their higher support for composting than their counterparts enjoying the PDK's service. Despite these findings, in general composting is socially acceptable. In conclusion, most components of IMSWPM can be accepted by the public in the municipality.

3.1.7. Financial

Financial feasibility refers to the available financial resources and opportunities for prospective funding sources. The implementation of IMSWPM will require sufficient funds to carry out partnerships in initiatives associated with waste reduction and reuse, source separation, service provision, recovery and recycling, composting, and safe disposal.

Potential actors that can contribute to provide funds for promoting waste reduction and reuse, source separation, composting, and recovery and recycling, include the Directorate General of Human Settlement Development DJCK, the State Ministry of the Environment, the Environmental Impact Management Agency (Bapedal), PDK-Bandung, the municipal government of Kotamadya Bandung, non-governmental organizations, foreign agencies, and individuals.

The promotion and implementation of reuse may not require funds as much as waste reduction since it has been part of households' tradition to meet their needs. Funds will be needed for campaigns or dissemination of

information to the public. Efforts to promote the importance of source separation need to be initiated immediately to support the implementation of Indonesia's Agenda 21.

The experience and failures from a residential source separation pilot project in Jakarta should provide lessons about the necessity to introduce and acquaint households with source separation in their homes or community before it becomes mandatory. PDK-Bandung, non-governmental organizations, and donors should work together to initiate pilot projects for source separation in different residential areas such as high-, middle-, and low-income households.

A shortage of funds in PDK-Bandung has been a major problem. Based on 1995 data, the total costs for operation and maintenance and depreciation for temporary disposal, collection and final disposal were 7,509 rupiah per cubic meter of waste. According to a municipal law issued in 1995 that has not been changed, the waste management cost of solid waste has been determined to be 7,500 rupiah per cubic meter. This implies that with daily waste collected and disposed of about 6,600 cubic meter, the total waste management costs in of PDK in each month should be about 1,485 million rupiah. The monthly service fees collected in 1999 were only about 800 million rupiah. Therefore, it is not surprising that PDK-Bandung has not been able to provide service to all residents in the municipality, and to operate all disposal sites as sanitary landfills. Moreover, it is unlikely to expect PDK-Bandung to allocate more of its revenues for promoting waste reduction, source separation, recovery and recycling, and composting.

There are three main opportunities to obtain additional funds for the provision of effective, efficient, and reliable service provision. The first is through increasing the existing service fees for PDK to increase its capacity for hiring crews, purchasing collection vehicles, and operating the existing final disposal sites as sanitary landfills. However, this suggestion might disappoint households. Ever since 1997 the economic crisis in Indonesia may have influenced households' opinions about the existing PDK's service fee. A total of 310 households, 279 (90%) thought that the existing fee was sufficient. In addition, 211 out of 310 households (68%) were unwilling to pay more in order to get better service. These findings suggest that increasing the current PDK's fee will pose a challenge for the municipal government of Kotamadya Bandung. The second opportunity is through municipal government subsidies. If the possibility for increasing the current service fees is unlikely, then the municipal government of Kotamadya Bandung should be willing to increase subsidies to PDK-Bandung. The third opportunity is by allowing private contractors provide service to some residents. The major handicap with this proposal, however, is that the regulation has not yet recognized and accepted the role of the private sector in the municipality. Unless the municipal government changes its regulation, privatization of service provision is impossible.

As stated earlier, the idea of recovery and recycling sites is not accepted by PDK-Bandung because it will require additional land and facilities. Therefore, unless other funding sources can be found, the proposed recovery and recycling sites will never be implemented. To overcome this situation, partnerships with large-scale businesses in credit provision to the informal waste sector, as suggested by Indonesia's Agenda 21, should be promoted. This suggestion has been practiced in the partnerships in plastic bottle recycling in Bekasi, West Java, sponsored by PT Aqua Golden Mississippi and PT Coca Cola Indonesia. Another alternative is to use some of the existing transfer stations, and this idea has actually been taking place. Waste collection crews of PDK-Bandung have informally used two transfer stations as sites for plastic bottle recovery operations. They choose plastic bottles because the markets have been relatively steady compared to the other products such as used papers, corrugated paper, and metal. The other alternative is through contributions by potential donors which have been previously mentioned.

Composting has to be promoted and introduced to households and communities. Pilot projects will be needed to show the public how they can work and contribute in reducing the amount of waste requiring treatment and disposal as well the production of compost for planting purposes. Unless the public knows the importance of composting, it will not be willing to purchase and install a small composter in their homes as urged by the mayor. A composter should be provided free to households and communities willing to use it, but this will require funds.

Interviews with chiefs of neighbourhood units revealed various requirements to perform composting by communities. Not only did neighbourhood chiefs ask for the provision of facilities to conduct community-level composting in their areas, they also wanted some money to hire the workers who would operate the facilities. Communities will unlikely be willing to spend more of their money to finance the operation of community-level composting in their areas unless the municipal government endorses it. In another sense, some funds will be required to promote and initiate pilot projects of community-level composting in the municipality.

An alternative to promote composting at communities could be based on what has been done in one large residential area in Serpong, West Java. There, a developer has adopted an integrated waste management model that includes composting. This approach can be used in Bandung by encouraging developers to perform composting in residential areas they manage, in particular the middle- and high-income ones. This approach will reduce the funds required to promote and operate community-level composting.

Similar efforts to promote community-level composting need to be conducted as well with high schools and universities, with the primary purpose to educate the young people. Although the biggest handicap as reported by DTC-ITB was the lack of demonstration space, a small composter can be used as an example. This idea could be tried with coordination of the Department of Education of Culture.

The continuity of composting activities by PDK-Bandung depends on the availability of compost demands. In other words, composting at the final disposal sites with the simple windrow technology does not require funds if a sufficient amount of compost demand exists. The largest users of the compost produced by PDK-Bandung have been plantation centres. Perhaps PDK-Bandung and the municipal government of Kotamadya Bandung should become responsible for the funds for composting at the municipal level.

Indonesia's Agenda 21 proposes access to credit for the informal waste sector including waste pickers and small collectors (lapak) for composting. This suggestion might work well as is the case with recycling. Unlike recycling in which markets are available, finding and sustaining markets for compost continues to be a major challenge. In other words, unless the markets for compost are economically feasible and sustainable, the scheme for providing access to credit for the informal waste sector will not be financially feasible because the possibility for returning the credit is low.

A proposal to contract out composting to a private contractor who uses vermi-composting technology was rejected by officials of PDK-Bandung because it will take too much money from PDK's incomes. Therefore, the potential of involving private contractors in composting funded by PDK-Bandung is grim.

As mentioned earlier, of three final disposal sites owned and operated by PDK-Bandung, only TPA Pasir Impun has functioned as a sanitary landfill. Some additional income will be needed to operate its final disposal sites as sanitary landfills. Two possible alternatives for additional funds are through increasing the existing service fees and the government subsidies. Based on the conclusion of the State Ministry of the Environment (KLH, 1995) that the public's and the private sector's willingness to share environmental management costs

is in general still low, increasing the existing service fees should be given priority in the near future.

The use of incineration is still in the "learning phase" or pilot project stage. The technology is expensive and this is why PDK-Bandung has refused to purchase composting technologies offered by several vendors. As suggested in Indonesia's Agenda 21, the use of incineration for metropolitan or large cities can be financially feasible.

One way to overcome funding shortages to environmentally-sound waste disposal options is proposed by Indonesia's Agenda 21 through regional cooperation between municipalities (kotamadya) and districts (kabupaten) where appropriate to develop regional landfill sites. If this idea can be implemented, both municipal and district governments can enjoy the benefits from having technically, economically, and environmentally viable waste disposal sites. PDK-Bandung and the district cleaning department of Kabupaten Bandung need to consider and explore this possibility.

In conclusion, IMSWPM at the present time is financially infeasible if the required funds to carry out the various initiatives are expected to come only from PDK-Bandung or the municipal government.

3.2. Sustainability of IMSWPM

Sustainability of IMSWPM is analyzed along three aspects: economic, social, and environment. The economic analysis looked at contributions to income generation, employment creation, savings in waste management, poverty alleviation, and economic diversity. The social aspects will be viewed relative to the satisfaction of basic human needs, social participation, human rights and social justice, and institutional development. Major environmental issues to be examined are pollution reduction and the maintenance of the city's cleanliness and neatness, and resource conservation.

3.2.1. Economic aspects

It was difficult to gather data about the direct contribution of MSWPM to the economic growth in the Municipality of Bandung. With limited data available, figures about income generation and employment creation can be provided. In 1999 PDK-bandung had about 1,800 staff with a total monthly salary around 400 million rupiah ($ 80,000 Canadian). A consultant's report (PT. Kartika Pradipta Prisma, 1996) estimated that about 3,500 people were involved in the informal waste businesses in Bandung. Although the number of people involved in the corrugated paper businesses is not known, the daily transactions of corrugated paper could worth between 5 and 10 million rupiah.

Employment creation or income generation has also been enjoyed by some people hired as primary service collection workers, although their number was not available. As mentioned before, the municipal government of Kotamadya endorses every community (Rukun Warga) to arrange and fund its own primary service collection to bring households' waste to temporary disposal sites. Through consensus, each community determines the fees for the service as well as the salary for the workersAnother kind of economic contribution of IMSWPM is in terms of savings of waste management costs from the recovery activities by the informal waste sector. The consultant's report, mentioned above (PT. Kartika Pradipta Prisma, 1996), estimated that the recovery of inorganic waste by the informal actors including waste pickers, small collectors (lapak), and big brokers (bandars) could save PDK-Bandung up to 1.7 million rupiah daily.

It is not easy to see the contribution of IMSWPM in poverty alleviation in the Municipality of Bandung. A major focus of urban poverty alleviation in developing countries, as discussed in the literature review (Jones and Ward, 1994; Wegelin, 1994), has been on managing the economic and social aspects of poverty, including waste pickers and this has been a very difficult task. If waste pickers can be assisted so that they can improve their economic and social status, some day they will be expected to change their occupation. The poverty problem, however, will remain because there is a high chance that other unemployed people will replace them as the next generation of waste pickers. Waste pickers will always exist if two conditions co-exist: there is demand for secondary materials and there are unemployed people with low-level educational background and few skills. In sum, it is difficult to expect IMSWPM to contribute to alleviating poverty.

IMSWPM can make a contribution to economic diversity, for instance, through the use of recycled materials and a reduction in use of virgin materials. Reuse and recovery have been practiced by both households and businesses in Bandung. Although figures about rates of participation were not available, reuse and recovery practices are very important in changing consumption patterns away from wasteful habits. One of the long-term goals of waste reduction proposed by Indonesia's Agenda 21 is to promote a fundamental shift in behaviour and attitude that strives toward sustainable consumption patterns. The corrugated paper business alone in the City of Bandung is a big business with daily transactions amounting to between 5 and 10 million rupiah.

3.2.2. Social aspects

According to Indonesia's Agenda 21, the provision of service to urban residents is considered essential for meeting basic human needs. In urban or especially metropolitan areas in which population density tends to be high and house areas tend to be smaller, the availability of effective, efficient and reliable service becomes a necessity. Unlike those who reside in rural areas where every household is capable of performing its own disposal by simple open dumping, most people in the metropolitan areas do not have a similar option. In other words, urban residents become more dependent on support from others who provide service to them. In 1994, for example, when landslides took place at the largest final disposal site in Bandung, waste collection in the city had to be abandoned for two weeks. The city was in crisis: all collection trucks loaded with waste were parked in the city; temporary disposal sites were overloaded with waste; and, a bad smell was everywhere. For people in large or metropolitan cities in Indonesia, including Bandung, the availability of effective, efficient and reliable service has indeed become a basic need.

The service coverage of PDK-Bandung in 1999 was almost 96%. Some residential and industrial areas were not served. The proposed IMSWPM that supports partnerships of stakeholders in service provision is expected to increase the capacity in service provision by improving the capability of PDK-Bandung, involving private contractors, or persuading large residential areas to provide their own service to the residents. These alternatives are proposed so that all residents in the municipality can get waste service, one of their basic needs.

Another contribution of IMSWPM is to nurture and strengthen public participation in many aspects associated with waste management. Without public participation, the achievement of many goals will unlikely be successful. Participation depends on attitude and behaviour to support various initiatives, including reuse, source separation, composting, proper disposal, service fee payment, and monitoring and law enforcement of regulations. Unlike the conventional approach which places municipal cleaning authorities as the sole actor, the proposed IMSWPM approach calls for more involvement from various stakeholders.

In terms of human rights and social justice, IMSWPM acknowledges the existence and role of waste pickers. This approach proposes that recovery and recycling sites to accommodate and facilitate waste pickers conducting their activities should be established. IMSWPM not only recognizes the social status of waste pickers, but also gives security to them by providing specific sites at which to work. Such sites were prepared by the previous mayor but were never implemented.

Another social goal is institutional development. According to the State Ministry of the Environment (KLH, 1995), institutional development deals with efforts for improving capacity for coordination, developing a regulatory framework to anticipate future challenges in environmental management, and developing human resources of government institutions. IMSWPM advocates partnerships of stakeholders in order to strengthen the capability of municipal authorities to provide satisfactory, equitable, and reliable service for all residents as well as to deal with the other issues associated with MSWPM. In other words, IMSWPM supports the idea of developing the capacity of municipal institutions to deal with their waste management tasks.

3.2.3. Environmental aspects

According to the State Ministry of the Environment, government is expected to formulate policies and coordinate partnerships of stakeholders in order to increase capacity for environmental sustainability (KLH, 1995). According to a national law issued in 1997 (Undang-Undang Nomor 23 Tahun 1997), everybody has an obligation to sustain and prevent the environment from being degraded. By promoting partnerships of stakeholders, the capacity to enhance various initiatives associated with waste reduction and reuse, source separation, service provision, recovery and recycling, composting and safe disposal, can be expected. These initiatives should make direct contribution in maintaining the cleanliness and health of the urban environment. Through the CDS (City Development Strategy) facilitated by the World Bank, the municipal government and the district government of Bandung have recognized the necessity to make Bandung a healthy city.

Another contribution to enhance the environment is through resource conservation by reusing and recycling materials which would otherwise be treated as waste. Reuse practices by households, the recovery and recycling activities by the informal waste sector, and the formal waste processing factories all contribute to reducing the use of virgin materials, and such efforts can be regarded as a kind of natural resource conservation.

4. CONCLUSIONS AND RECOMMENDATIONS

Some concluding comments about the feasibility and sustainability of IMSWPM in the Municipality of Bandung can be drawn. With regard to the problems and challenges in waste management, IMSWPM is appropriate and timely. Such an approach will become sustained when stakeholders believe it to be an adequate approach to deal with the problems and challenges in MSWPM; when they maintain their vision of a healthy city; and when they see the continued economic, social and environmental benefits of the approach for the city. The sustainability level will be greater if the municipal government embraces and endorses the same concept through passage of a municipal law which gives strong legitimacy to the approach.

Based on the guidelines of the Directorate General of Human Settlement Development (DJCK), both waste reduction and reuse by households are technically viable because they are simple, politically acceptable, and are supported by many government institutions. Waste reduction is relatively still unknown, while reuse is socially acceptable because it is part of households' tradition. The promotion of reuse seems to require less funds than that for waste reduction. The sustainability of reuse is greater than that of waste reduction.

As stated in a mayor' instruction, source separation by households should be technically feasible. Source separation is also politically and socially acceptable as it is supported by many government institutions and households, neighbourhood chiefs, and university students. However, legitimacy of source separation is insufficient because the mayor's instruction is only persuasive. There appear to be prospective funding sources to finance the promotion and introduction of source separation.

The involvement of community organizations and PDK-Bandung has been regulated by a municipal law, and therefore its legitimacy is sufficient. In addition, this arrangement is also politically and socially acceptable. The financial feasibility of this scheme is also high because it has been funded mostly through the service fees collected by local community organizations and by PDK-Bandung. The involvement of private contractors, however, has not been possible. The sustainability of service provision by local community organizations and PDK is high, but this arrangement could become insufficient in the future unless PDK-Bandung improves its service capability.

The proposed recovery and recycling sites should be socially acceptable because they concentrate waste pickers at certain sites and reduce the number of waste pickers who enter residential areas or scatter around the city, and therefore avoid opposition from some households, neighbourhood chiefs, and municipal officials. However, they are technically and financially infeasible, and lack of legitimacy. The sustainability of the proposed recovery and recycling sites is uncertain or low.

Community-level composting is socially acceptable and operationally feasible if some requirements proposed by neighbourhood chiefs can be met. Funding sources seem also possible to promote and introduce community-level composting in the Municipality of Bandung. The legal support for community- and household-level composting is insufficient. The sustainability of household-level composting may not be as high as that of community-level composting because it requires every household to purchase and operate a composter. The sustainability of the municipal-level composting depends on the availability and continuity of compost demands.

The use of safe disposal, in particular sanitary landfill, is technically viable. It is also backed by a municipal law concerning with the necessity for proper disposal. The sustainability of a sanitary landfill site, however, is low due to insufficient PDK's budget. Sanitary landfills can be sustained if sufficient additional funds are available, and enforcement for proper operation is upheld.

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