

# **A CASE STUDY OF A HOTEL SOLID WASTE MANAGEMENT PROGRAM IN BALI, INDONESIA**

by

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I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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## **ABSTRACT**

The main objectives of this study were: to provide a review of key concepts and issues relevant to solid waste management in developing countries; to analyse and evaluate the hotel solid waste management (HSWM) program in Bali, Indonesia; and to suggest recommendations and areas for further research. The following data collection methods were used in this study: review of documents and literature, interviews, surveys and field observations.

Tourism in host regions such as Bali can bring both positive and negative impacts. One aspect of tourism that can have an impact on local communities is solid waste management (SWM). Improper SWM can lead to pollution and deterioration of the aesthetic appeal of tourist destinations. Conversely, solid waste can be a resource to the local community, providing opportunities for business development and the achievement of social, political and environmental objectives.

Planning for SWM is complex, involving the consideration of multiple and interconnected issues. Therefore, in addressing SWM issues, it is appropriate to use an integrated approach that recognises the various stakeholders, activities and perspectives involved. In addition, concepts such as appropriate technology, cleaner production, life cycle assessment and environmental management systems can be useful for improving how solid waste management is approached.

A local environmental non-governmental organisation (NGO), waste hauler and hotels in Bali developed a program to improve the management of solid waste from hotels. The history, planning, management and stakeholders involved with the development of this program are described in this study. Various issues pertaining to the achievement of social, environmental and economic objectives are investigated to provide a view of program realities and the range of challenges faced by program participants.

Conclusions and lessons learned from the case study are presented and links between concepts in the literature and findings from the case study are discussed. Recommendations concerning topics such as planning, management, stakeholder involvement, health and safety, data management and source separation are suggested and future research directions are outlined.

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## ABBREVIATIONS

BAPEDAL	<i>Badan Pengendalian Dampak Lingkungan</i> – Indonesia’s Environmental Impact Management Agency
BSDP	Bali Sustainable Development Project
DKP	<i>Dinas Kerbersihan dan Pertamanan</i> – office of cleanliness and gardening
EMS	Environmental management system
H&S	Health & safety
HSWM	Hotel solid waste management
IHEI	International Hotels Environment Initiative
IH&RA	International Hotel & Restaurant Association
ISO	International Organisation for Standardisation
LCA	Life cycle assessment
MRF	Material recovery facility
NGO	Non-governmental organisation
NIMBY	Not in my backyard
4Rs	Waste reduction, reuse, recycling and recovery
SWM	Solid waste management
TPA	<i>Tempat Pembuangan Akhir</i> – final disposal site
UNEP	United Nations Environment Programme
US-AEP	United States – Asia Environmental Partnership
WTO	World Tourism Organization
WTTC	World Travel & Tourism Council

# CHAPTER 1

## INTRODUCTION

In the coming decade, companies will be challenged to develop clean technologies and to implement strategies that drastically reduce the environmental burden in the developing world while simultaneously increasing its wealth and standard of living.

Hart 1997:76

### 1.1. Background

The tourism industry can have both positive and negative impacts on tourist destinations, such as Bali, Indonesia (Tribe et al. 2000; Manuaba 1995). Benefits include economic activity and employment opportunities. Negative impacts include deterioration of natural and cultural resources, and contribution to existing problems, such as increasing quantities of solid waste. Since tourism activities are linked to the characteristics of the setting, businesses in the tourism industry (such as hotels) depend on the sustainability of a high-quality environment and therefore, have a role to play in the enhancement of natural and cultural resources (WTTC, WTO and Earth Council 1996).

Concern about the degradation of natural and cultural resources has spurred the formation of local non-governmental organisations (NGOs), such as the Wisnu Foundation in Bali. In developing countries in Asia, environmental protection has often been neglected in the haste to achieve economic development, resulting in pollution, sanitation problems, intensified urban congestion and resource depletion (Jindal et al. 1998). Solid waste management (SWM) is one of the serious, complex and challenging problems in developing countries that NGOs (such as Wisnu) have identified as a strategic way of addressing environmental and social concerns (Furedy 1997).

For thousands of people in developing countries struggling against poverty, informal waste recovery represents a means of earning a living (Razeto and Hemelryck, 1991; Fernandez 1997a). Informal recycling networks provide employment opportunities, reduce collection and disposal costs, conserve natural resources, and provide raw materials to industry at comparatively low cost (Jindal et al. 1998). However, issues of

concern for informal waste recovery systems include the disposal of waste residues and the health of waste workers (Lohani and Baldesimo 1991; Lardinois and van de Klundert 1995; Pinnock 1998). In tourist destinations such as Bali, hotel waste is regarded as a resource that local waste haulers are willing to pay for because recyclable materials can be sold (Suarnatha 1999).

The partnership of hotels, an NGO and a local waste hauler in Bali to address the challenge of managing tourism waste is explored in this study. The Hotel Solid Waste Management (HSWM) program in Bali resulted from the shared goals of reducing environmental impacts, increasing standards of living and enhancing cultural resources. The HSWM program in Bali is an example of a bottom-up, integrated approach to managing waste from the tourism industry and represents an innovative response to environmental challenges in a tourism area.

## **1.2. Research Goals**

The improvement of solid waste management is one of the challenges faced by tourist destinations in developing countries. Case studies about best practices are one way of increasing awareness about more sustainable approaches to solid waste management. This thesis provides a case study of the HSWM program in Bali to disseminate information about an innovative solid waste management program in a tourist destination. This study will explore who the stakeholders were in the HSWM program, what they did, and what issues they faced. Topics in the literature review will include tourism, sustainable development, appropriate technology, integrated waste management, cleaner production, life cycle assessment, environmental management systems and planning. These topics will be discussed in relation to the HSWM program. Conclusions, recommendations and future research directions will be presented at the end of the study.

The research objectives for the study were:

1. To provide a review of key concepts and issues related to solid waste management in developing countries;
2. To analyse and evaluate the hotel solid waste management (HSWM) program in Bali, Indonesia; and

3. To suggest recommendations and areas for further research.

The study of the Hotel Solid Waste Management (HSWM) program will enable the following questions to be explored:

1. What concepts and issues are relevant to the study of solid waste management in developing countries?
2. How did the HSWM program in Bali operate?
3. What lessons learned from the case study and literature review would be helpful for other programs and researchers?

### **1.3. Relevance of the Research**

In general, there is a lack of literature discussing how to implement integrated approaches to environmental management (Margerum and Born 1995). Regarding solid waste management in particular, there has been improvement regarding interest, research and expertise in integrated approaches in developing countries, however, there is a lack of information about local initiatives (Furedy 1997). There is a need for information to be shared, projects to be evaluated, and difficulties to be discussed (Furedy 1997).

This study addresses several research needs by providing a case study which has been evaluated in comparison with environmental management concepts, thereby helping to increase general understanding of solid waste management in developing countries and bridge the gap between theory and practice. Although the case study of the program reflects the program's specific history, context and conditions, the sharing of experiences and lessons learned may be of use to others to increase understanding of solid waste management in developing countries, and inspire the development of ideas and actions. The description and discussion of the SWM partnerships and operations at a material recovery facility (MRF) in a developing country can help others recognise and define the challenges they face. In particular, this case study provides an example of a SWM program developed through an NGO-business partnership that can be compared to public and private sector initiatives.

## **1.4. Structure of this Document**

This study is organised into six chapters. Following this introductory chapter, concepts and issues relevant to solid waste management in Asian developing countries are reviewed in Chapter 2. In Chapter 3, the methodology, methods, challenges and limitations of the research are described. Chapter 4 is the case study that provides a description of the hotel solid waste management (HSWM) program and an investigation of operational and management issues. Chapter 5 provides a summary of key findings from the case study and a discussion of the connection between the case study and concepts in the literature review. In Chapter 6, recommendations, areas for future research and conclusions are presented.

## **CHAPTER 2 LITERATURE REVIEW**

In this chapter, concepts and issues relevant to waste management in developing countries will be reviewed. To begin, the importance, impacts and initiatives of the tourism industry related to sustainable development will be introduced to provide the context for host regions that rely on tourism for economic development. Principles and goals of sustainable tourism and sustainable solid waste management will be reviewed to explore what sustainable development means to the tourism industry and solid waste management. The evolution of attitudes towards sustainable development will be explored by reviewing the stages of organisational development between environmental indifference and proactive environmental management.

A conceptual framework for integrated waste management, that includes stakeholders, waste management elements and strategic aspects, will be used to provide an overview of solid waste management in developing countries. This will be followed by a review of concepts relevant to solid waste management businesses in developing countries. The following topics will be introduced: appropriate technology, cleaner production, life cycle assessment, and environmental management systems. In the final section of this chapter, planning processes for solid waste management in developing countries are outlined.

### **2.1. Tourism**

Travel and tourism is a major economic force, generating an estimated US\$3.5 trillion in gross output in 2001 and estimated to generate US \$7.0 trillion in gross output in 2011, and employing an estimated 207 million people in 2001 and expected to employ 260 million people by 2011 (WTTC et al. 2002). In addition to employment, business opportunities and economic development, other benefits of tourism include infrastructure improvements, foreign exchange and tax revenues. These positive aspects of tourism can contribute to a country's development at the national, regional and local levels.



Conversely, tourism can also have negative impacts on the environment and communities, such as increased consumption of natural resources, consumerism and waste generation. Hotels often generate large quantities of solid waste, in the form of packaging materials, kitchen and garden waste, old furniture and equipment, and potentially hazardous waste such as asbestos and solvents (WTTC et al. 2002). Improper waste management can cause environmental degradation and loss of aesthetic appeal, through litter on beaches and streets, and illegal dumping and burning of garbage. Other potential negative impacts of tourism include: loss of agriculture land, clearing of mangroves, damage to coral reefs, resource conflicts over land and water use, higher land prices, overcrowding, and conflict with local communities (Tribe et al. 2000; Manuaba 1995).

Improper tourism management can result in the deterioration of the environmental and cultural resources that attracted tourists in the first place. Therefore, the tourism industry has a vested interest in protecting natural and cultural resources, reducing environmental impacts and preserving the beauty of destinations (Tribe et al. 2000; WTTC, WTO and Earth Council 1996). In addition to moral, social and political interests, greater resource efficiency makes economic sense because there are fewer resources being consumed in the first place and less waste requiring disposal in the end. The commitment of the tourism industry to sustainable tourism provides a necessary basis for implementing environmental management initiatives, such as the conservation of resources and disposal of wastes in an environmentally sound way.

Management activities to reduce tourism's negative impacts can be targeted at tourist behaviour and at the facilities that are providing amenities to tourists (Tribe et al. 2000). Institutions, governments and industry have begun to recognise the need for a systematic approach to environmental management, improved environmental practices and self-regulation (UNEP and IH&RA 1996). National environmental rating systems for hotels have also been developed to help consumers make decisions based on environmental and social criteria. These include Thailand's Green Leaf and Bali's Eco-Hotel Rating Program, as examples from a growing list. With these programs, waste reduction and

recycling in hotels is one of the required elements for demonstrating environmental responsibility (Wisnu 1998b). These national programs complement international initiatives such as the International Hotels Environment Initiative (IHEI), Green Globe, Tour Operators Initiative for Sustainable Tourism Development, and Global Code of Ethics for Tourism.

## **2.2. Sustainable Development**

In the context of tourism, sustainable development has been defined by the World Tourism Organization (1994) as:

“[meeting] the needs of present tourists and host regions while protecting and enhancing opportunity for the future. It is envisaged as leading to management of all resources in such a way that economic, social, and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity, and life support systems”.

In 1992, Tourism Concern and the World Wide Fund for Nature developed ten principles for sustainable tourism, as outlined in Table 1. These principles provide direction for developing tourism in a more sustainable manner. The principles for sustainable tourism address resource use, waste reduction, diversity, integration, local economies, community, stakeholders, training, marketing and research.

Similarly, the Bali Sustainable Development Project (BSDP) outlined criteria for sustainable development that addressed ecological integrity, efficiency, equity, cultural integrity, community, integration/balance/harmony, and development as a realisation of potential (as summarised in Table 2). The BSDP started in 1989, at the invitation of the Balinese government and financially sponsored by the Canadian International Development Agency (CIDA). The work was a collaborative effort carried out by universities in Bali, Java and Canada, provincial and central government in Indonesia, and NGOs. When preparing a sustainable development strategy for Bali, the BSDP recognised the important role that tourism played in Bali’s economy and the guidelines of stability, growth and equity in the Indonesian “Trilogy of Development”. Sustainable development was defined by the BSDP in Martopo and Mitchell (1995) as:

1. the continuity of natural resources and production,

2. the continuity of culture and the balances within culture, and
3. development as a process to enhance quality of life.

The environmental, economic and social considerations associated with the sustainable development paradigm can be integrated into the attitudes and behaviour of organisations. Stages of organisational development describing the integration of sustainable development principles have been identified by authors such as Clarkson (1995), Park (1996) and Klinkers et al. (1999). These stages of organisational development are outlined in Table 3. In general, the path towards sustainable development is described as moving from indifference or opposition to environmental requirements towards proactive measures that go beyond pollution standards.

The final stages of the models listed in Table 3 describe proactive organisations that internalise environmental costs as part of their responsibility towards society. This orientation is critical for the development of sustainable systems for resource and solid waste management. The internalisation of costs associated with waste management develops the long-term efficiency of the economy through the conservation and efficient use of materials, waste minimisation, and waste reuse, recycling and recovery (Schubeler, Wehrle and Christen 1996). When polluters pay for pollution prevention or mitigation, the price of goods and services reflect their true cost (Sheldon and Yoxon 1999).

**Table 1: Principles for Sustainable Tourism (Tourism Concern and WWF 1992)**

<b>Principle</b>	<b>Description</b>
1. Using resources sustainably	The conservation and sustainable use of resources – natural, social and cultural – is crucial and makes long-term business sense.
2. Reducing over-consumption and waste	Reduction of over-consumption and waste avoids the costs of restoring long-term environmental damage and contributes to the quality of tourism.
3. Maintaining diversity	Maintaining and promoting natural, social and cultural diversity is essential for long-term sustainable tourism, and creates a resilient base for the industry.
4. Integrating tourism into planning	Tourism development which is integrated into a national and local strategic planning framework and which undertakes environmental impact assessments, increases the long-term viability of tourism.
5. Supporting local economies	Tourism that supports a wide range of local economic activities and which takes environmental costs and values into account, both protects those economies and avoids environmental damage.
6. Involving local communities	The full involvement of local communities in the tourism sector not only benefits them and the environment in general but also improves the quality of the tourism experience.
7. Consulting stakeholders and the public	Consultation between the tourism industry and local communities, organizations and institutions is essential if they are to work alongside each other and resolve potential conflicts of interest.
8. Training staff	Staff training which integrates sustainable tourism into work practices, along with recruitment of local personnel at all levels, improves the quality of the tourism product.
9. Marketing tourism responsibly	Marketing that provides tourists with full and responsible information increases respect for the natural, social and cultural environments of destination areas and enhances customer satisfaction.
10. Undertaking research	On-going research and monitoring by the industry using effective data collection and analysis is essential to help solve problems and to bring benefits to destinations, the industry and consumers.

**Table 2: Sustainable Development Criteria for Bali (Martopo and Mitchell 1995)**

<b>Criteria</b>	<b>Description</b>
1. Ecological Integrity	To maintain life support systems, to preserve genetic diversity and to ensure the sustainable use of species and ecosystems
2. Efficiency	To evaluate alternative paths or methods of development in terms of costs (money, time, personnel and public convenience)
3. Equity	To strive for equality of opportunity and recognition of needs amongst individuals and households, social groups, genders, generations and species
4. Cultural Integrity	To foster the preservation and renewal of life-enhancing/celebrating traditions of the Balinese culture as expressed in religion, art and institutions
5. Community	To enhance local capabilities in participating in the development process and thus play a part in attaining other criteria, such as meeting basic needs, equity, ecological and cultural integrity
6. Integration / Balance / Harmony	To achieve greater integration between certain key factors, such as economy and environment, and agriculture and tourism
7. Development as a Realisation of Potential	To enhance the capabilities at all levels; from the village, to the province, to the national, to address needs and improve the quality of life

**Table 3: Stages of Organisational Development Regarding Environmental Management**

	<b>Clarkson's Types of Organisational Behaviour (1995)</b>	<b>Park's Stages of Evolution (1996)</b>	<b>Klinkers et al.'s Developmental Stages for Sustainable Business Development (1999)</b>
1.	Reactive (deny responsibility, do less than required)	General indifference	Output-oriented (reactive to environmental issues)
2.	Defensive (admit responsibility but fight it, do the least required)	Dawning of public awareness	Process-oriented (measurements of the process)
3.	Accommodative (accept responsibility, do all that is required)	Beginning of corporations' taking initiatives beyond what is legally required of them	System-oriented (improvements of the organisation's internal management and processes)
4.	Proactive (anticipate responsibility, do more than required)	Eco-efficiency becomes the main factor in corporate decision making	Chain-oriented (partnership with external parties in the product chain)
5.	-	Environmental costs are internalised in corporate accounting	Stakeholder-oriented (responsibility towards society)

### 2.3. Goals of Sustainable Solid Waste Management

The overall aim of establishing sustainable SWM systems is to meet the needs of all citizens, including the poor (Schubeler, Wehrle and Christen 1996). Jindal et al. (1998) identify the need for SWM to accomplish “a more hygienic, safe and pollution-free environment; cleaner and more comfortable living conditions, and a higher standard of living; reduction in diseases; and optimum utilization of resources”. Principles and goals of sustainable SWM proposed by various authors are outlined in Table 4.

**Table 4: Principles and Goals of Sustainable Solid Waste Management**

	<b>van de Klundert and Anschutz 2001</b>	<b>Schubeler, Wehrle and Christen 1996</b>	<b>Habitat 1994</b>
1.	<b>Equity:</b> all citizens are entitled to an appropriate waste management system for environmental health reasons.	Promote the health and well-being of the entire urban population	Minimise the production of waste
2.	<b>Effectiveness:</b> the waste management model applied will lead to safe removal of all waste.	Protect the quality and sustainability of the urban environment	Maximise waste recycling and reuse
3.	<b>Efficiency:</b> the management of all waste is done by maximising the benefits, minimising the costs and optimising the use of resources, taking into account equity, effectiveness and sustainability.	Promote the efficiency and productivity of the urban economy	Promote safe waste disposal
4.	<b>Sustainability:</b> the waste management system is appropriate to the local conditions and feasible from a technical, environmental, social, economic, financial, institutional and political perspective. It can maintain itself over time without exhausting the resources upon which it depends.	Generate employment and income	Expand waste collection and disposal services

### 2.4. Integrated Waste Management

To implement the goals of sustainable SWM, the various dimensions of SWM must be considered. Stakeholders, waste management elements and strategic aspects have been identified as key dimensions of integrated waste management (van de Klundert and

Anschutz 2001; Schubeler, Wehrle and Christen 1996; Yudoko 2000). The integrated approach to SWM is a response to failures of the conventional approach that treated SWM as a purely technical or economic operation, and involved the transfer of sophisticated technologies from industrialised countries (Jindal et al. 1998). The narrow focus of the conventional approach has been criticised as being economically costly, socially unsuitable and ecologically harmful (Guibbert 1991).

In response to dissatisfaction with the conventional approach, an integrated approach that is holistic, interconnective, goal oriented and strategic in nature has been proposed (Margerum and Born 1995). An integrated approach to SWM involves the diverse set of interconnected activities and issues related to SWM instead of just the simple transfer of waste to disposal sites (Bartone 2000; Fernandez 1997a; Jindal et al. 1998). The anticipated benefits of an integrated approach to waste management include: lower costs, better cost management and cost recovery, fewer health hazards, less environmental pollution, conservation of natural resources, better coordination and performance, greater impact at the local level, improved public participation, better image, and more income from tourism, fishing and agriculture (van de Klundert and Anschutz 2001; Bartone 2000).

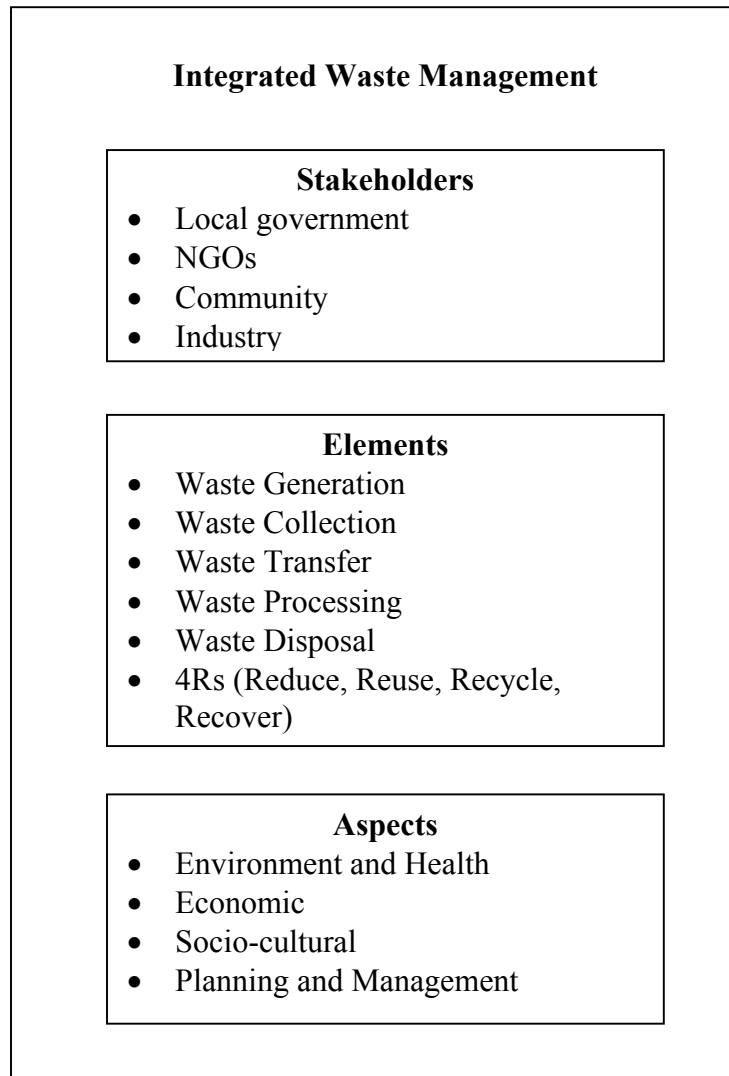
Integrated waste management has been defined in terms of dealing with all types and sources of solid waste (McDougall and Hruska 2000), combined technologies (Duston 1993) and the waste management hierarchy involving waste reduction, reuse, recycling, energy recovery and disposal (Center for the Study of Law and Politics 1991; Habitat 1994). Social and political issues, institutional arrangements, regulatory instruments, motivational activities, public health and stakeholder participation have also been included in definitions of integrated waste management (Fernandez 1997a; Claggett et al. 1998).

Conceptual frameworks for integrated waste management comprising of stakeholders, waste management elements (activities/options) and strategic aspects (objectives/issues) have been developed by authors such as van de Klundert and Anschutz 2001, Schubeler, Wehrle and Christen 1996, and Yudoko 2000. Based on these models, a conceptual

framework for integrated waste management is presented in Figure 1. This conceptual framework identifies stakeholders, waste management elements and strategic aspects as key components of integrated waste management. This framework will be used in the following sections to provide an overview of solid waste management in developing countries.



**Figure 1: Key Components of Integrated Waste Management Systems**



### **2.4.1. Stakeholders in Waste Management**

Citizen participation entails not merely “involving” residents to cooperate with waste management plans devised by city authorities; effective waste management comes when all citizens understand issues of resource use and waste production, realize the true cost of waste management, and are prepared to change their daily lives. Solid waste management planning must incorporate the concept of “stakeholders,” that is, the representation in planning of different interests that are central to resource consumption, waste production, and recycling.

Working Group III 1992, as found in Fernandez 1997a

The term “stakeholder” is often used to describe those participating in a decision making process, including those potentially affected by a decision and those knowledgeable about the subject of a decision (Alexander 1986). Use of the term “stakeholder” when describing actors in waste management therefore implies that these individuals or groups have specific concerns and roles to play in the subject of SWM (Fernandez 1997a).

There are a number of groups who have responded to the inadequacy of the existing solid waste management systems and become involved, such as the government, NGOs, community and industry stakeholder groups. These groups have been identified in the conceptual framework for integrated environmental management (Figure 1).

Cooperation between stakeholders in SWM is needed to implement sustainable SWM systems. Environmental management is often about managing tension and conflict between stakeholders who have different understandings, assumptions, values, priorities, interests, hopes, expectations and personalities (Mitchell 1997). Mitchell (1997) identified compatibility, respect, trust, integrity, patience, perseverance, distribution of benefits, equitable representation, communication mechanisms and adaptability as important elements of successful partnerships. Understanding the circumstances and positions of stakeholders can help in the resolution or minimisation of conflicts between stakeholders. The characteristics, roles and responsibilities of the stakeholders in solid waste management are briefly described in Table 5.

**Table 5: Partnership Roles in Promotion of Solid Waste Recycling and Reuse**

<b>Partner</b>	<b>Characteristics</b>	<b>Role and Responsibilities</b>
Local Government	<ul style="list-style-type: none"> <li>• Limited resources, needs to make use of all available resources in the community</li> <li>• Bureaucracy often restricts from meeting community expectations</li> <li>• Perceived as providers</li> </ul>	<ul style="list-style-type: none"> <li>• Policies and regulations should support integrated approaches</li> <li>• Facilitator</li> <li>• Develop programs and train participants, provide NGOs and community access to available infrastructure, information, technical expertise and skills</li> </ul>
NGOs	<ul style="list-style-type: none"> <li>• More responsive to communities than the government</li> <li>• Not regarded as providers, can motivate communities to meet their own needs and achieve self-reliance</li> <li>• May not be well developed, may have weak program design, may lack resources, may lack commitment and support of government</li> </ul>	<ul style="list-style-type: none"> <li>• Raise awareness, motivate, organize, and provide technical and managerial assistance to community and industry</li> <li>• Link together local government, community and industries, facilitate the expression of ideas</li> <li>• Help improve working conditions and raise the status of waste pickers</li> </ul>
Community	<ul style="list-style-type: none"> <li>• May lack resources, expertise, motivation and organisation</li> <li>• Often unwilling to pay for services because perceive government as provider</li> </ul>	<ul style="list-style-type: none"> <li>• Design, implement and manage projects with external assistance when necessary</li> </ul>
Industry	<ul style="list-style-type: none"> <li>• Formal and informal sector</li> <li>• Operating styles, business interests and loyalty developed among people in recycling businesses</li> <li>• Do not want others to interfere with their working relations and methods</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure market for source separated recyclables</li> <li>• Improve technology and working conditions, strengthen health and safety standards, improve industrial productivity and profitability</li> </ul>

Source: Habitat 1994

### **2.4.2. Waste Management Elements**

The functional elements of a solid waste management system typically include: waste generation (sources, quantity, composition, storage); collection; transfer and transportation; processing or treatment; and final disposal. Waste reduction, reuse and recycling have been incorporated in more comprehensive waste management strategies. In the design of an efficient and effective waste management system, each element of the waste management process and compatibility between elements must be considered (Jindal et al. 1998).

In developing countries, municipal solid waste contains on average around 50% organic matter and 30% recyclable materials, meaning that potentially 80% of waste can be recycled (Habitat 1994). Compared to industrialised countries, the waste is dense and has a high moisture content since it is composed primarily of organic matter (Habitat 1994). Per capita waste generation rates are lower in developing countries than in industrialised countries because of lower levels of prosperity and consumption, and extensive recovery and reuse of materials before and during waste collection (Jindal et al. 1998). In Indonesian cities, it is estimated that waste pickers reduce refuse quantities by one third (Furedy 1990).

Growing urban populations and increasing consumption levels result in increased waste generation. As well, industrialisation and modernisation result in changes in waste composition as products such as plastic bags replace banana leaves<sup>1</sup>. Uncontrolled dumping is widely practiced in Asian developing countries because of rapid urbanisation and lack funding, resources and space for landfills (Jindal et al. 1998).

Household source separation is not very popular in developing countries because people view the handling of waste as being “below an accepted level of social dignity” (Habitat 1994). Lack of source separation of solid waste increases inefficiencies in the recycling system because materials become contaminated and dispersed (Jindal et al. 1998). Recycling through source separation has been found to provide more materials that are of better quality compared to waste picked out of mixed waste streams (Furedy 1997). However, source separation is a relatively new topic compared to studies of waste pickers (Furedy 1997).

Waste reduction, reuse, recycling and recovery (the 4Rs) is being promoted as a way of reducing disposal costs, reducing the burden on landfills and reducing environmental impacts. The environmental benefits of the 4Rs include: reduction of greenhouse gases, reduction of pollution of air, land and water, conservation of water, energy and resources, and reduction of the amount of waste requiring disposal (Center for the Study of Law and

Politics 1991). In the major cities of Asia, the recycling industries already have the technological skills, equipment and processes for recycling most kinds of wastes (Habitat 1994). However, large quantities of solid wastes still remain for disposal in Asian countries, indicating that the potential to recycle larger quantities of waste exists (Jindal et al. 1998). A study of waste management in Bangkok, Jakarta, Kanpur, Karachi and Manila indicated that the average recycling rate is 7.5%, however, the estimated potential recycling rate is between 70-80% (Habitat 1994).

The viability of recycling operations depends on local circumstances and technical, organisational and economic considerations (Jindal et al. 1998). The success of hundreds of reprocessing enterprises in developing countries demonstrates the viability of recycling endeavours (Marti, 1991; Lardinois and van de Klundert, 1995). However, “[virtually] all of the opportunities for easy and profitable recovery are already being exploited” (Jindal et al. 1998:94). Making recycling a viable endeavour is challenging because of collection, transportation, sorting, cleaning and processing costs involved with upgrading the quality of recycled materials (Jindal et al. 1998). Waste management planners interested in the possibility of increasing waste recovery must address the challenges associated with “mixed wastes which make up most of the solid waste currently disposed of without recovery” (Jindal et al. 1998:94).

Waste is viewed as a resource when economic incentives exist. A clear economic incentive to recover materials exists when materials “are available in pre-separated, concentrated and relatively uncontaminated form, e.g., in industrial sectors, and where the materials have high inherent value and, collection and processing costs are comparatively low” (Jindal et al. 1998:94). Local small-scale reprocessing industries can make reasonable profits when investment requirements are relatively low, waste materials are cheap, and production processes are relatively reliable and technically uncomplicated (Lardinois and van de Klundert, 1995; Thanh, Lohani, Tharun 1978).

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<sup>1</sup> The use of plastic bags to package and carry goods has proliferated in Asia. Asians produce a higher proportion of plastic waste than Europeans and Americans (Jindal et al. 1998:92).

In most cities of Asian developing countries, resource recovery is managed predominantly by the informal sector (Jindal et al. 1998). These traditional waste recycling activities provide employment opportunities and are cheaper to operate than western systems of waste management (Haight 1995). The informal sector's recycling activities are common not because of ecological concerns, but because they are a means of alleviating poverty and improving economic livelihoods (Razeto and Hemelryck 1991; Fernandez 1997a).

Materials of value are recovered at various stages of the waste management system (i.e. storage, collection, transfer and disposal). Although seeming to be casual, the informal sector's waste recovery activities can be highly organised (Jindal et al. 1998). There can also be a high level of specialisation in materials selected for recovery and a high level of creativity involved with home-based recycling activities (Thomas-Hope 1998).

Itinerant waste buyers travel door-to-door purchasing waste items from householders. Waste pickers recover items of value along streets, at transfer stations and at dumpsites. In some countries, municipal waste collectors salvage materials during collection (Jindal et al. 1998). Materials are sold to waste dealers, who in turn sell the materials to waste wholesalers and manufacturers (Furedy 1990).

### ***2.4.3. Strategic Aspects of Solid Waste Management***

There are various perspectives to consider when seeking to obtain an integrated view of SWM in developing countries. An introduction to SWM issues in developing countries will be provided for the following perspectives: environment and health, economic, socio-cultural, and planning and management.

#### **2.4.3.1. Environment and Health**

In developing regions of Asia such as Indonesia, improper disposal of solid waste is a major source of environmental pollution (Listyawan 1997). Wisnu (1999b) estimated that 60% of solid waste is not collected or disposed of properly in Bali, and is instead

dumped in “informal” landfills, the ocean or along the side of roads. The need to improve public cleansing and solid waste management has gained the attention of citizens, government and industry in Indonesia (Listyawan 1997).

Waste is unsightly and malodourous, polluting land, air and water, clogging drainage systems, posing serious public health risks, and restricting potential land use (Pernia 1992; Haan, Coad and Lardinois 1998). Spontaneous ignition of gases and deliberate burning are common at dumpsites (Thomas-Hope 1998). The burning of garbage releases smoke and hazardous substances. Leachate from the waste can contaminate soil, surface water and groundwater. Mosquitoes that can carry dengue fever and yellow fever breed in fresh water from accumulated rainfall in cans and bottles (Pinnock 1998).

Disease vectors such as mosquitoes, flies, cockroaches and rodents thrive on solid waste (Pinnock 1998). The pathways of direct and indirect contact identified include insects, rodents, pigs, birds, air and water pollution, and food contamination (Pinnock 1998). Similarly, Fedorak and Rogers identified three mechanisms by which micro-organisms could be disseminated from a waste disposal site (1991). The first mechanism was leachates into groundwater, the second was airborne particles, and the third was life forms that consume or pick up microbes. Waste such as facial tissues, pet feces, soiled diapers and putrescible food may contain large numbers of micro-organisms (Fedorak and Rogers 1991).

In developing countries, amenities for workers’ welfare are normally absent (Jindal et al. 1998). People working in the waste management sector can encounter a number of work related health concerns such as pain, illness, stress, injuries, accidents and emergencies. Waste pickers at dump sites report numerous negative health effects, such as eye irritations, respiratory diseases, asthma, leg cramps, backache, pain in arms, dental problems, parasitism, intestinal disorders, diarrhoea, skin diseases, severe headache, lacerations, puncture injuries, minor accidents and mental health problems (Lohani and Baldisimo 1991; Pinnock 1998). Factors that contribute to these ailments include unsanitary conditions (smoke, dust, faecal matter, rats, insects), unhealthy practices (food

contamination), heavy loads, handling operation, mechanised equipment, nature of the materials handled, extent to which safeguards are employed (gloves, boots, etc.) and availability of cleaning facilities (Lohani and Baldisimo 1991; Lardinois and van de Klundert 1995; Pinnock 1998).

Workers often do not use safety equipment such as facemasks, ear plugs, gloves and proper footwear, and there is a need for education about health and safety issues (Thomas-Hope 1998). The lack of precautions, unsafe practices, noise, high temperatures, polluted atmosphere (dust, hazardous chemicals), contaminated waste, and long working hours in many working areas present serious health hazards (Lardinois and van de Klundert 1995; Habitat 1994). There is a need to improve standards and strengthen labour and health regulations, however, even when regulations exist, many informal recycling activities do not comply with them (Lardinois and van de Klundert 1995). Lack of enforcement of legislation is a common problem in Asian developing countries (Jindal et al. 1998).

#### **2.4.3.2. Economic**

In Bangkok, Jakarta, Kanpur, Karachi and Manila, on average around US\$15 million is spent annually on waste collection and disposal per city (Habitat 1994). The collection and transportation stages are usually the most expensive components of the system (Jindal et al. 1998). Although municipal governments spend 30-50% of their operating budgets on solid waste management, they are generally able to collect only 60-70% of the solid waste in cities (Habitat 1994).

Waste recycling can reduce waste disposal costs for local authorities by extending the life of landfills, reducing the need to invest in transport vehicles and equipment, reducing vehicle operation and maintenance costs, and reducing fuel consumption for transporting waste (Habitat 1994). Businesses are provided with cheap raw materials. In several countries, steel, paper and glass industries are dependent on recycled materials (Jindal et al. 1998). The use of recycled materials reduces the need to import raw materials, meaning that less money is spent on foreign currency. Banning the import of foreign



waste helps prevent the destruction of local markets for recycled materials, and the health and environmental problems associated with contaminated waste (Habitat 1994).

Local conditions affect the attractiveness of recycling for local entrepreneurs. The costs associated with using recycled materials can be higher than those for virgin materials if virgin materials are available in concentrated form and have a more homogeneous composition (Jindal et al. 1998). It is easiest to find markets for high quality, readily accessible waste materials. Mixed, contaminated, low value waste materials offer less potential for recovery and reprocessing. A recycling rate of 7.5% results in an annual cost reduction of over US\$1 million in each city, therefore, the potential cost savings from improving the recycling rate are even greater (Habitat 1994). An estimated 1% of the urban population is involved in the recycling sector, however, if the recycling system were to be developed to its potential, as much as 2-3% of the urban population could be employed in recycling activities (Habitat 1994).

Recycling is a labour-intensive activity with relatively low start-up costs, providing opportunities for employment and income generation for a great number of people as waste pickers, itinerant waste buyers, waste dealers, workers in recycling businesses, business managers and entrepreneurs (Lardinois and van de Klundert, 1995). Waste recycling often serves as an entry point into the urban economy, providing participants with economic benefits, higher social status, on-the-job training and business opportunities (Marti 1991; Panwalkar 1991).

#### **2.4.3.3. Socio-cultural**

Although waste management projects that focus on human development and community participation sound promising, they do not come easily (Mungai 1998). Changing the attitudes and behaviour of people in developing countries can be a challenging task if a culture of cooperation and enforcement mechanisms is lacking (Thomas-Hope 1998). Although there is some awareness of waste management problems, greater appreciation of SWM issues (such as waste minimisation) is needed at all levels of society (UNCRD 1994, as found in Fernandez 1997a).

In Asian countries, the general public is “still unmindful of its crude ways of disposing of wastes” (Jindal et al. 1998:43). Vandalism, social alienation and disregard for property are not uncommon (Thomas-Hope 1998). Premature introduction of SWM reforms could result in adverse effects such as “illegal dumping, burning of household garbage and the bribing to collection staff to take up materials for which they are not responsible” (Figueroa 1998:39).

In developing countries, a cultural transformation is needed to solve waste management problems (Figueroa 1998). Cultural transformation can be measured in terms of changes in perceptions regarding roles and responsibilities concerning waste and the environment in general, and participation in formal and informal organisations (Figueroa 1998; Thomas-Hope 1998). Environmental education and student involvement are needed to cultivate ecological literacy and empower the public to investigate issues, make decisions and take action (Collins-Figueroa 1998; Figueroa 1998). Education and public awareness are key elements of any strategy involving public participation and source separation, however, it takes time to raise awareness and gain public support. The minds and behaviour of the population need to be redirected towards the shared goal of maintaining a beautiful, clean and healthy environment (Thomas-Hope 1993).

Environmental awareness and the willingness of people to voluntarily participate in waste reduction and sorting programs are indicators of social capital in the environmental field (Figueroa 1998). In response to SWM problems and growing environmental awareness, citizen groups have begun to participate in waste management projects in Asian cities (Furedy 1997). Community participation, incentives and legislation must be based on citizens understanding environmental issues (e.g. resource use, waste production, waste management costs) and being prepared to change their daily lives (Working Group III 1992, Figueroa 1998). Development of this social capital involves cultivating popular consciousness, knowledge, organisation and experience to support significant changes in behaviour patterns, social interactions and relationships between individuals and between the individual and society (Figueroa 1998).

The relationship between waste pickers and society is an important issue in SWM in developing countries. The contribution of waste pickers to waste recycling is often not appreciated by governments and residents who tend to view waste pickers as outcasts who are a nuisance and security threat (Chaturvedi 1998). Many politicians and residents oppose waste pickers because they can interfere with collection and dumping operations (Jindal et al. 1998; Thomas-Hope 1998). In general, people involved with waste management have “very low social and economic standing because society perceives that dealing with something which is dirty and thrown away by others is demeaning” (Habitat 1994).

The informal sector often comprises of poor and lowly educated people who have migrated to the cities from rural areas in search of employment (Habitat 1994). Waste pickers face low social esteem, long work hours, precarious conditions and health hazards (Jindal et al. 1998). Within the informal recycling sector, waste pickers receive the lowest profit margins and are often vulnerable to exploitation by waste dealers (Habitat 1994). Changes to the waste management system can threaten the means of survival for people working in the informal sector (Lardinois and van de Klundert 1995). To improve the welfare of waste pickers, integration of waste pickers into the SWM system has been promoted (Chaturvedi 1998). However, this can be challenging because of resistance to waste pickers who are suspected to be involved with illegal activities (Furedy 1997). Furedy (1997) promotes source separation efforts, as well as continuing efforts to improve living and working conditions for the poor, with recognition that the different goals of stakeholders in SWM can lead to conflict regarding street picking, public health concerns and efficient management of solid waste.

#### **2.4.3.4. Planning and Management**

Planning and management of solid waste in developing countries is a complex undertaking because of the need to balance environmental goals (such as waste reduction), social goals (related to waste pickers), contextual factors (such as income disparity) and stakeholder interests (such as health, safety and aesthetics) (Furedy 1997;

Fernandez 1997a). Compromises are necessary because of the potential tension between different goals and conflict between stakeholders (Furedy 1997). The environmental approach to SWM based on the principles of “reduce, reuse, recycle and recover” provides a basis for partnerships to improve SWM in developing countries (Furedy 1997).

The interaction and cooperation of stakeholders is necessary for implementation of an integrated approach to solid waste management. Interaction is identified by Margerum and Born as the key operational element for integrated environmental management (1995). The participation of stakeholders enables the needs of people to be targeted more effectively and ownership to be enhanced (Shubeler 1996). Stakeholders whose capacities should be employed and developed during the planning and management of solid waste include governments, businesses, the informal sector, civil society and the general public (Schubeler, Wehrle and Christen 1996).

The involvement of the private sector in SWM has emerged as an approach to addressing SWM problems in developing countries (Cointreau-Levine 2000; Fernandez 1997a). Some reasons for the efficiency and cost-effectiveness of the private sector in SWM (as described by Cointreau-Levine 2000, and Haan, Coad and Lardinois 1998) are:

1. the private sector can deliver services at lower cost than the public sector because of competition and motivation to maximise profits;
2. the private sector aims to please clients and therefore is accountable;
3. the private sector has less bureaucracy and more flexibility in hiring and terminating staff, paying staff according to performance, and adjusting work hours to meet demand; and
4. the private sector is reliable because contracts outlining specific performance measures enable standards of operation to be achieved and penalties to be incurred if services are not provided.

The four basic types of arrangements for SWM by micro- and small enterprises (MSEs) identified by Haan, Coad and Lardinois (1998) are: private enterprises that work to make a profit; co-operatives that provide mutual support for workers; community-based enterprises that are established to meet a local need; and labour contracted by an individual or social organisation to meet a local need. Haan, Coad and Lardinois (1998)

conclude that the best arrangement for SWM is when the durable motivation to earn money is complemented with concern for public welfare and the environment. Reasons for the lack of survival of MSEs that depend on donations, subsidies and volunteers include: the dependence of community-based enterprises on the leadership of one person, the greater sense of accountability and improved motivation associated with the commercial approach, and the fact that the desire to work together can be destroyed by minor disputes (Hann, Coad and Lardinois 1998).

## **2.5. Key Concepts for Solid Waste Management**

Conceptual tools relevant to forming a private sector approach to sustainable SWM in developing countries will be reviewed in this section. The concept of appropriate technology is a response to past failures of conventional Western technical approaches that did not adequately consider local conditions and complexities. Cleaner production and life cycle assessment involve looking beyond “end-of-pipe” solutions by considering impacts from “cradle-to-grave”. Environmental management systems provide a planning framework that can integrate concepts such as appropriate technology, integrated waste management, cleaner production and life cycle assessment into systems for managing waste.

### **2.5.1. *Appropriate Technology***

For the effectiveness and overall success of any waste management program as a part of urban and rural planning in developing countries the key concept is appropriate technology.

Jindal et al. 1998:4

Western countries have provided assistance in SWM to developing countries with the narrow view of SWM as a technical problem (Jindal et al. 1998). The logic of donor countries can be summarised as follows: “1. *They have a solid waste problem. 2. We have solved our solid waste problem with this machinery. 3. If we supply this machinery, their solid waste problem will also be solved.*” (Haan, Coad and Lardinois 1998). The “blind technology transfer” of machinery from western countries to developing countries has brought attention to the need for appropriate technology (Jindal et al. 1998). Quick solutions involving complex machinery from industrialised countries are often

inappropriate for developing countries that may lack the resources for proper operation and maintenance (Haan, Coad and Lardinois 1998).

For the transfer of technologies to be successful, the conditions in developing countries must be considered, such as widespread unemployment, low wages for unskilled labourers, and shortages of organisational capacities, trained and experienced professionals, land, funds and amenities for workers (Ahmad 1989; Jindal et al. 1998; Thomas-Hope 1998). Differences in concerns regarding waste management are outlined in Table 6.

**Table 6: Comparison of Industrialised and Asian Developing Countries Regarding Solid Waste Management Concerns**

<b>Concern</b>	<b>Industrialised Countries</b>	<b>Asian Developing Countries</b>
Global implications	Global climate change	Reduction of imports Protection against entry of toxic and hazardous wastes
Economics of operation	Cost recovery	Cost reduction
Concern about management alternatives	Meeting recycling targets	Need to prolong life of ultimate disposal sites
Natural setting	Temperate zone	Warm and moist tropics
Waste characteristics	High percentage of paper, plastics and cans	High percentage of organic waste; variation in moisture content (seasonal) and combustibles
Technology choice	Environmentally safe alternative Development-oriented decisions	Low-cost alternatives More expedient solution Politically-motivated
Citizens and government interphase	Years of learning from experience High educational level of citizens	Lack of trained and experienced personnel Low level of environmental awareness and civic pride of citizens
Emphasis of urban planning and design	Amenity	Health
Desirable level of service	Realistic, “do-able” within wide range	Makeshift measures Response to complaints

*Source: Fernandez 1997a*

Technologies from industrialised countries cannot simply be imported to developing countries without modification (Thomas-Hope 1998). Imitations of foreign technologies

have often failed to produce appropriate solutions to waste management problems in developing countries since they did not respond to local needs (Guibbert, 1991). Examples of expensive, large-scale technologies include modern trucks, central recovery centres, mechanised composting plants, incinerators and sanitary landfills. Once external help from foreign agencies is removed, these large-scale technology-intensive projects often fail to function effectively and cease to operate after the first breakdown (Jindal et al. 1998). Since developing countries often lack the know-how and experience that industrialised countries have accumulated over the past few decades, projects could not be sustained because of their cost and complexity (Fernandez 1997a).

Successful planning for solid waste management in developing countries depends on the selection and adaptation of appropriate strategies for the context of developing countries (Ahmad 1989; Jindal et al. 1998; Thomas-Hope 1998). Technologies need to be appropriate for the circumstances in developing countries, availability of scientific, technical and financial resources, as well as socio-economic concerns such as poverty alleviation, employment generation, economic growth and reduction of imports (Fernandez 1997a). Geographic, socio-cultural, institutional, technical and economic factors affecting SWM in developing countries are outlined in Table 7.

For solid waste management, appropriate technology means addressing differences in waste characteristics, using local resources, and selecting simpler technologies, such as small-scale windrow composting instead of mechanised composting plants (Jindal et al. 1998; Fernandez 1997a). The operating characteristics, performance, training and maintenance requirements, and life-cycle costs of technologies need to be assessed during the technology selection process to determine their suitability (Shubeler, Wehrle and Christen 1996).

**Table 7: Factors Affecting Solid Waste Management**

<b>Factor</b>	<b>Description of Factor</b>
Location and topography	<ul style="list-style-type: none"> <li>• type of terrain will affect transportation, storage, treatment and disposal options</li> <li>• availability of natural resources will affect waste generation</li> </ul>
Land area	<ul style="list-style-type: none"> <li>• availability of land will affect facilities for waste management</li> </ul>
Climate and seasonal cycles	<ul style="list-style-type: none"> <li>• temperature, rainfall and humidity will affect the frequency of collection and the breeding of flies and vermin</li> </ul>
Population and population density	<ul style="list-style-type: none"> <li>• population will affect waste generation and population density will affect how waste is stored and collected</li> </ul>
Rural infrastructure	<ul style="list-style-type: none"> <li>• rural lifestyle, social and cultural traditions, practices, incomes, education, awareness, etc. affect waste generation and disposal practices</li> </ul>
Urban infrastructure	<ul style="list-style-type: none"> <li>• income level, modernisation, traditions, service charges, type of settlement and littering habits affect waste generation, composition, separation, level of service and disposal practices</li> </ul>
Industrialisation	<ul style="list-style-type: none"> <li>• industrial developments create wastes that are more complex and toxic in nature</li> </ul>
Standard of living	<ul style="list-style-type: none"> <li>• higher degree of development, standard of living and consumption of packaged products will increase waste generation and affect waste composition</li> </ul>
Economy	<ul style="list-style-type: none"> <li>• the income of the country will affect the amount of funds available for SWM</li> <li>• higher income results in higher consumption level and waste output increases proportionally to growth of the gross national product (GNP) (Jindal et al. 1998:21)</li> </ul>

Sources: Claggett et al. 1998; Fernandez 1997a; Jindal et al. 1998 and Pinnock 1998.

### **2.5.2. Cleaner Production**

Cleaner production involves evaluating and redesigning products, processes and services to obtain environmental and economic benefits. This concept can be used to expand the scope and role of waste management from dealing with wastes to managing society's resources (i.e., sustainable integrated resource and waste management). Waste management can be regarded as "an interface between the production, distribution and consumption of goods on the one hand, and soil, groundwater, air and climate on the other" (ISWA and UNEP, 2002).

UNEP Industry and Environment introduced the term "cleaner production" in 1989 and defined it as the continuous application of an integrated preventive environmental



strategy to processes, products and services to increase eco-efficiency and reduce risks for humans and the environment. Other terms, such as source reduction, waste minimisation, pollution prevention, enhanced productivity and green productivity, convey the same idea as cleaner production, with the aim of considering life cycle impacts, decreasing consumption of resources and production of wastes, and increasing productivity (Park 1996; Huisingh 1989; Yamada 1996). By examining the life cycle of products and services, problems can be identified and processes changed to either prevent or reduce the generation of waste (e.g., using less resources, selecting input materials that are less environmentally harmful, selecting products with a high recycled content). Often, cleaner production options are low-cost housekeeping techniques that require ingenuity and little financing, with payback periods ranging from less than one year to three years (Boazhong 1996; Huisingh 1989; Yamada 1996).

The anticipated benefits of adopting preventative approaches such as cleaner production include protection of the environment, reduced risks to humans, improved productivity and competitiveness, and reduced costs of governmental regulatory efforts, waste management and clean-up (Huisingh 1989). Financial benefits can be achieved through decreases in raw materials costs, waste management costs, energy down-time costs, worker health risks, environmental hazards and long-term liability for clean-up of waste materials that might otherwise have been buried (Baozhong 1996; Huisingh 1989). A company can benefit from improved product quality, productivity and company public image, as well as increased competitiveness of products in national and international markets (Baozhong 1996; Huisingh 1989).

Countries such as Indonesia are developing programs for implementing cleaner production. The Indonesian environmental impact management agency's (BAPEDAL) Cleaner Production Program will involve activities such as technical assistance, training, guidelines, demonstration projects, and audits. It is hoped that developing countries can 'leapfrog' ahead to the preventative cleaner production approach, and skip the costly end-of-pipe<sup>2</sup> approach. The cleaner production paradigm represents a shift away from end-of-

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<sup>2</sup> End-of-pipe approaches treat emissions and wastes to reduce toxicity and environmental impacts after the process.

pipe pollution control to pollution prevention. There is a growing awareness within industry and government that end-of-pipe approaches are not as effective or efficient at achieving the goals of cleaner air, land and water as preventative approaches such as cleaner production (Huisingsh 1989).

In South East Asia, a major shortcoming of cleaner production demonstration projects has been a lack of self-promoting and sustained adoption of cleaner production (Bunyagidj and Greason 1996). Instead of becoming a tool for continual improvement, cleaner production ends up being a one-time initiative (Bunyagidj and Greason 1996). Without adequate management, evaluation and auditing techniques, the adoption of cleaner production is not sustained (Bunyagidj and Greason 1996). In response to this failure, Bunyagidj and Greason recommend making cleaner production an integral part of an ISO 14001-certified environmental management system (EMS). An EMS can provide a framework that helps companies incorporate and continuously review cleaner production policies and practices. The EMS framework is reviewed in Section 2.5.4.

### ***2.5.3. Life Cycle Assessment***

The consideration of life cycle impacts is an integral part of a cleaner production strategy and can aid in the evaluation of SWM options. Life cycle assessment (LCA) is a tool for analysing environmental effects associated with the life cycle of a product or service. Examining impacts from cradle-to-grave involves identifying environmental impacts (such as air and water pollution, resource consumption and habitat loss) associated with the procurement of raw materials, production, distribution, consumption and disposal. LCA is a decision making tool that can enable the best environmental and cost options to be chosen (UNEP and IH&RA 1996).

Applied to the tourism industry, an LCA could be performed to assess the impacts associated with transport, resource use and infrastructure operation (Tribe et al. 2000). For solid waste management, different technologies, financial costs and environmental impacts are associated with each element of waste management, such as waste collection and disposal, as well as waste reduction and recycling (Schubeler, Wehrle and Christen 1996; Thomas-Hope 1998).

Lifecycle inventories and models (e.g., White et al. 1995) have been developed to assess environmental impacts and costs associated with solid waste management. These models can address various sources and types of waste, as well as waste minimisation and treatment options. Use of these models can help the planner of SWM systems evaluate various options based on environmental impacts and costs, however, socio-economic factors (e.g., providing employment opportunities) are often not included in these models and may need to be addressed separately.

#### **2.5.4. Environmental Management Systems**

Environmental management systems (EMSs) provide a framework that can help organisations incorporate tools such as cleaner production and life cycle assessment (Bunyagidj and Greason 1996). EMSs involve the achievement of environmental goals through the management of environmental aspects in a consistent way. Environmental goals are set by the organisation and achieved through the control of operations. The EMS framework is based on Shewhart and Deming's "Plan, Do, Check, Act" cycle and requires that the organisation be committed to managing environmental issues, ensuring compliance, adopting a pollution prevention approach, and increasing environmental awareness and stewardship.

EMSs can be applied in the absence of industry standards and regulations since they are process-based not performance-based (Rice 2002). Voluntary approaches such as environmental management systems have been recognised as an effective method of encouraging businesses in the tourism industry to improve their environmental performance in the absence of legislative enforcement (WTTC et al. 2002). However, voluntary approaches have been criticised for legitimising activities that degrade the environment, pre-empting imposed regulations, leading to stereotypical approaches and allowing 'free-rider' companies to gain competitive standing (Forsyth 1997). Therefore, EMSs may not be a substitute for effective and enforced environmental regulations but they can facilitate compliance and enable organisations to go beyond regulations and adhere to best practices.

ISO 14001 is the voluntary standard for environmental management systems developed by the International Organisation for Standardisation. ISO 14001 was designed as a generic standard for organisations from any industry. The ISO 14001 standard for environmental management systems is anticipated to be one of the most significant international initiatives for sustainable development (IISD 1996). ISO 14001 certification is a recognised indicator of environmental concern that can help enhance an organisation's image and competitiveness.

Benefits of EMS implementation can include increased productivity, compliance with environmental legislation, operational consistency, and marketing advantages and improved stakeholder relationships through the demonstration of commitment of environmental management excellence (Rice 2002; Tribe et al. 2000). Although the effect of EMS adoption on SWM in developing countries is still unclear (Fernandez 1997a), it has the potential to help organisations be aware of the impacts associated with solid waste and develop solutions to address waste management problems. In industrialised countries, municipal solid waste management departments such as the Waste Management Division of the Regional Municipality of Waterloo and King County Solid Waste Division in Seattle, Washington have implemented environmental management systems.

Transparency and reporting of the activities of the tourism industry have been identified as issues that need to be further addressed (WTTC et al. 2002). For the tourism industry, a number of global voluntary initiatives have been initiated, such as the International Hotels Environment Initiative, Green Globe, Green Leaf, Green Key and Ecotel. These programs seek to raise environmental awareness and improve environmental performance in the tourism industry through guidance materials, certification programs and ecolabels (WTTC et al. 2002). Support services can include training, education and guidelines that focus on best practices, cost-saving techniques, operational issues, and corporate policy matters. These programs can help companies of various sizes and types (e.g., hotels, office facilities, restaurants and catering facilities, tour operators and travel agents,

transport, and visitor attractions) to improve environmental management and obtain recognition for their level of commitment and environmental performance.

WTTC et al. (2002) observe that the enforcement of regulations and verification of environmental performance is highly complex for the hospitality sector, which consists primarily of small to medium sized enterprises. Self-regulation has been promoted as a viable way of managing the various environmental aspects associated with hotel operations that do not typically fall under the control of any one monitoring agency (WTTC et al. 2002). The need for specific performance indicators was one of the issues highlighted by non-industry stakeholders (WTTC et al. 2002).

## **2.6. Planning and Solid Waste Management**

Solid waste management is a component of urban planning that can involve government, academia, industry, NGOs and communities. Since there are various stakeholders, elements and aspects to consider in SWM, often there is no easy solution. The multiple objectives and challenges involved with planning for SWM mirror the issues discussed in planning literature.

Friedmann (1987) described planning as linking scientific and technical knowledge to action in the public domain, processes of societal guidance and processes of social transformation. Dluhy (1986) described planning as being a technical and political activity, requiring planners to think analytically and politically (i.e., to be both interdisciplinary and interparadigmatic). An interdisciplinary approach to planning is required since planners need to integrate various branches of scientific and technical knowledge to gain insight in addressing complex planning problems. An interparadigmatic approach is needed to understand and integrate various stakeholder perspectives.

There is a diversity of approaches and theories that attempt to describe how planning is done or should be done. The classic rational-comprehensive approach describes problem solving as a series of steps. These steps typically include problem definition, formulation

of goals and objectives, comprehensive data gathering for the identification and comparison of alternatives, selection and implementation of the preferred option, monitoring and evaluation. Although the approach is appealing because of its thorough and logical nature, for solving real life planning problems, numerous inadequacies have been identified. Rittel and Webber (1973) described planning problems as “wicked” problems that are difficult to define and the by-product of another problem. The inability of the rational-comprehensive approach to handle “wicked” problems has led to criticisms related to the lack of time and resources for gathering comprehensive information (inadequate knowledge) and multiple competing interests instead of a common interest (conflict).

To address the inadequacy of the rational-comprehensive approach, other perspectives of planning have emerged. These include the incremental, strategic, adaptive and transactive approaches, among others. Lindblom’s (1959) incremental approach describes how in reality, people muddle through, considering only a few options that differ slightly from the existing situation. The strategic approach lies between the rational-comprehensive and incremental approaches, and involves focussing on key components and relationships to achieve results. The adaptive approach involves treating initiatives as experiments and learning from experience. The transactive approach described by Friedmann (1973) involves interaction with stakeholders and mutual learning.

Depending on the situation, planners can play a variety of roles. For clearly defined problems, the traditional role of the planner as technical expert, acting in the public’s interest and following an orderly, rational approach may be appropriate. For problematic situations, where multiple perspectives, assumptions and potential solutions may exist, the planner may play a mediating role between competing interests, acting as a facilitator and addressing social concerns. This leads to a broader definition of problems and the associated challenges with deciding on priorities and dealing with incompatible expectations.

### **2.6.1. Solid Waste Planning Process**

New forms of participation are required in the management of solid waste in developing countries, as the causes and consequences go beyond the capacity of a single national authority to address them satisfactorily. Management must also equip existing actors and encourage others. In addition to public sector authorities and private companies, the community needs to be involved through citizen's associations, neighbourhood groups, local government committees and councils and non-governmental organizations (NGOs) of all types, whether focusing upon the community or the environment. The activities have then to be carried out within the arrangements of the regulatory frameworks designed for the handling of solid waste as a major aspect of present-day environmental management.

Thomas-Hope 1998:6

In the past, the approach to waste management in developing countries was ad hoc, fragmented and uncoordinated, characterised by the notion “out of sight, out of mind” (Claggett et al. 1998; Fernandez 1997a; Thomas-Hope 1998). There was short-term crisis management instead of long-term planning, a lack of data for planning, and minimal stakeholder involvement in SWM master plans (Fernandez 1997a). A proactive approach dealing with waste before it is produced, and planning for changes such as economic and population growth, is needed in developing countries to deal with increases in waste generation and pollution (Fernandez 1997a; Thomas-Hope 1998).

An integrated approach has been proposed as a way of addressing SWM (van de Klundert and Anschutz 2001). Integrated approaches attempt to blend strategic analysis and stakeholder interaction. The role of the planner in integrated approaches involves creating opportunities for interaction among key actors, such that values and preferences are integrated with scientific and technical knowledge (Hart 1986). The integrated approach to environmental management has also been described as a situation where a “diverse group of stakeholders comes together, shares information and perspectives, fosters mutual understanding, and develops a collaborative approach to managing an environmental system” (Margerum 1999).

Interaction with stakeholders (also known as public participation) can serve a variety of purposes, such as providing and gathering information (learning process), contributing to

a sense of involvement (building support for decisions or redistributing power), and improving the quality of decisions (better services rendered) (Alexander 1986). Unfortunately, these objectives can be competing, incompatible or conflicting. As in industrialised countries, the NIMBY (“not in my backyard”) syndrome is present in developing countries, making SWM a political issue that may not follow the rational-comprehensive planning model (Fernandez 1997a).

Models of the planning process for SWM as a series of logical steps have been described by agencies and authors such as the World Bank (Wilson et al. 2001) and WASTE advisers (van de Klundert and Anschutz 2001), as presented in Table 8. These models are based on the understanding that the planning process must integrate strategic elements, functional waste system elements and stakeholder interests. The model by WASTE advisers explicitly presents opportunities for stakeholder participation. In general though, both models are examples of the rational-comprehensive approach. As noted by Fernandez (1997a), the planning process for SWM in developing and industrialised countries is political, and therefore, may not follow logical steps as described by the World Bank and WASTE advisers.



**Table 8: Planning Process for Solid Waste Management**

	<b>Strategic Solid Waste Planning Process (Wilson et al. 2001)</b>	<b>Steps for Developing a Sustainable Waste Management System (van de Klundert and Anschutz 2001)</b>
1.	Mobilise the planning process	Start a participatory planning process
2.	Define the baseline	Analyse the existing waste management situation
3.	Establish the strategic planning framework	Publish and circulate the findings of the analysis
4.	Identify and evaluate options	Formulate a draft action plan and budget, including a plan for cost recovery
5.	Develop the strategy	Present the action plan to the stakeholders and incorporate their comments and input
6.	Prepare the action plan	Refine and formulate a final action plan, which is approved by the City Council or other legislative body
7.	Implement the strategic plan	Implement the action plan and monitor the results

## **CHAPTER 3 RESEARCH METHODOLOGY**

### **3.1. Research Approach**

The research approach for the case study was primarily qualitative. Quantitative data about solid waste, wastewater and program finances were collected to complement qualitative information in the case study. The research approach for this study can be characterised as grounded theory, naturalistic, inductive and ethnographic.

Qualitative research is defined by Cresswell (1994) as “an inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting”. This approach was appropriate for exploring, describing, explaining and evaluating a program and context that was unfamiliar to the researcher. The case study approach allows a researcher to investigate the richness and complexity of a phenomenon within its context using multiple sources of evidence (Yin 1993).

### **3.2. Research Methods**

Information was gathered using a variety of methods to gain a better understanding of the situation, issues, perspectives and priorities. Data collection methods included document/literature review, semi-structured interviews, questionnaires and observation.

#### **3.2.1. Document and Literature Review**

Literature concerning solid waste management in developing countries was reviewed. Documents were collected from various sources in Canada, Thailand and Indonesia, such as universities, industry associations, foreign agencies, government institutions and NGOs.

#### **3.2.2. Interviews**

Interviews in Bali were conducted with key informants from recycling businesses, NGOs and the tourism industry. To learn about the Hotel Solid Waste Management (HSWM)

program, the researcher interviewed staff from Wisnu (local environmental NGO), the material recovery facility (MRF) operated by Jimbaran Lestari (private sector waste hauler), and hotels participating in the HSWM program. The MRF is located in Jimbaran (south of Kuta, near the airport) and the NGO is located in Denpasar. Hotels participating in the HSWM program are located primarily in the tourist areas of Jimbaran, Nusa Dua, Sanur and Kuta. Figure 2 provides a map of Bali. Appendix 4 provides a list of key informants and data collection methods employed.

Both management (owner, manager, supervisors) and workers (compost, wet waste, dry waste, drivers, assistants) were interviewed at Jimbaran Lestari. Successive conversations with MRF and Wisnu staff were helpful for gaining a better understanding of the issues that emerged. An initial set of questions was prepared in advance and additional questions were asked as the interviews were conducted. The use of semi-structured interviews was appropriate for the case study because its flexibility allowed topics to be explored as appropriate. During interviews with respondents who did not speak English, a research assistant translated questions and summarised responses while the researcher took notes.

**Figure 2: Map of Bali**



*Source: IndonesiaPhoto.com*

### **3.2.3. Surveys**

A survey was designed with feedback from Wisnu to obtain information about the objectives and priorities of directors and managers at Wisnu and Jimbaran Lestari. Perceptions of staff (non-management) were investigated qualitatively through semi-structured interviews and observation. The survey was given to four people from the NGO and three people from the MRF. Three people from the NGO and one person from the MRF completed the survey. The survey questions and responses are provided in Appendices 1 and 2, respectively. As needed, the survey was translated into Bahasa Indonesia and responses were translated into English. The responses about specific issues in the survey are summarised in the “Investigation of Issues” found in Section 4.4.7.

A survey to obtain information about the concerns of the hotels was sent to the ten hotels participating in the HSWM program. The survey questions are provided in Appendix 3. Only one hotel responded. This response helped to inform the researcher about the

perspective of a hotel for the case study. When the research was being conducted, one hotel decided not to renew its contract with the HSWM program. In addition, there was conflict between key program stakeholders and personnel changes were occurring. Therefore, the researcher decided that it was not an appropriate time to follow up with hotel survey responses. With the exception of a few hotels that were open and enthusiastic about their environmental programs, in general, obtaining access to hotels was a challenging task.

#### **3.2.4. Observation**

Field work pertaining to solid waste management in developing countries was conducted between June 1999 and May 2000 in South East Asia. This included site visits to hotels, NGOs, MRFs, recycling companies, informal recycling shops, waste transfer stations, community areas, composting facilities, incinerators, landfills and informal dumpsites in Indonesia and Thailand. These field visits helped familiarise the researcher with SWM practices and challenges in developing countries of Asia.

To learn about the HSWM program's operations and the perceptions of program participants, daily activities at the MRF were observed and issues were discussed informally with staff at the NGO and MRF. Field research focussing on the HSWM program was conducted between the middle of October 1999 and March 2000, with a one month interruption from mid-December to mid-January to attend a conference in Bangkok where initial research findings were presented. In March 2000, the feasibility of anaerobic digestion as a method of further reducing waste quantities was investigated with the assistance of a member of the NGO.

### **3.3. Data Analysis**

Unlike statistical analysis, there are few fixed formulas or cookbook recipes to guide the novice [in case study analysis]... Instead, much depends on an investigator's own style of rigorous thinking, along with the sufficient presentation of evidence and careful consideration of alternative interpretations... The ultimate goal is to treat the evidence fairly, to produce compelling analytic conclusions, and to rule out alternative interpretations

Yin 1984:99-100

Both qualitative and quantitative data were used to describe and evaluate the HSWM program. Qualitative data analysis involved reviewing documents and classifying data into similar categories and themes. Quantitative data were tabulated.

A qualitative approach to analysis of survey data was used because of the small sample size (i.e., one respondent from the MRF and three respondents from the NGO). The importance ratings from the respondents are ordinal data. To provide a comparison of NGO and MRF survey responses, the minimum and maximum values of the NGO responses were compared to the MRF response. If the MRF response was within the minimum and maximum values of the NGO responses, the MRF response was considered to be similar to the NGO's response. If the MRF response was outside of the minimum and maximum values of the NGO responses, the MRF response was considered to be dissimilar.

As discussed in Section 3.2, the researcher's understanding of the program was gained through a combination of methods that included observation at the MRF, hotels and NGO, survey responses, interviews and informal discussion with key informants, and review of documents. Triangulation through the collection of data through various sources enabled findings and perceptions about the program to be verified. For the synthesis and presentation of information from these sources, the researcher used the integrated waste management framework and the framework of issues as identified in the MRF and NGO survey. The use of these frameworks enabled the multiple stakeholders, activities and aspects of the program to be explored and presented in a logical and coherent way.

### **3.4. Challenges and Limitations**

Doing research involves tackling a number of challenges because reality often differs from what is planned. In this section, challenges and obstacles encountered during the research process are identified.

### **3.4.1. Culture and Language**

Research assistants were needed for translation of interviews and documents. In Indonesia, members of the Wisnu Foundation provided research assistance. Having research assistants for translation instead of being able to speak directly with those interviewed may have resulted in misunderstandings. Being a foreigner unaccustomed to the culture could also have resulted in misinterpretations of data, observations and discussions. Some of the people interviewed were hesitant about talking with a foreign female researcher. The investigation of health issues could have been affected by the following factors: a lack of awareness of health risks, an acceptance of blame for injuries (because workers thought they were not being careful enough), an awareness that finding a job was difficult and other jobs involved risks, and the perception that hotel waste was harmless.

The researcher observed that there was a greater reluctance to discuss problems and be critical of the program when interviews were conducted in the presence of management level staff. In small group discussions with employees when no management level staff were present, employees were more candid about revealing the ideas they had about what was being done well and how things could be improved. Therefore, for future research, informal small group discussions with employees performed by a researcher fluent in Bahasa Indonesia and without the presence of management level staff would be the best way to elicit the ideas of MRF employees. In general though, it seemed that most employees from the MRF were comfortable leaving decisions to management.

### **3.4.2. Lack of Accessibility**

The Wisnu Foundation helped the researcher gain access to Jimbaran Lestari (the MRF) and the hotels participating in the HSWM program. As acknowledged by Yin (1993:43) “For business organisations especially, the problem of gaining access can be a serious problem”. Even with the support of research assistants from the NGO, gaining access to hotels could be challenging unless the NGO’s director was present.

### **3.4.3. Topic Changes**

A conceptual framework for the case study was not developed before the research began because the HSWM program emerged as a research topic after the researcher's original topic (plastics recycling) was abandoned. Performing research while in the field is a research process known as "field access opportunism" (Yin 1993). Data collection was conducted prior to a clear definition of study questions and issues. People involved with the HSWM program recommended different areas of research. This uncertainty led to the design of the survey to assess program priorities. The researcher was informed that the library at the local university had burned down and was advised to review literature upon return to Canada after the field research. Yin warns that "only an experienced investigator is likely to be successful in following the nonlinear path" (Yin 1993:111). As the researcher was relatively inexperienced, following a nonlinear path for an ill-defined problem was a challenging task.

### **3.4.4. Program Evaluability**

When evaluating a program, it is easy to "be biased or plain wrong" (Alexander 1986:4). Evaluation of the HSWM program was challenging because goals and objectives were not clearly defined and agreed to, performance measurements were not in place, and people did not agree about what information should be gathered and how it should be used. Problems resulting from these types of challenges can include irrelevant or unrepresentative questions, program failure to meet unrealistic goals, inconclusive findings, and unwillingness or inability to act on evaluation findings (Shaw 1999).

### **3.4.5 Limited Generalisability**

The survey of program priorities was only designed to assess the priorities of the primary decision makers at the NGO and MRF. Therefore, the findings of the survey cannot be extrapolated to a wider population (i.e., all staff at the NGO and MRF). Issues identified in the survey and perceptions of staff were investigated through semi-structured interviews with staff and observation of operations at the MRF.



The conclusions drawn from the case study of the HSWM program are expected to apply to other tourism areas in developing countries outside of Bali (i.e., other tourism areas in Indonesia, Asia and other developing countries) with conditions and challenges similar to those in Bali. However, since the case study findings reflect the HSWM program's specific history, context and conditions, the findings from this research should be understood to be most directly applicable to Bali.

## **CHAPTER 4**

### **CASE STUDY OF THE HOTEL SOLID WASTE MANAGEMENT PROGRAM**

#### **4.1. Bali**

Bali is a tropical island with a population of approximately three million. Located just south of the equator, Bali enjoys warm temperatures, plentiful rains and gentle winds. Covering around 5,000 square kilometres, Bali extends 140 kilometres from east to west and 80 kilometres north to south (Eiseman 1990).

The Balinese have a strong Hindu culture that involves participation in ceremonies for temple festivals and lifecycle rites. Daily offerings consisting of flowers, food and money are presented to the gods at shrines, temples, houses, businesses and roads. The Balinese have a strong belief in magic and spirits, close family ties, a sense of mutual responsibility and obligation, and community groups that control social, religious and economic affairs (Eiseman 1990).

The Balinese philosophy of life is based upon Tri Hita Karana (THK) which refers to the relationship between a human being and other human beings, a human being and the environment, and a human being and the supreme God (Haight 1995). Balinese culture has endured in the face of external forces and provides a “foundation for development planning” (Rendha 1995). As in the rest of Indonesia, the family and local community are important social groups for social change (Widianto 1993).

Bali’s unique culture, Hindu temples, long white sand beaches, coral reefs, terraced rice paddies and volcanic mountains create the image of a tropical paradise that draws tourists from around the world (Bater 1995; Manuaba 1995). Tourism has become a dominant activity in Bali, playing a vital role in its economy and development (Bater 1995). In 1998, Bali was the most important tourism destination in the Indonesian Archipelago, receiving over two million foreign tourists (Juniartha and Syahreza 2000). Since the late 1980s, tourism in Bali has grown rapidly (Manuaba 1995). In 1999, there were 1,022 hotels in Bali, corresponding to 31,372 hotel rooms (Juniarta and Syahreza 2000).

Tourism has brought many changes and challenges, such as resource conflicts over land and water use, environmental degradation, inequitable distribution of economic benefits, and pressure on Balinese cultural traditions (Manuaba 1995). Employment opportunities have been created that benefit the local people and attract migrants from other islands. The development of tourist facilities and services, growth of population and intensification of agricultural have put pressure on Bali's resources, land and water, making resource management a challenging task (Bater 1995). In areas where there is great demand for water for urban, industrial and tourist-based developments, groundwater supplies are extracted faster than they are recharged, resulting in salt water intrusion (Bater 1995).

## **4.2. Waste Management in Bali**

One of the challenges posed by tourism is the management of waste produced by tourists, tourist facilities, and economic and population growth accompanying tourism development. In the absence of proper waste collection coverage and proper disposal sites, it is estimated that 60% of solid waste in Bali is dumped in vacant lands, rivers and roadside ditches (Wisnu 1999b). Litter in rice paddies, ravines, streams, beaches and the sea decreases the island's aesthetic appeal. The common 'dump and burn' method of disposal is unsightly and unhealthy, attracting vermin and resulting in the pollution of land, air and water (Wisnu 1999b). Air pollution is caused by the burning of refuse such as plastic that releases toxic chemicals into the air, and water pollution is caused by the residual waste that is dumped in rivers and flows down to the mangrove areas or into the ocean (Wisnu 1999b).

The Wisnu Foundation estimated that 18% of total waste generated in Denpasar and Badung came from the tourism industry (Suarnatha 1999). Each hotel room in Bali generates an estimated 9.2 kg of waste per day (Wisnu 1999b). In Indonesia, per capita waste generation rates were 0.65-0.83 kg/day in large cities, 0.55-0.63 kg/day in medium cities and 0.47-0.5 kg/day in small towns (Jindal et al. 1998). Therefore, the amount of waste generate per hotel room is over ten times the amount of waste generated per day per capita.

According to a study by the Wisnu Foundation in 1995, 80% of waste in Bali is organic. Although the proportion of plastic, metals and paper was relatively small in 1995, it was expected that the quantities of inorganic materials would increase as the standard of living increased. The consumption of plastic packaging products such as plastic bottles and plastic bags has increased steadily in recent years. The increasing quantity and changing composition of waste creates the need to find better waste management solutions. As in many developing countries, the local government is unable to cope with the increasing amounts of waste.

In the year 2000, the waste generation rate for Denpasar was approximately 1,500 m<sup>3</sup>/day (300 tonnes/day) (Juniarta 2000). This waste generation rate is an increase from the estimated waste generation rates of 796 m<sup>3</sup>/day in 1982 and 1,400 m<sup>3</sup>/day in 1987 (Doberstein 1992). Denpasar's landscape and sanitation department operates trucks to collect waste from markets, streets and temporary storage areas, however, these trucks are not in good condition and not capable of collecting all the waste generated in Denpasar (Juniarta 2000). Approximately 438 m<sup>3</sup> of the 796 m<sup>3</sup> of urban solid waste generated per day in 1982 was collected and disposed of at the Suwung TPA<sup>3</sup>, approximately 1,050 m<sup>3</sup> of the 1,400 m<sup>3</sup> per day in 1987, and approximately 1,121 m<sup>3</sup> of the 1,400 m<sup>3</sup> per day in 1990 (Doberstein 1992). This means that approximately 300 to 350 m<sup>3</sup>/day of urban solid waste remained uncollected during this period of increasing waste generation (Doberstein 1992).

In Bali, businesses such as hotels, restaurants, supermarkets and shopping centres that produce more than two cubic metres of waste per day are responsible for their own waste management services. At the Suwung TPA, small trucks with a capacity of around four cubic metres pay a 2500 rupiah<sup>4</sup> retribution fee and large trucks with a capacity of around six cubic metres pay a 3500 rupiah retribution fee (Prendeville and Billington 1999). Unfortunately, instead of travelling the distance to the official dumpsites and paying the retribution fee, it is common for waste haulers to dump their loads at 'unofficial'

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<sup>3</sup> In Bahasa Indonesia, the final dumpsite is called the 'tempat pembuangan akhir' (TPA).

<sup>4</sup> In 1999, CDN\$1 = 4700 rupiah.

dumpsites. As in many developing countries, the private arrangements for waste collection made by business, industry and hospitals often result in inappropriate and illegal dumping practices (Thomas-Hope 1998).

Solid waste is managed in each of the eight regencies<sup>5</sup> and city of Denpasar by the office of cleanliness and gardening (DKP<sup>6</sup>), with each regency having a final dumpsite (TPA). The largest final dumpsite is located in Suwung and receives the waste from Denpasar. Although the Suwung TPA was designed to be a sanitary landfill with leachate treatment, inadequate funds and management have caused it to become a simple open dump filled far beyond its intended capacity (Doberstein 1992). Doberstein (1992) identified a water quality study that showed contamination of fisheries products was occurring because of leachate migration from the disposal site. The Suwung TPA continues to operate even though it was originally scheduled to close in 1989 because there are no alternative dumpsites (Doberstein 1992).

### **4.3. Recycling in Bali**

In Bali, as in other developing countries, there is a network of waste pickers (pemulung<sup>7</sup>) and waste dealers (middlemen and agents<sup>8</sup>) that recover waste materials. The informal solid waste recovery system in Indonesia is illustrated in Figure 3. In Bali, there are thousands of waste pickers, about sixty middlemen and five agents (Pak Bidin, Ibu Basri, waste dealers in Bali, pers. comm. 1999). The benefits of this informal recycling network are employment, reduction of collection and disposal costs, conservation of natural resources, and provision of raw materials at a comparatively low cost.

Waste pickers recover items of value such as food, plastics, metals and paper from waste at households, transfer stations and dumpsites. Waste pickers earn between 4,000 and

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<sup>5</sup> The eight regencies are: Badung, Tabanan, Bangli, Gianyar, Karangasem, Klung Kung, Buleleng, and Jembrana.

<sup>6</sup> In Bahasa Indonesia, the office of cleanliness and gardening is called the 'Dinas Kebersihan dan Pertamanan' (DKP).

<sup>7</sup> 'Pemulung' is the Indonesian title for waste pickers (also know as scavengers).

<sup>8</sup> Agents are bigger players in the waste recycling sector than middlemen.

10,000 rupiah per day<sup>9</sup> (Prendeville and Billington 1999). Recovered food is fed to pigs. Recyclables are collected using bicycles with bins or pushcarts and sold to waste dealers. The prices for recyclables bought and sold by waste recyclers in Bali are shown in Tables 9 and 10. Recyclables are sorted, weighed, packaged and sent to bigger agents or factories in Surabaya or Jakarta in Java. Agents typically deal with waste volumes valued at 200 to 300 million rupiah per day (Ilham 1999, pers. comm.).

**Table 9: Prices for Recyclables Bought and Sold by a Middleman in Suwung, Bali**

Item	Bought (rupiah per kilogram)	Sold (rupiah per kilogram)
Thin Cardboard	100	150
Thick Cardboard	400	550
Iron (metal)	250	400
Thick Plastic	550	750
Plastic	300	800
Paper	200	350

In 1999, CDN\$1 = 4700 rupiah.

Source: Prendeville and Billington, 1999

**Table 10: Prices for Plastics Bought and Sold by a Plastics Recycler in Bali**

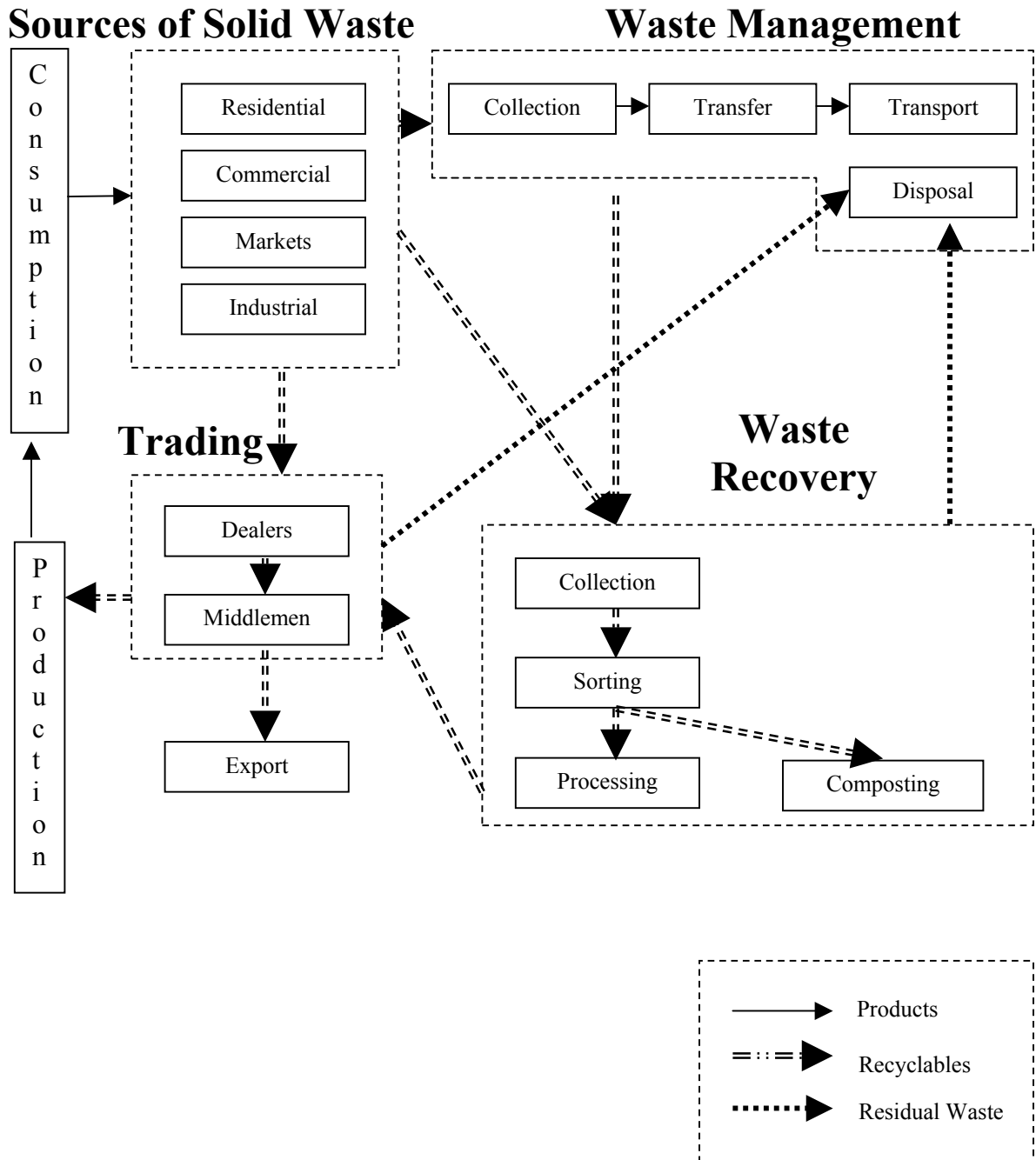
Item	Bought (rupiah per kilogram)	Items (after sorting and chopping)	Sold (rupiah per kilogram)
Mixed dirty plastic	1000	Low quality plastic	300
Mixed clean plastic	1500	Chopped PET (polyethylene terephalate)	2000
-	-	Chopped HDPE (high density polyethylene – mixed)	4000

In 1999, CDN\$1 = 4700 rupiah.

Source: Interview with a plastics recycler, December 1999

<sup>9</sup> The average minimum wage in Bali is 180,000 rupiah per month or 6,000 rupiah per day.

Figure 3: Informal Solid Waste Recovery in Indonesia (adapted from Furedy 1990)



## **4.4. Hotel Solid Waste Management Program in Bali**

The case study of the HSWM program in Bali will provide a description of how the program became established, including how it was planned, managed and operated. The process of building relationships with hotels and the elements of the SWM system will then be described. In particular, information about the wastewater treatment system and the management of waste data will be provided, since these elements may not typically be included in informal waste management systems. Finally, the interests of stakeholders involved in the program and various issues of concern for the program will be explored.

### **4.4.1. Program History**

Eight Indonesian professionals established the Wisnu Foundation in 1993 in response to concerns about environmental degradation in Bali. The Wisnu Foundation is a local non-governmental organisation (NGO) dedicated to conserving the environment in harmony with local culture. Wisnu became involved in hotel waste management in 1994 when asked to perform a solid waste audit for a starred hotel in Bali. Wisnu recommended a system involving source separation and onsite composting, and facilitated the implementation of the new system.

In 1995, the hotel's waste hauler met with members of Wisnu because he felt his business was being threatened by the new waste management system. In Bali, there has been a very close relationship<sup>10</sup> between local private waste haulers and hotel waste management (Wisnu 1998b). After discussion and planning, a better understanding was reached and a partnership formed between Wisnu and the waste hauler. In 1995 and 1996, Wisnu and the waste hauler worked together to negotiate contracts with starred

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<sup>10</sup> Local waste haulers began collecting waste from hotels informally to support their pig farming (Wisnu 1998). Valuable materials that could be reused, recycled or fed to animals were recovered while residual waste was dumped and burned in vacant lands, adjacent to waterways that enable residual waste to be carried towards the ocean (Wisnu 1999b). Lack of money, training, land, equipment and connections are some of the reasons why waste haulers often did not manage hotel waste properly (Wisnu 1999b).



hotels in southern Bali. The material recovery facility (MRF) operated by the waste hauler is a private company called Jimbaran Lestari<sup>11</sup>.

In 1996, three five-star hotels in Jimbaran and Nusa Dua signed contracts with the waste hauler's company, Jimbaran Lestari. In June 1997, two more starred hotels signed contracts with Jimbaran Lestari. In June 1997, with funding from the Asia Foundation and US-Asia Environmental Partnership (US-AEP) NGO-Business Environmental Partnership Program, Wisnu approached ten hotels and a waterpark in southern Bali to become part of the integrated solid waste management system. The project involved compiling baseline data, preparing training sessions and manuals for hotels and waste haulers, monitoring, reporting and information dissemination (see Table 11 for the project schedule) (Wisnu 1998b).

In the end, none of the companies originally approached as part of the US-AEP project decided to join the program<sup>12</sup>, however, several other hotels expressed a strong desire to participate in the program (Wisnu 1998b). In hindsight, Wisnu (1998) acknowledged that the reduction to three participants made the project more manageable. From 1997 to 1999, an additional six hotels signed contracts with Jimbaran Lestari, bringing the number of participating hotels up to eleven. At the end of 1999, one hotel decided not to renew its contract.

In 1997, the waste hauler and Wisnu designed, expanded and improved the facility for sorting waste and making compost. The design of the facility was based on a material recovery facility from overseas. More workers were hired for hauling and sorting, work areas were improved, storage areas for the recyclables were prepared, and a wastewater treatment plant for wastewater from washing floors, bins and trucks was built. The initial capital investment came from a bank loan and a member of Wisnu (see Table 12). The

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<sup>11</sup> Lestari means everlasting in Bahasa Indonesia. Jimbaran is a traditional coastal community located in Southern Bali, just south of the Ngurah Rai airport. Jimbaran faces the Indian Ocean and is home to a commercial fishing industry, a beautiful white sand beach, and tourist facilities such as shops, restaurants and hotels.

<sup>12</sup> Wisnu (1998) speculated that hotels were reluctant to join the program because of disunity among the group members to "go green" and perceived financial constraints.

local waste hauler owned the site and truck, and was the largest shareholder. Wisnu wanted to ensure that the local waste hauler had ultimate ownership and decision making power.

At the beginning of the year 2000, the Jimbaran Lestari MRF had 42 employees and six trucks. It occupied an area of approximately 1500 square metres. There were ten hotels participating in the program that generated around 9 tonnes of waste per day.

Recyclables were sold to six waste dealers and kitchen waste was sold to 50 pig farmers. Wisnu estimated that 18% of total waste generated in Denpasar and Badung came from the tourism sector and that the HSWM program handled 20% of tourism sector waste (Suarnatha 1999).

During the year 2000, the program began working on the construction of new facilities and workstations to improve efficiency and double the MRF's capacity to manage waste. The program's plans were to expand the number of participants from ten hotels to twenty to twenty-five hotels. It was expected that the amount of waste handled by the MRF would increase from being around ten tonnes per day to being around twenty tonnes per day. The better layout would improve the flow of activities (e.g., truck maneuvering). The new wet waste workstations would allow sorters to stand at the edge of the elevated floor and pull the waste towards them to sort the waste into two bins (one for pig feed and another for residual waste). The way of handling dry and garden waste would remain the same. Using a trolley, the residual waste would be transported to a press to reduce the volume of the residual waste and remove the remaining liquid. This could decrease the number of truckloads transported to the final dumpsite and prevent liquid from leaking from the trucks. A new wastewater treatment system, laundry facilities and a canteen were also to be added.

**Table 11: Project Schedule for Implementation of the HSWM Program**

Activities	Phase I: Survey and Preparation				Phase II: Implementation					Phase III: Review		
	1	2	3	4	5	6	7	8	9	10	11	12
Commitment of Hotels, Contract Agreement	xx	xx										
Collecting Baseline Data	xx											
Data Compilation	x	x										
Strategic Planning		x	x									
Training Manuals, Posters, Handbook			xx	x								
Selecting and Training Waste Haulers			x	xx								
Setting-up Hotel's Internal System				xx	xx							
Training for Hotel Employees					xx							
Project Monitoring, Assistance to Hotel & MRF Employees for Day-to-Day Operations, Recording System, Composting Program					x	x	x	x	x	x	x	x
Project Review					x	x	x	x	x	x	x	x
Interim Report						xx						
Troubleshooting					x	x	x	x	x	x	x	x
Report Writing (Monthly Solid Waste Report)					x	x	x	x	x	x	x	x
Press Release										x	x	
Information Dissemination										xx	xx	
Final Report											xx	xx
BUDGET ALLOCATION (in US\$)	14 690				19 617					12 137		
Percentage	31.63%				42.42%					26.13%		

Source: The Wisnu Foundation

**Table 12: Financial Profile of the HSWM Program**

Year	Waste Hauler (% of budget)	Member of the Wisnu Foundation (% of budget)	Hotel Contracts (% of budget)
1995	65%		35% (3 hotels)
1996	63%		37% (5 hotels)
1997	21%		79% (7 hotels)
1998		42%	91% (7 hotels)
1999			116% (10 hotels)

*Source: Jimbaran Lestari*

#### **4.4.2 Management of the MRF**

The MRF was owned and managed by the waste hauler's private company, Jimbaran Lestari. As described in the contract between the waste hauler and NGO, the NGO assisted the waste hauler with management issues such as building relationships with stakeholders (e.g., hotels, waste dealers, and government) and defining financial and design requirements for the MRF (e.g., costs, layout and facilities). The waste hauler was responsible for supervising personnel and daily operations, and deciding how resources were allocated. Based on the researcher's observations and discussions with MRF managers and staff, there appeared to be a sense of pride regarding the waste hauler's management system, and a commitment to managing the staff and facilities well and making improvements.

The following description of the internal management system at the MRF is based on information obtained by the researcher through interviews with managers and staff at the MRF. The waste hauler had supervisors for the different work areas acting as communication links between employees and upper level management, and responsible for paying attention to employee issues. As described by one supervisor, problems were addressed by having employees talk with the supervisor in the work area. The supervisor would then alert the manager of the problem and the manager would then tell the senior supervisor to solve the problem. Since problems could be observed on a daily basis, supervisors said they knew what was important and did not need to write down what was happening. As such, complaints, problems, issues, accidents and injuries were rarely

recorded in writing, and there was no formal performance evaluation of staff. Everyday, the supervisors could evaluate all the staff because they could see whether people were working or not. If there were a problem with an individual, then they would talk with that person individually.

MRF employees were recruited by asking current employees to ask family and friends. The waste hauler had the freedom to dismiss people who were not working hard or performing tasks as required, as demonstrated by the turnover of workers in the compost area. The fact that a woman who was older and got sick was still employed by the waste hauler seemed to be an indication that management had a sense of compassion and took care of its employees. There was a two-hour meeting every month where employees got their wages, talked with the boss and brought up problems either directly or through their supervisor. Interviews with staff indicated that this was considered to be sufficient.

#### ***4.4.3. MRF Contracts and Operations***

In this section, the development of contracts and operations are summarised based on the researcher's observations, interviews and documents provided by the Wisnu Foundation (Wisnu 1997 a & b, 1998, 1999 a, b & c; Suarnatha 1999). The waste hauler's contracts with hotels were based on operational costs and standard operating procedures. The NGO helped the waste hauler negotiate agreements and contract values so that hotels received proper waste management services and the waste hauler was paid fairly to maintain proper operations. Hotels signed a yearly contract with the waste hauler and paid a monthly hauling fee as part of their implementation of the polluter pays principle. Typical start-up, operational and maintenance costs for waste hauling and composting services are outlined in Tables 13 to 17. Photographs of the HSWM program are provided in Appendix 5.

Some of the factors considered when negotiating the contract agreement were the number of rooms, the hotels' room rates (ability to pay), the condition of the hotel garbage rooms and loading dock, the distance of the hotel from the material recovery facility, and initial, operational and maintenance costs. The value of the hotel solid waste hauling services

contracts ranged between 1,700,000 and 4,813,000 rupiah per month (equivalent to CDN\$350-1000 per month).

The location of the MRF near the hotels and final dumpsite was important for efficient waste transportation. The size of land for the MRF needed be large enough to provide space for: sorting wet waste, dry waste and garden waste; composting; parking trucks; storing recyclables and residue; treating wastewater; and having an office, washrooms, canteen and housing (see Table 18 and Figures 4 and 5). Equipment such as hoses, plumbing system, septic tank, trolleys, bins, bamboo waste baskets, brooms, shovels and mops were purchased. Trucks were needed for hauling the waste from the hotels to the material recovery facility and to the final dumpsite. The trucks had to have third party liability insurance for the security of the hauler, the hotel and other parties. Tarpaulin covers for the trucks were purchased to prevent littering while waste was being transported.

The waste hauler composted garden waste for four hotels that lacked their own space for onsite composting. As part of the garden waste contract with hotels, a specified amount of compost was provided each month to the hotels for their gardens. Extra compost was given to the NGO, which sold the compost to gardeners, farmers and other consumers. Two hotels had their own onsite compost facilities. The rest of the hotels hired another waste hauler for their garden waste and were reluctant about committing to the added cost of composting as opposed to disposing of garden waste at the dumpsite. One hotel had tried doing its own composting but had stopped after a few weeks because of problems with insects.

Employees were recruited, trained and provided with uniforms. Training and equipment such as boots, gloves and face masks needed to be provided for health and safety reasons. Contacts with waste dealers and pig farmers were established to ensure the sale of recyclables and pig feed. Formal arrangements and contracts were arranged when necessary. The sale of recyclables, pig feed and compost provided revenue for the program (see Table 19: Prices for End Products from the HSWM Program).

Record keeping procedures, a scale and logbooks were needed to report the amounts of waste generated by the hotels, the amounts of end products after sorting (recyclables, pig feed, compost, wastewater and residue) and comments. Using this information, monthly waste reports were prepared detailing the types and quantity of waste recycled, the amounts of residue, and items such as kitchen utensils that were returned to the hotel. The NGO was responsible for conducting yearly reviews of the waste data and waste management system, and performing ongoing troubleshooting, monitoring and evaluation of standard operating procedures. Monitoring was regarded as important for gaining information about amounts of waste recycled and costs avoided. Evaluation was important for determining whether the program was meeting its goals, what strategies worked best, and how to proceed.

**Table 13: Start-up Costs for a Material Recovery Facility for a 400 Room Hotel**

<b>Item</b>	<b>Estimated Cost in US\$</b>
Land Purchase – 500 m <sup>2</sup>	<b>16,667</b>
<b>Construction Cost</b>	
Office – 6 m <sup>2</sup>	750
Storage – 25 m <sup>2</sup>	938
Sorting Facility – 40 m <sup>2</sup>	667
Bottle Storage – 40 m <sup>2</sup>	417
Toilets	375
Septic Tank	200
Garage	375
Fence	656
Total Construction Cost	<b>4,377</b>
<b>Installation Cost</b>	
Electricity and Telephone	<b>375</b>
<b>Vehicle Cost</b>	
Purchase of 5-Tonne Truck and Bed	<b>22,917</b>
<b>Material Costs</b>	
Water Pump & Well	396
Water Heater	417
Fly Killer	271
Trash Bins (15)	93
Shovels (2)	4
Hoses (6)	8
Scale	104
Truck Cover	31
Total Materials	<b>1,323</b>
<b>Personnel Uniforms and Equipment</b>	
Uniforms – 6 Employees	88
Boots, Masks, Gloves	59
Total for Uniforms and Equipment	<b>146</b>
<b>Consulting Fees – Wisnu Foundation</b>	
Planning, Site Selection, Impact Assessment and Training of Personnel	<b>1,698</b>
<b>TOTAL START-UP COSTS</b>	<b>47,503</b>

*Source: The Wisnu Foundation (converted to US\$ using US\$1 = 2400 rupiah because the costs were calculated in 1996 before the economic crisis.)*



**Table 14: Expenses for Solid Waste Hauling Services for a Hotel**

Type of Expense	Cost per Month in Rupiah (CDN\$1 = 4700 rupiah)
<b>VARIABLE COSTS</b>	
labour: 5 workers	900,000
equipment	100,000
landfill ticket	120,000
sludge treatment service	300,000
fuel	450,000
<b>Total Variable Costs</b>	<b>1,870,000</b>
<b>FIXED COSTS</b>	
Supervisor salary	300,000
Assistant supervisor salary	200,000
Electricity	30,000
Telephone	50,000
Truck insurance	100,000
Truck maintenance	150,000
Miscellaneous	50,000
<b>Total Fixed Costs</b>	<b>880,000</b>
Wisnu supervision fee	250,000
<b>GRAND TOTAL</b>	<b>3,000,000</b>

*Note: Costs are based on two pick-ups per day, seven days a week.*

*Source: The Wisnu Foundation*

**Table 15: Land Rental Expenses for Garden Waste Composting for a Hotel**

Item	Unit	Unit Price (Rupiah)	Cost for 5 years (Rupiah)	Cost per year (Rupiah)	Cost per month (Rupiah)
Sorting area	10 m <sup>2</sup>	15,000 / 5 years	150,000	30,000	2,500
Composting area	100 m <sup>2</sup>	15,000 / 5 years	1,500,000	300,000	25,000
Maturing area	20 m <sup>2</sup>	15,000 / 5 years	300,000	60,000	5,000
Screening area	5 m <sup>2</sup>	15,000 / 5 years	75,000	15,000	1,250
Warehouse area	2 m <sup>2</sup>	15,000 / 5 years	30,000	6,000	500
Waste residue area	8 m <sup>2</sup>	15,000 / 5 years	120,000	24,000	2,000
<b>Total area</b>	<b>145 m<sup>2</sup></b>		<b>2,175,000</b>	<b>435,000</b>	<b>36,250</b>

*Note: Costs are based on composting of 3-4 m<sup>3</sup> of raw materials per day.*

*Source: The Wisnu Foundation*

**Table 16: Equipment Expenses for Garden Waste Composting for a Hotel**

Item	Unit	Unit Price (Rupiah)	Total (Rupiah)
Rakes	3	10,000	30,000
Shovels	2	25,000	50,000
Grass cutter	2	10,000	20,000
Bucket	2	10,000	20,000
Saw	1	15,000	15,000
Axe	1	10,000	10,000
Thermometer	3	50,000	150,000
Cart	1	200,000	200,000
Screen	1	100,000	100,000
Windrow	25	35,000	875,000
Uniform	6	65,000	390,000
Boots	3	30,000	90,000
Hats	3	10,000	30,000
<b>Total Cost</b>			<b>1,980,000</b>

*Note: Costs are based on composting of 3-4 m<sup>3</sup> of raw materials per day*

*Source: The Wisnu Foundation*

**Table 17: Operational Costs for Garden Waste Composting for a Hotel**

Item	Unit	Unit Price (Rupiah)	Total (Rupiah)
Labour: 3 workers	3	200,000	600,000
Supervisor	1	150,000	150,000
Equipment maintenance	1	50,000	50,000
Compost residue disposal	10	20,000	200,000
<b>Total Cost</b>			<b>1,000,000</b>

*Note: Costs are based on composting of 3-4 m<sup>3</sup> of raw materials per day*

*Source: The Wisnu Foundation*

**Table 18: Space Requirements at the MRF for Sorting Waste**

Activity	Area Required
Wet Waste Sorting	2.13 m <sup>2</sup>
Dry Waste Sorting	4.17 m <sup>2</sup>
Storage	11.11 m <sup>2</sup>

*Note: Areas required are based on waste quantities from 9 hotels.*

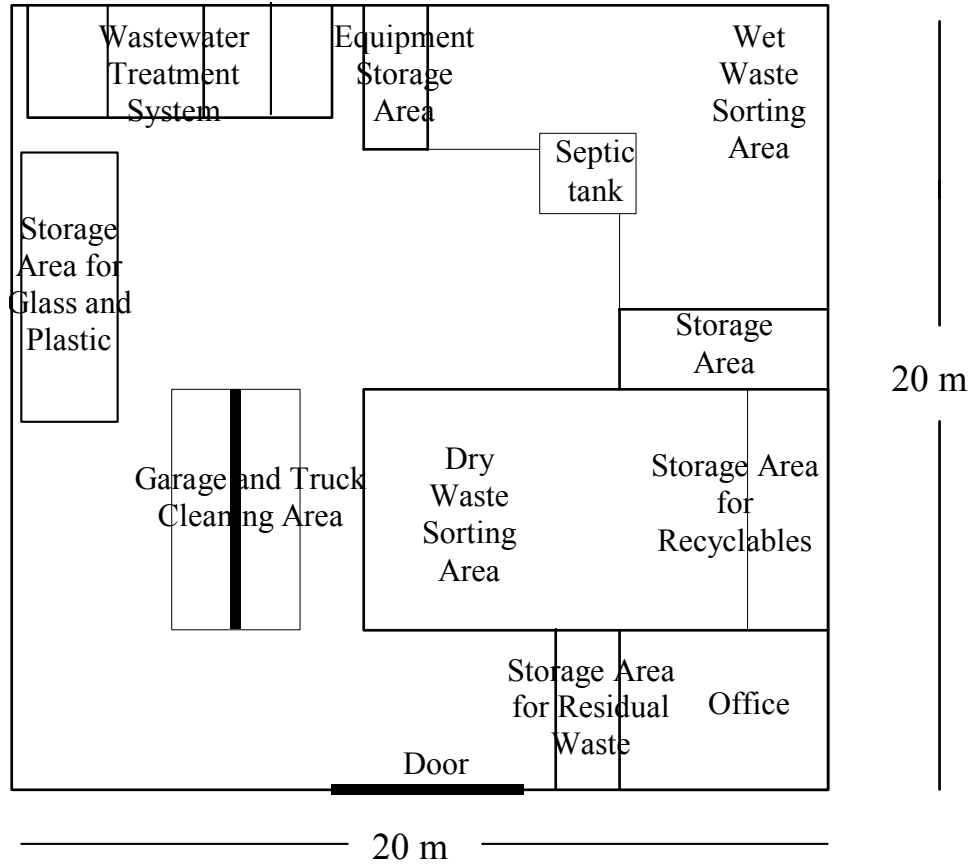
*Source: Wisnu 1998a*

**Table 19: Prices for End Products from the HSWM Program**

Waste Stream		Products	Price in Rupiah per Kilogram (CDNS1 = Rp 4700)
wet waste		pig feed	Rp 2,500 per 25 kg bucket Rp 12,500 per 125 kg drum
garden waste		firewood	Rp 20,000/m <sup>3</sup>
		compost	provided to hotels as part of contract; if sold by the NGO, Rp 700/kg or Rp 35,000 per 35 kg bag
dry waste	plastics	LDPE	200
		PET	200
		mixed plastics (HDPE, PP)	600
		plastic jerrycans	600/jerrycan
		aqua jerrycans	400/jerrycan
	paper	newspaper	600
		mixed paper	150
		office paper and magazines	450
		cardboard and boxboard	600
		egg cartons	400
	metal	tin	75/tin
		oil tins	2000/tin
		different type of oil tin	125/tin
		aluminum	5250
		iron	100
	glass	clear glass	60
		coloured glass	40
	flowers	cow feed	free for workers

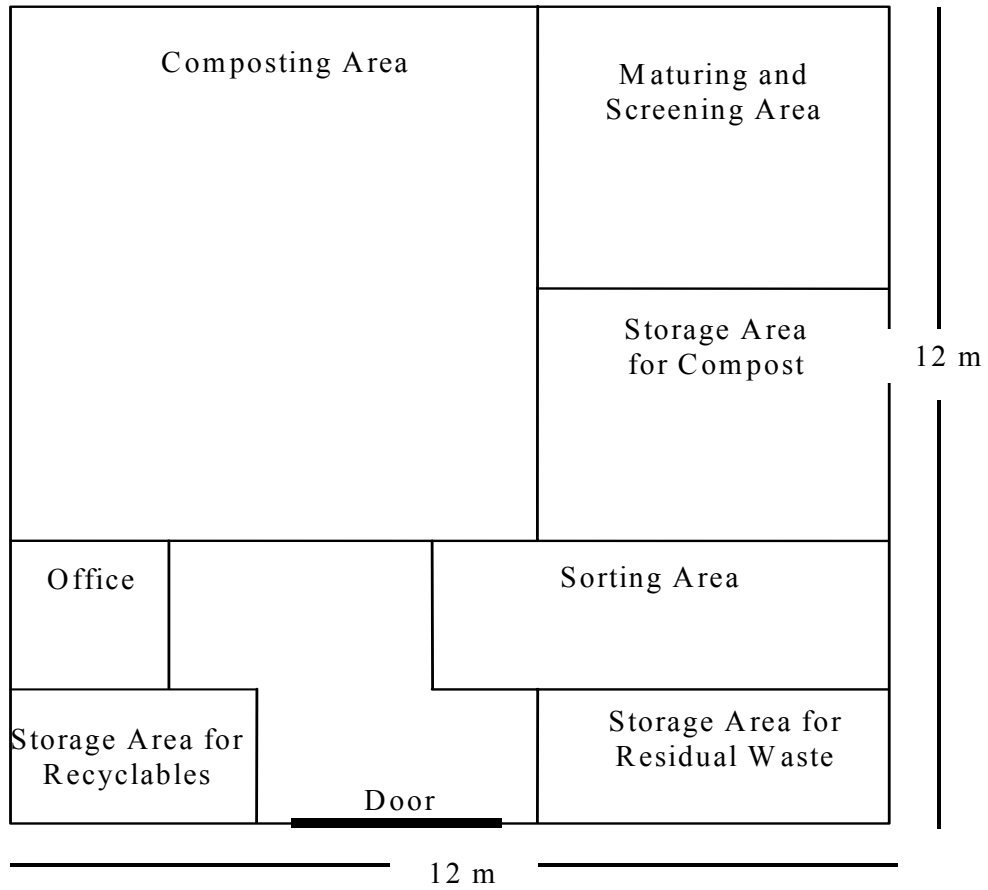
Source: Jimbaran Lestari

**Figure 4: Layout for a Material Recovery Facility**



Source: Wisnu 1997b

**Figure 5: Layout for a Composting Facility**



*Source: Wisnu 1997b*

#### **4.4.4. Hotel Participation in the HSWM Program**

As discussed in Section 4.4.1 (Program History), there was some initial reluctance on the part of hotels regarding joining the program. A “no risk policy” helped to build trust because it ensured that hotels would not receive bad publicity if they did not comply. Wisnu also helped develop an Eco-Hotel Rating Program<sup>13</sup> that included proper solid waste management as one of the components monitored by that program.

A hotel interested in improving their SWM was sent a solid waste audit that had to be completed and sent back to Wisnu. Wisnu did a site visit, then prepared a proposal and contract agreement. The proposal included a strategic plan for training, implementation and monitoring. The contract specified the terms of reference, rights and obligations of the hotel and hauler, and contract value. Negotiation was needed to ensure a mutually beneficial situation for both parties.

After the contract was signed, the hotel and hauler’s sites, procedures and staff were prepared for the waste management program. Wisnu provided training manuals and supervision to ensure that the system worked properly. Wisnu helped to solve any problems that arose during the establishment of the new system and acted as a mediator for the two parties.

Wisnu recognised that the support of top-level management at the hotels was important for implementation of the HSWM program. The hotels were advised to have an environmental policy that supported the waste management system and identified long-term and short-term goals; an environmental committee and environmental manager who

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<sup>13</sup> The Eco-Hotel Rating Program is a standard for evaluating a hotel's environmental management practices. The program was developed by a working group composed of the Wisnu Foundation, hotel general managers, chief engineers, chief stewards, human resource managers and executive assistant managers. It was designed as a voluntary program for starred hotels, based on the IHEI's (International Hotel Environmental Initiative) environmental management manual for hotels. The concept, criteria, standards and procedures for the Eco-Hotel Rating program were delivered to Indonesia’s Environmental Agency (BAPEDAL), the agency that implemented PROPER, a public rating system for water emissions from factories. Similar to PROPER, the Eco-Hotel Rating Program uses a five-colour rating scheme to summarise compliance with the standards. Hotels in Bali participated in a pilot program for the rating program that would be tested in Bali before being implemented throughout Indonesia.

implemented and monitored environmental practices; a hotel employee responsible for supervision of waste management; environmental training for all staff (including training about waste management); and cooperation from guests, suppliers and contractors.

Wisnu observed that if the hotel's environmental management system was not in order, staff were not motivated to adopt environmental practices. Since cooperation was essential for the implementation of the waste management system, it was important that hotel managers and employees have a strong awareness of environmental management and sustainable tourism.

Hotels were also required to provide proper equipment and follow procedures to support the waste management system. Clearly labelled containers for wet and dry waste were to be provided as required in every department for source separation. The garbage room for wet waste needed to be refrigerated to prevent rotting, odours and flies. A loading dock needed to be provided to facilitate the transfer of waste from the garbage rooms to the truck. For pick up, proper bins were needed for the wet waste and plastic bags or boxes were needed for the dry waste.

When a hotel first joined the program, Wisnu staff would visit the hotel each week to check that everything was working properly. After one year, Wisnu staff would visit the hotel twice a month to supervise operations. Wisnu staff would mediate problems and complaints from the hotels or waste hauler. Once a year, the program was evaluated to provide feedback about waste management practices and to set targets for reducing waste and increasing recycling rates.

The hotels were responsible for separating waste into three waste streams: wet waste from the kitchens; dry waste from the guest rooms and other outlets; and garden waste from the gardens. A couple of the hotels had their own facilities for composting garden waste onsite. Some of the hotels participated in Wisnu's Blue Bag program for office paper recycling. Although separation of glass, plastic and metal was recommended, that degree of source separation did not usually occur.

There were a number of barriers that could prevent the hotels from improving their environmental practices. Hotels may have been hesitant to give too many instructions to guests seeking luxuries rather than constraints. During peak times when hotels were busy with a lot of guests, staff found it difficult to sort garbage and the garbage room would be filled to the ceiling. It was easy for waste management issues to become a low priority and not receive adequate attention and resources.

In Wisnu's evaluation of the HSWM program (Wisnu 1999c), it was recommended that hotel management should give more attention and take more responsibility for minimising waste. Wisnu recommended that each hotel should have a dedicated manager for environmental management. Only one of the hotels participating in the HSWM program had a dedicated environmental manager. At the rest of the hotels, the environmental manager had another job such as Food and Beverage. Wisnu also recommended that hotels should have a manager responsible for supervising waste management (cleanliness) and improving communication and coordination with the waste hauler, as well as representatives responsible for environmental/waste management and cleanliness in each hotel department.

#### ***4.4.5. Elements of the Solid Waste Management System***

The key components of the hotel solid waste management system were storage, collection, transportation, recycling and disposal (see Figure 6: Hotel Solid Waste Management Process). Hotel waste was generated in the kitchens, restaurants, guestrooms, offices, other outlets and garden. Hotel employees brought waste to the garbage rooms using trolleys. Wet waste from the kitchens was stored in bins in refrigerated garbage rooms while dry waste from the other outlets was stored in plastic bags or bins. Depending on the amount of waste and the collection system, transferring waste from the garbage room to the truck could take from 30 to 90 minutes. Since food waste rotted quickly and storage space was limited, waste was picked up twice a day at the times specified in the contract. A separate truck picked up garden waste. Hazardous waste and construction debris were not included in the contract but would be handled by the waste hauler if the hotels paid an additional fee.



There were 5 drivers and 10 assistants for picking up waste from the hotels. They wore uniforms and reported to the hotel's security prior to each pick-up. The driver recorded the amount of wet and dry waste collected and obtained the signature of the supervising hotel staff. The drivers and assistants were responsible for transferring waste from the hotels to the MRF, leaving the garbage rooms in good condition, cleaning bins, helping with sorting, and tying cardboard into bundles. The trucks for collecting waste were back-end loading, with an open top. A tarp was used to cover the truck while in transit to prevent littering. There was a rolling system meaning that every three months, the truck drivers and assistants switched the hotels they picked up waste from to even out the distances traveled.

At the MRF, workers had two 4-hour shifts, one starting at 4 am and the other at 3 pm. Waste was sorted manually to recover recyclable or reusable materials, provide pig feed and make compost. The wet waste workers were responsible for sorting the kitchen waste into pig feed, recyclables and residue. The wet waste was composed of fruit, meat, leftover food and soup. The liquid portion went to the drains (that often got clogged). After the wet waste was emptied out of the bins onto the floor, the sorters squatted near the pile of wet waste and scooped away materials that were unsuitable for pig feed. Recyclable and reusable items were retrieved (e.g., plastic water bottles, beer and pop cans, glass, tins, cutlery). The residue was composed of items such as fish, banana leaves, pineapple tops, snakefruit peels, plastic wraps, plastic bags, palm leaves, egg shells, bones, paper packaging and wet tissue. The wet tissue and fruit peels were not composted because of odour problems. Hotel items, such as cutlery, that accidentally ended up with the waste were returned to the hotels. This resulted in substantial savings for the hotels.

The pig feed was composed of fruit, vegetables and their rinds. Larger pieces of watermelon, lettuce and leafy vegetables were placed on a wooden block and chopped into smaller pieces using a long knife. Pig farmers came to the material recovery facility to buy the pig feed right after the sorting process was completed.

The dry waste workers were responsible for sorting the dry waste into recyclables and residue. Most of the workers sat on upside down buckets and leaned over to handle the waste. Some preferred to squat or alternate between squatting and sitting on a stool/bucket. Half of the workers liked to empty the bags onto the floor first, while the other half preferred to sort the waste straight from the bag. Some used a glove on the hand that took waste out of the bag, transferred the item to their other hand and then put the item into the proper bag or bin for sorted materials. A plastic scoop was used for picking up the residual waste after recyclable items had been removed. The residual waste was composed of potato chip bags, bottle caps, styrofoam, crates, small pieces of wood, palm leaves, and leaves that were too thick for composting. To dispose of residual waste, the workers threw the bags of residue over a five-foot wall into the residual waste storage area. Recyclables were carried to their respective storage areas. The bags that the dry waste came in were used for holding recycled materials and residue. Recyclables were put in storage and then sold to waste dealers. Some paper was recycled locally, however, in general most of the recyclable materials were shipped to East Java where there were recycling industries.

There were three trucks that picked up garden waste once a day. The garden waste was sorted to select materials suitable for composting (such as small leaves, young trees, offerings, grass clippings and tissue) and wood for firewood. The residual waste was composed of bamboo, thick branches, food waste and plastic. Windrow<sup>14</sup> composting was the method used for composting the garden waste. Although two months was given as the time for garden waste to be turned into compost, employees said that it took three months during the wet season and four months during the dry season. At the beginning when new material was added, the compost pile was watered everyday. The temperature and moisture<sup>15</sup> of the pile was tested everyday. If the pile was too hot, water was added. The pile was turned every five days unless the workers did not have enough time, in which case, the piles would be turned every seven days and this would increase the amount of time it took for the compost to mature. Although the majority of plastic

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<sup>14</sup> Windrows are triangular structures made of bamboo used for aeration of compost piles. Windrows cost 16000 rupiah and came from Java. The windrows lasted for 8 or 9 months before needing to be replaced.

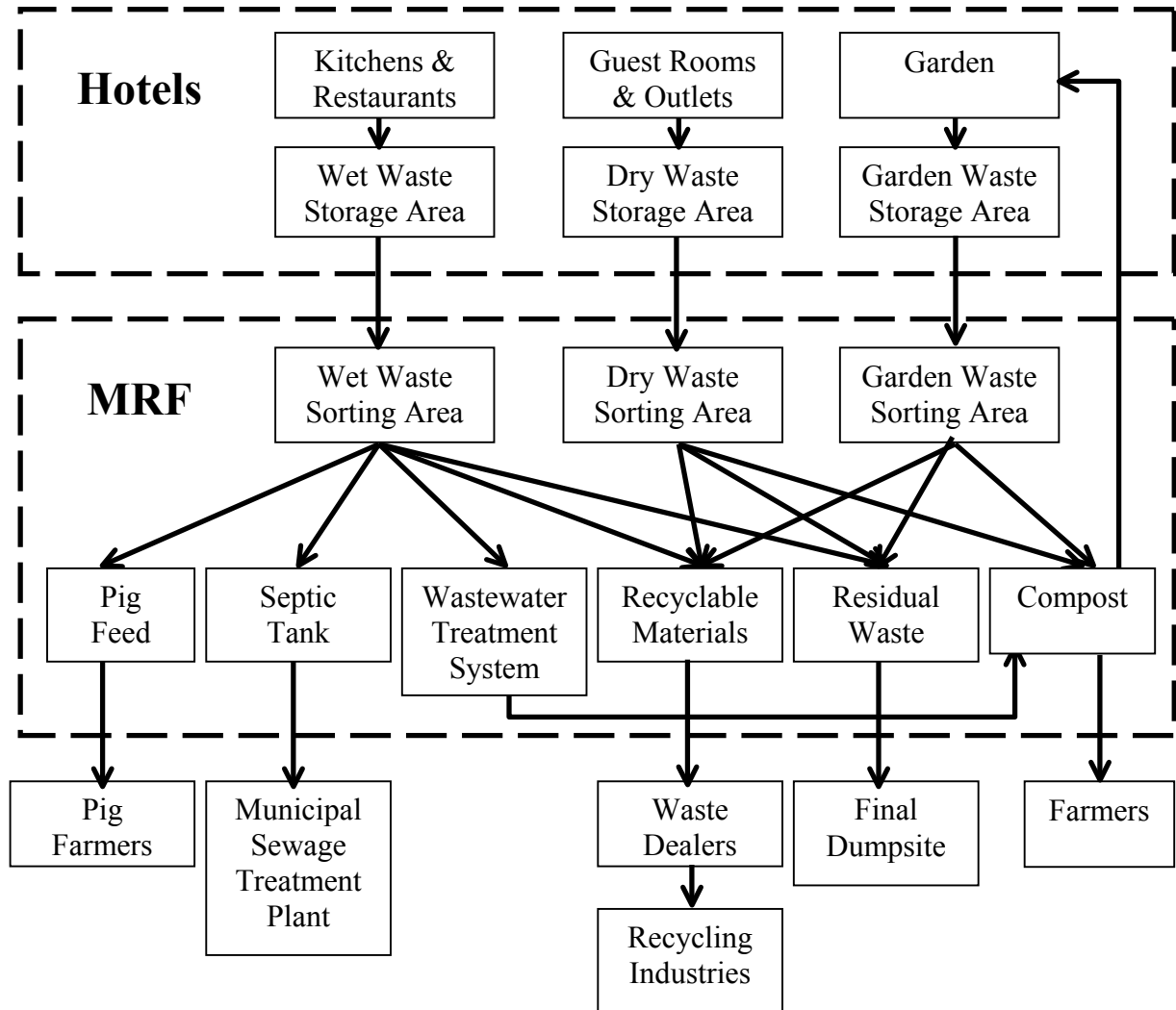
<sup>15</sup> The dampness of the pile was tested by taking a handful and squeezing it to see if water came out.

materials were removed during the initial sorting of garden waste, two employees were required for picking plastic out of the compost heaps. This was important for the efficiency of compost production and aesthetics (i.e., when guest visited the MRF). After two months, the compost was screened. After screening, about 20% of the compost was residue. The residue was put in a pile for one month before being screened again. After this second screening, about half of the material was compost and the rest was waste. The residual waste was brought to the final dumpsite. When the compost was mature, it was given to the hotels to be used in their gardens. Tree branches and trunks from the garden waste were sold as firewood and flowers from the dry waste were used as cattle feed.

The workers who handled the residue dressed in garbage bags and black rubber boots. They used the wet waste bins to help load the residual waste on the truck. The dry residue was in plastic bags. The residue truck was covered with a tarp. There were three truckloads of residual waste that were brought to the government's final dumpsite per day, one for garden waste, one for dry waste and one for wet waste. At the final dumpsite, the tipping fee of 5,500 rupiah per truck was paid, and a receipt and signature from the dumpsite staff was obtained. The receipts from the final dumpsite were provided to the hotels each month to show that the waste was being dumped legally.

To keep the site clean, the floors, bins and trucks were washed. The wastewater from cleaning the facilities went to the onsite wastewater treatment system. The wastewater was pumped out of the treatment system to water the compost piles. Excess wastewater was drained to the ditch. Because of their strong smell, liquids directly from the food waste went to an underground septic tank to be later transported to the municipal sewage treatment plant.

**Figure 6: Hotel Solid Waste Management Process**



*Sources: Field Notes 1999 and Wisnu 1997a*

#### **4.4.5.1. Wastewater Treatment System**

Survey responses from both the NGO and MRF recognised the importance of having a proper treatment system for wastewater to prevent odour problems and pollution of waterways. The two main sources of wastewater from MRF activities were liquid waste that accompanied the kitchen waste from hotels (i.e., the wet waste) and the wastewater from washing the bins, floors and trucks. The liquid waste from the wet waste was stored in an underground septic tank (capacity: 4000 litres) and collected by truck every two or three days for treatment at the municipal sewage treatment plant. The wastewater from cleaning activities was treated by the onsite wastewater treatment plant.

The city truck that handled the liquid waste from the septic tank also took the sludge from the onsite wastewater treatment plant to the municipal treatment plant. The waste hauler had a contract with one of the hotels to pick up grease for the hotel's kitchen grease trap. Three bins (80 litres each) were picked up every two days. The grease was added to the underground septic tank. The cost to the waste hauler for pick up and treatment of wastewater offsite was 50,000 rupiah. It cost the waste hauler between 6 to 9 million rupiah per year for the treatment of sludge and wastewater from the septic tank.

The onsite wastewater treatment system was built in 1997 to handle the wastewater from three hotels. It consisted of a screen, grease trap, baffles and three sedimentation tanks. Aluminum sulphate was added as a flocculant occasionally. The wastewater from the wastewater treatment plant was pumped to the compost piles to water them twice a day.

Water quality had been tested on occasion. Water quality data for the liquid waste (from the wet waste), wastewater from cleaning activities and treated wastewater are provided in Tables 20, 21 and 22. The water quality data indicate that in general, the wastewater was acidic and had high levels of organics, nutrients and coliform. The analytical results for the treated wastewater indicate that levels of BOD5, COD and TSS were at acceptable levels in 1997. Possible reasons cited by the NGO for the high coliform count after treatment were the hot climate, dog droppings and contaminated water supply.

In 1999, an attempt was made to construct a wastewater treatment plant for the liquid waste from the wet waste. It was composed of three tanks. In one week, the first tank filled with sludge. There were problems with the smell and a lot of rice. The use of this new treatment system was discontinued after two months.

As the number of hotels participating in the HSWM program increased, the treatment system built in 1997 became inadequate to handle the increase in wastewater. In 1999, only one tank was being used in an attempt to reduce the smell. When there was an overflow of water (e.g., during the rainy season), the wastewater was drained to a ditch. Improvements to the onsite wastewater treatment system were included as part of the expansion renovations to reduce odour problems and increase the wastewater treatment system's capacity and effectiveness. The quantity of wastewater produced by the MRF when managing the waste from ten hotels is estimated in Table 23.

**Table 20: Water Quality Data for Liquid Waste from the Wet Waste Area**

Parameters	Units	Analytical Results	National Water Quality Standards in 1996	
			Water quality standard group I	Water quality standard group II
pH		4.28	6-9	6-9
BOD5	ppm	496	50	150
COD	ppm	985	100	300
TSS	ppm	130	200	400
NO <sub>3</sub> -N	ppm	13.70	1	5
NO <sub>2</sub> -N	ppm	4.56	1	3
PO <sub>4</sub>	ppm	324.8	-	-
Fenol	ppm	160.6	0.5	1
E.Coli	MPN/100mL	2100	-	-
Coliform	MPN/100mL	2100	-	-
oils+grease	ppm	1260	-	-
NH <sub>3</sub>	ppm	1084.5	-	-

*Note: Water quality tested on February 2, 2000*

**Table 21: Water Quality Data for Wastewater from Cleaning Activities (Pre-Treatment)**

Parameters	Units	Analytical Results	National Water Quality Standards in 1996	
			Water quality standard group I	Water quality standard group II
pH		4.13	6-9	6-9
BOD5	ppm	367	50	150
COD	ppm	639.6	100	300
TSS	ppm	771	200	400
NO <sub>3</sub> -N	ppm	74.4	1	5
NO <sub>2</sub> -N	ppm	0.5	1	3
PO <sub>4</sub>	ppm	292.2	-	-
Fenol	ppm	19.8	0.5	1
E.Coli	MPN/100mL	4,3x10 <sup>5</sup>	-	-
Coliform	MPN/100mL	4x10 <sup>6</sup>	-	-

*Note: Water quality tested on August 24, 1999*

**Table 22: Water Quality Data for Treated Wastewater**

Parameters	Units	Analytical Results	National Water Quality Standards in 1996	
			Water quality standard group I	Water quality standard group II
BOD5	mg/L	48.23	50	150
COD	mg/L	87.6	100	300
pH		5.95	6-9	6-9
TSS	mg/L	29.6	200	400
Coliform	MPN/100mL	11x10 <sup>7</sup>	-	-

*Note: Water quality tested on July 14, 1997*

**Table 23: Estimated Wastewater Quantities for the MRF**

Source of Wastewater	Amount of Wastewater (m <sup>3</sup> /day)
Cleaning bins	3
Cleaning trucks	2
Cleaning floor of wet waste area	1
Liquid waste from wet waste	1.5

*Source: The Wisnu Foundation*

#### 4.4.5.2. Management of Waste Data

Using logbooks, the waste hauler recorded the number of bins of wet waste and bags of dry waste collected from the hotels. Items such as cutlery were retrieved from waste, reported and returned to the hotels. The weighing of recyclable waste had been neglected but the waste hauler was working to improve procedures for the weighing of the amount

of waste recycled per hotel. The waste hauler had records of the number of truckloads of residual waste and the amount of wastewater stored in the septic tank. Based on that data, the amount of residual and liquid waste per hotel was calculated or estimated.

Each month, the amount of dry waste was weighed to develop an estimate for the weight per bag of dry waste. An estimate for the weight per bin of wet waste was used. The need to improve the estimate of the weight of the wet waste was recognised when it was found that the estimated amount was less than actual amount. The volume of garden waste was estimated. Staff were familiar with the quantity and composition of waste generated by the different hotels since they handled it everyday.

Records about waste data enabled the program to provide important information about waste generation rates, waste composition and waste recycling rates for hotels. The quantity and composition of waste handled by the HSWM program are shown in Tables 24 to 26. Performance was monitored using the waste reports and targets were set at annual meetings with the hotels. Since the literature did not provide information about what a good recycling rate for hotels would be, the NGO recommended that the hotels should agree together about short, middle and long term targets such as increasing the recycling rate to 70%. At the meeting to review 1998 data, hotel managers reached consensus that recycling rates should be more than 70%. The NGO also recommended that the total amount of waste generated by the hotels should be reduced by 10%.

The NGO recommended that the hotels identify recycling opportunities and review purchasing of products since purchasing decisions determine the quantity of waste, recycling rates, disposal needs and environmental impacts. Cross visits between hotels to share experience were suggested. The NGO also recommended analysing the breakdown of waste residue and having regular coordination meetings to communicate problems and progress regarding waste generation, waste recycling and waste residue. The NGO thought that the waste reports should be reviewed every month or every three months to reach targets.



Based on a review of the 1998 waste data, a number of observations can be made. In 1998, according to waste data collected by the HSWM program, the average waste generation rates for the hotels ranged between 4 and 12 kilograms per room per day<sup>16</sup>. For the hotels that participated in the program in 1998, the percentage of waste recycled ranged between 36% and 58% and the percentage of wet waste (kitchen waste) varied between 77% and 87%. In the NGO's evaluation of the 1998 data (Wisnu 1999c), it was found that the waste generation and recycling rates fluctuated significantly. It was also concluded that if a hotel had a good EMS (environmental management system) and employees had a sense of responsibility towards the environment, there was less residual waste. If a hotel did not have a good EMS, then employees did not support the 4Rs (reduce, reuse, recycling and recovery) and the hotel produced more residual waste.

A comparison of the hotel waste statistics from 1998 and 1999 is presented in Table 24. From 1998 to 1999, the recycling rate for dry waste went from 56% to 82% and the recycling rate for wet waste went from 38% to 56%. From 1998 to 1999, the overall recycling rate (not including liquid waste) went from 45% to 69% and the overall recycling rate (including liquid waste) went from 41% to 60%. An increase in the proportion of liquid waste can also be noted from a comparison of 1998 and 1999 data. The NGO recommended that the amount of liquid waste should be reduced by putting wastewater into kitchen sinks instead of wet waste bins.

Around 56% of garden waste was converted into compost, 4% was used for firewood and the remaining 40% was residue. Quantities of garden waste handled by the MRF are presented in Table 25. The composition of the waste from the hotels is compared to the waste produced by households in Bali and the United States in Table 26. The percentage of paper waste for the hotels was low compared to the statistics for Denpasar and the United States. This may be because the hotels used shredded paper for packing items to be shipped. The percentage of plastic waste for the hotels was also low. This may be because the hotels tried to avoid plastic products. The percentages of glass and organic

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<sup>16</sup> The number of rooms per hotel ranged between 73 and 451. Occupancy data was used to calculate the number of rooms occupied. If there were four guests in each room, then the waste generation rate would range between 1 and 3 kilograms of waste per guest per day. In 1989, Canadians produced 1.7 kilograms of waste per person per day (Shikaze 1991).

waste were higher, perhaps because more wine and food were consumed in the hotel restaurants.

**Table 24: Waste Quantities Handled by the MRF**

	1998 Data for 9 Hotels					Jan – Aug 1999 Data for 10 hotels				
	Day (kg)	Month (kg)	Year (kg)	%	% of Total Waste	Day (kg)	Month (kg)	Year (kg)	%	% of Total Waste
<b>Dry Waste Recycled</b>	911	28,255	339,060	56%	9%	1,270	39,385	472,620	82%	13%
<b>Dry Waste Residue</b>	711	22,049	264,588	44%	7%	274	8,494	101,928	18%	3%
<b>TOTAL DRY WASTE</b>	1,623	50,304	603,648	100%	17%	1,544	47,879	574,548	100%	15%
<b>Wet Waste Recycled</b>	3,083	95,578	1,146,936	38%	32%	4,775	148,015	1,776,180	56%	47%
<b>Wet Waste Liquid</b>	724	22,450	269,400	9%	7%	1,309	40,585	487,020	15%	13%
<b>Wet Waste Residue</b>	4,249	131,716	1,580,592	53%	44%	2,454	76,059	912,708	29%	24%
<b>TOTAL WET WASTE</b>	8,056	249,744	2,996,928	100%	83%	8,537	264,659	3,175,908	100%	85%
<b>Solid Waste</b>	8,955	277,598	3,331,176		<b>Rate for Solid Waste</b>	8,773	271,953	3,263,436	<b>Rate for Solid Waste</b>	<b>Rate for Total Waste</b>
<b>Total Waste including Liquid</b>	9,679	300,048	3,600,576			10,082	312,538	3,750,456		
<b>Total Recycled</b>	3,995	123,833	1,485,996	45%	41%	6,045	187,400	2,248,800	69%	60%
<b>Total Residue including Liquid</b>	5,684	176,215	2,114,580		59%	4,037	125,138	1,501,656		40%
<b>Solid Residue</b>	4,960	153,765	1,845,180	55%		2,728	84,553	1,014,636	31%	

**Table 25: Garden Waste Quantities for Four Hotels**

	<b>Day (m<sup>3</sup>)</b>	<b>Month (m<sup>3</sup>)</b>	<b>Year (m<sup>3</sup>)</b>	<b>%</b>
Compost	7	220	2640	56
Firewood	0.5	15	180	4
Residue	5	155	1860	40
<b>TOTAL</b>	12.5	390	4680	

**Table 26: Municipal Solid Waste and Hotel Waste Composition in Bali Compared to Municipal Solid Waste Composition in the United States**

<b>Waste Component</b>	<b>Item</b>	<b>Waste Composition (%) in Denpasar, Bali in 1987 (Doberstein 1992:70)</b>		<b>Waste Composition (%) for Hotels in Bali in 1998</b>		<b>American Municipal Waste Composition (%) in 1997 (Valiante 2000)</b>
Paper and paperboard	Paper	9.5		2.64	4.11	38.64
	Newspaper			0.39		
	Cardboard			1.08		
Metal	Tin	1.5		0.51	0.69	7.66
	Aluminum			0.18		
Glass	Clear glass	1.8		1.43	2.41	5.54
	Colour glass			0.98		
Yard and kitchen	Kitchen waste for pig feed	66.8		32.11	84	22.88
	Liquid waste			7.54		
	Solid residue from kitchen waste			44.24		
	Soil/Inerts/Bones	8		-		-
	Wood	-		-		5.33
Plastics, rubber and leather	Plastic and rubber	11.5	13.9	1.27		13.22
	Textile	2.4				
	Miscellaneous and dry residue	-		7.8		7.03

#### **4.4.6. Stakeholders**

In this section, the roles, responsibilities and interests of stakeholders involved with the HSWM program in Bali are described. Qualitative findings from the survey of managers from the NGO and MRF, and observations about the motivation and program benefits for stakeholders are discussed. Principal stakeholders are defined as those who are directly involved with decision making. Supporting stakeholders are defined as the people whose actions support the program on a daily basis but who are not typically involved in decision making. Background stakeholders include those who affect or are affected by the program. Stakeholders for the HSWM are identified and classified in Table 27.

A survey was designed with feedback from the NGO to identify issues of importance and management perceptions concerning these issues and needed actions. Three managers from the NGO and one from the MRF completed the survey. A breakdown of importance ratings by respondent is provided in Appendix 2. The respondents were asked to rate issues on a scale of one to five, with a rating of one meaning that the issue was not important and a rating of five meaning that the issue was considered essential.

A summary of responses from the NGO and MRF is presented in Table 28. An average rating for each issue was calculated with the assumption that a normal distribution can be used to approximate a distribution of discrete variables. There may be some error in making this assumption however, calculation of a median or mode can be problematic when sample sizes are small. The three issues that were rated as most important based on survey results were: (a) “improving the wastewater treatment system”, (b) “improving the management of waste haulers, record keeping and end product sales”, and (c) “improving the end products”.

A qualitative approach was used for the comparison of MRF and NGO responses because of the small sample size. The MRF response was compared to the minimum and maximum values of the NGO responses. If the MRF response was within the minimum and maximum values of the NGO responses, the MRF response was considered to be similar to the NGO’s response. If the MRF response was outside of the minimum and

maximum values of the NGO responses, the MRF response was considered to be dissimilar. The MRF response was not within the minimum and maximum values of the NGO responses for two issues. The MRF manager rated the issue “improving health and safety” with higher importance than the NGO managers did. The MRF manager rated the issue “improving the wastewater treatment system” with lower importance than the NGO managers did.

One of the survey questions asked about additional issues not addressed in the survey. The MRF’s social contribution to the residential area surrounding the facility and the MRF’s role as a demonstration model were identified as important issues. Issues from the survey are described in more detail in Section 4.4.7.

**Table 27: Stakeholders in the HSWM Program**

<b>Stakeholder Classification</b>	<b>Stakeholder Groups</b>
Principal	Jimbaran Lestari (Waste Hauler / MRF), Wisnu Foundation (NGO) and Hotels
Supporting	MRF Employees and Contractors, Members of Wisnu, Hotel Employees, Pig Farmers, Waste Dealers, Waste Pickers and Government Agencies
Background	Community Groups, Tourists and Travel Agencies, Foreign Agencies

**Table 28: Prioritisation of Issues at the MRF Based on Survey Results**

Issue	Average Rating from NGO and MRF Responses*	MRF Response	Minimum and Maximum Values from NGO Responses
Improving the wastewater treatment system	4.8	<b>4**</b>	<b>5 – 5</b>
Improving the management of waste haulers, record keeping and end product sales	4.4	5	3 – 5
Improving the end products	4	4	3 – 5
Improving the work environment	3.8	4	3 – 4
Improving environmental awareness and morale of workers at Jimbaran Lestari	3.8	4	2 – 5
Improving the accuracy and meaningfulness of record keeping	3.8	3	3 – 5
Improving waste handling at hotels to meet current expectations	3.8	4	3 – 5
Introducing better separation at source	3.5	4	2 – 5
Improving health and safety	3.3	<b>5**</b>	<b>2 – 3</b>
Improving workstations and the way tasks are performed	3.3	3	2 – 5
Starting new Material Recovery Facilities	3.3	2	2 – 5
Increasing efficiency	3	3	2 – 4
Increasing the salaries of workers at Jimbaran Lestari	2.5	3	2 – 3
Increasing the profitability of Jimbaran Lestari	2.5	3	1 – 4
Increasing the capacity of Jimbaran Lestari	2.5	3	2 – 3

\* Importance Ratings: not important = 1; somewhat important = 2; important = 3; very important = 4; essential = 5.

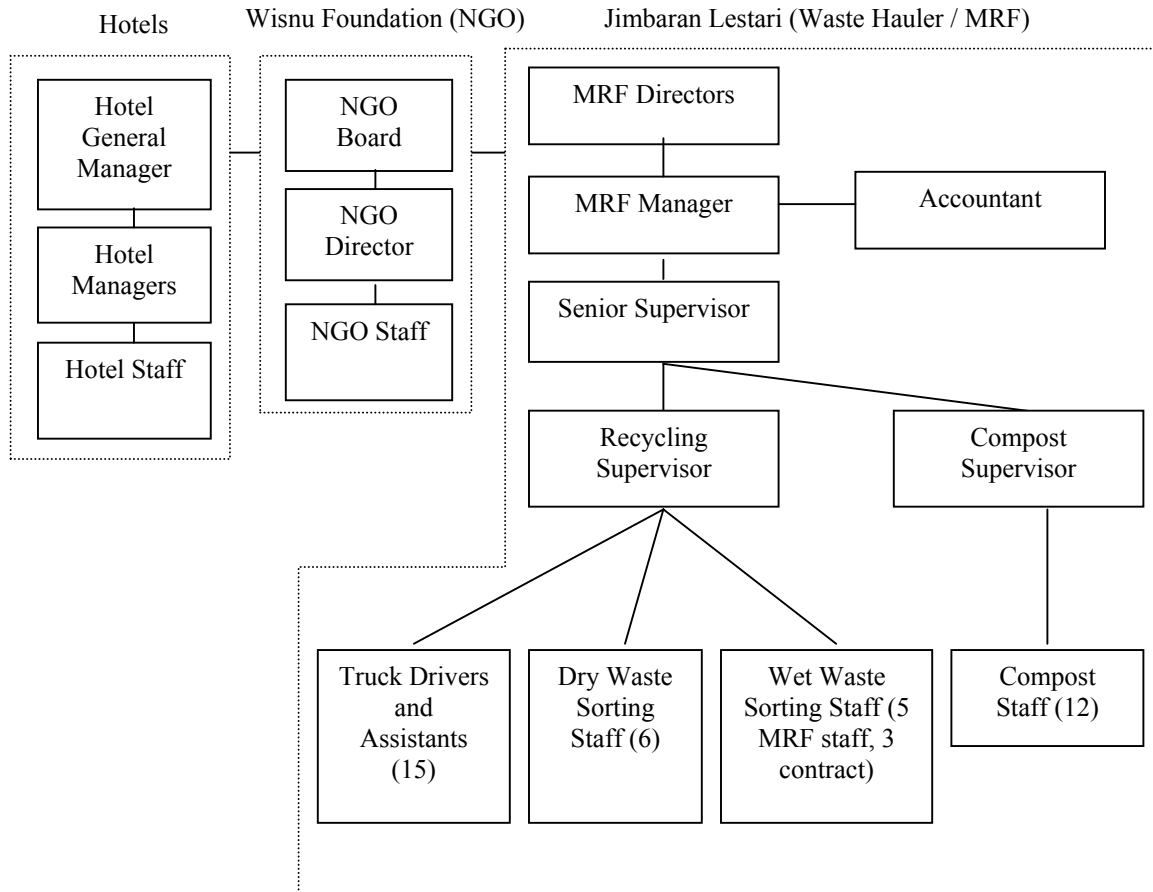
\*\* Bolded values indicate that the MRF response is considered dissimilar (i.e., not within the minimum and maximum values of the NGO responses).

#### 4.4.6.1. Principal Stakeholders

The three principal stakeholders in the HSWM program were the waste hauler (Jimbaran Lestari), the NGO (the Wisnu Foundation) and the hotels (10 participating hotels).

Relationships between and within the stakeholder groups are illustrated in Figure 7. The roles and responsibilities are then described, followed by a discussion of the nature of their partnership and challenges encountered. The descriptions of stakeholder perspectives and partnerships are based on the researcher’s interviews, observations and impressions of the motivation of and interaction between program stakeholders.

**Figure 7: Organisational Chart for the HSWM Program**



**4.4.6.1.1. The Waste Hauler / MRF**

Jimbaran Lestari was the private company operating the material recovery facility (MRF) that managed solid waste from hotels. The MRF management team was responsible for the program’s day-to-day operations and for providing training about the work system to the workers. The executive director invested resources (e.g., land, loans, planning) into the program, acted as the primary decision-maker and received the majority of the program’s profits. The executive director was a waste hauler and pig farmer<sup>17</sup> prior to the program’s initiation. The other director of the MRF was a founding member of the Wisnu Foundation. He invested in the MRF in 1998, played an advisory role and received a portion of the program’s profits. Program profits was shared between the

<sup>17</sup> The pig farm was closed because neighbours complained about the smell.



Wisnu Foundation (10%) and the directors (54% for the executive director and 36% for the director from Wisnu). In addition to a share of the profits, the Wisnu Foundation received a monthly consulting fee of three million rupiah if the program was profitable.

The aim of the MRF was to effectively and efficiently recycle waste, to make its workers prosperous, and to make new branches in strategic locations so that people in those locations could enjoy the benefits. The more waste the MRF processed, the better the salaries and the more successful the MRF was. As a business, the MRF's aim was to earn a profit, however, the MRF depended on employee productivity, community acceptance and proper environmental practices to achieve success. If the employees were to strike or the neighbours protest, the MRF would not survive. If the program was not perceived as 'environmentally friendly', it would lose its competitive advantage.

In the waste hauler's contract with Wisnu, it was stated that issues related to hotels, government, technology, training, evaluation and improvement were Wisnu's responsibility. Being associated with the Wisnu Foundation helped to enhance the MRF's reputation as a provider of socially and environmentally acceptable services. In fulfillment of its contract with Wisnu, the MRF was to implement the advice Wisnu provided that the MRF considered necessary for improving the workstations and performance. The MRF was also responsible for improving its record keeping and administration, and for fulfilling its responsibilities to clients in an honest and legal fashion. The MRF had to discuss changes, complaints and obstacles with Wisnu and share contract, financial, administrative and technical information. Since Wisnu expected the MRF to be independent after five years, one of the MRF's challenges was to develop its own capabilities for dealing with management, operational, social and environmental issues.

Managers at the NGO assisted the MRF by performing solid waste audits at the hotels, negotiating and formulating contracts (wording, monthly fee) between the MRF and hotels, preparing the MRF and hotels for program implementation, mediating complaints and problems between the MRF and hotels, and evaluating all the program results once a year. Staff members at the NGO helped create monthly waste reports, address

complaints, supervise operations and make suggestions. The responsibilities of the MRF manager were to manage the accountant, middlemen, hiring, human resources, operations, food, accommodation, uniforms, equipment and tools, and to communicate with Wisnu staff. The responsibilities of the MRF supervisor were to handle hotel invoices, composting, schedules, drivers, cheques, and inputting data on the computer. One of the MRF supervisors was a former member of Wisnu.

The MRF's revenue came from the monthly hauling fees paid by the hotels and the sale of pig feed and recyclables. The monthly hauling fee for hotels had values ranging from around two to five million rupiah. Program costs included salaries, utilities, fuel, wastewater treatment, equipment, maintenance and renovations. The program was financially profitable, enabling loans to be paid back. The renovations to increase the MRF's capacity to handle the waste from more hotels was expected to increase the program's profitability.

The MRF managers were concerned that a number of new hotels had expressed interest in joining the HSWM program but the NGO had not taken any steps to follow up with those potential participants. Near the end of 1999, the MRF lost one of its contracts because of a misunderstanding regarding the handling of garden waste and the cleaning of the garbage room. The MRF expressed some dissatisfaction with the NGO that was responsible for improving the program's procedures.

#### **4.4.6.1.2. The Wisnu Foundation / NGO**

The Wisnu Foundation is a local non-governmental organisation (NGO) that has worked with communities, organisations and businesses to find solutions to environmental problems in Bali. Wisnu has participated in a number of environmental activities related to issues such as solid waste, wastewater, watersheds and environmental awareness. As a catalyst for local community action, Wisnu strives to raise community awareness and intensify community participation using a systematic, holistic, interdisciplinary and participatory approach. The Wisnu Foundation received the Environmental Company Award from the World Travel Market 1998 sponsored by Travel News Asia.

Wisnu wanted to demonstrate alternative actions that could be taken to improve environmental management. As an NGO with less bureaucracy than government agencies, the Wisnu Foundation could work with stakeholders in a more efficient and less costly manner. Wisnu initiated the hotel solid waste management program to improve environmental management. The program's goals were to work with existing waste haulers and participating hotels to develop proper hauling practices that safely and legally disposed of the hotels' solid waste and minimised total solid waste disposed by redirecting waste for reuse and recycling. After five years, it was anticipated that Wisnu's involvement would lessen and the program participants would learn to manage the program independently.

The Wisnu Foundation (NGO) and Jimbaran Lestari (MRF) signed a contract whereby the NGO would help the HSWM program to improve and expand. The NGO's responsibilities included performing waste audits for hotels, making connections with other parties like the government, providing information and training to the MRF, and improving the procedures, workstations, management system, administration (not including accounting) and operational performance of the MRF.

Wisnu's role was to act as a bridge between theory and practice, developing and improving methods of achieving environmentally, socially and economically sustainable solutions. Wisnu worked with waste haulers and hotels to improve the solid waste management system by helping to form partnerships, perform solid waste audits, negotiate contract agreements, create training manuals, develop standard operating procedures, improve the material recovery facility, and coordinate with local government authorities. Wisnu also helped develop the Eco-Hotel Rating Program that would provide recognition to hotels for environmental management practices.

Wisnu was a communication link between stakeholders, helping to develop realistic, appropriate and cost-effective solutions. As a mediator, Wisnu's role was to build the mutually beneficial partnership between hotels and waste haulers. This involved helping with contract negotiation, problem solving, monthly waste reports and yearly reviews.

Wisnu acted as the conscience for waste haulers and hotel managers, raising their awareness of environmental and social issues. Wisnu told the MRF that it should not be profit oriented and encouraged hotels to adopt the polluter pays principle. As a supervisor and advisor, Wisnu's role was to ensure that hotels and waste haulers were acting responsibly, to find solutions to technical problems, and to make suggestions for program improvement. This involved ensuring that waste was reduced, reused, recycled or composted, that residue went to the legal final dumpsite, that wastewater was treated properly, that the health and safety of employees was protected, that waste amounts were recorded and reported, and that connections with markets for the end products were established.

As an educator and community organiser, Wisnu's role was to document the program, disseminate information and replicate the model. This involved report writing, press releases, information dissemination meetings, tours of the material recovery facility, awareness raising activities for the local community, training for staff, and preparatory work to apply the model in places such as Ubud and Candi Dasa.

As the program's supervisor and advisor, Wisnu received a consulting fee of 3 million rupiah per month, 10% of net profits per month and compost. In addition to monetary benefits, program involvement helped improve Wisnu's expertise and reputation.

Although Wisnu was pleased with many of the results the program had achieved, Wisnu was not completely satisfied with the program's approach. According to Wisnu, the program's approach was flawed because it created a local capitalist instead of sharing benefits equally by being community based or having a co-operative economic system. To increase staff ownership, pride and motivation, the NGO was interested in a participatory and co-operative approach. To gain community support and participation, Wisnu was interested in having the desa adat<sup>18</sup> be the owner of waste management enterprises. Wisnu recognised that every village has its own style and that development

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<sup>18</sup> The desa adat is the traditional organisation for a territory that is based on the concept of Tri Hita Karana (integration of sense of God, humanity and environment). A desa adat consists of banjars.

should be based on the nature of the banjar<sup>19</sup> and be responsive to the community. Therefore, the same model cannot be used identically all over Bali and development should be small scale and based on local needs and values.

Beyond the implementation of the polluter pays principle and cleaner production, Wisnu believed that waste should be a collective responsibility and a resource for civil society to get jobs, ideas, benefits, political rights and justice. Wisnu viewed the community-oriented lifestyle of the Balinese and Indonesians as a potentially powerful tool that, combined with environmental knowledge, could help Bali avoid environmental destruction (Suarnatha 1999).

#### **4.4.6.1.3. The Hotels**

Tourists come to Bali to enjoy clean beaches, unspoiled natural areas and the Balinese culture. Beach cleaning activities initiated by hotels in Bali expressed their awareness that lack of proper management resulted in the destruction of the natural resources that attract tourists to Bali. In an industry where hotels and destinations compete to attract tourists, recognition for good environmental management programs could attract environmentally aware tourists and travel agencies. By adopting proper environmental practices and marketing their environmental friendliness, hotels can enhance their corporate image and attract the attention of tourists and travel agencies.

On the contrary, improper waste disposal practices result in harmful environmental and health impacts, as well as liability and bad publicity. Compliance with local laws was another motivation for proper environmental practices. By law, hotels in Bali are responsible for their solid waste.

Hotels participating in the HSWM program were starred hotels and members of international hotel chains. As members of larger organisations that maintained environmental policies, guidelines and monitoring, hotels in Bali were responsible for

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<sup>19</sup> A banjar is a traditional institution that serves the community and handles religious matters such as weddings and temple ceremonies.

reporting on their practices. Some hotels had senior executives dedicated to environmental management.

Waste management was one component of the hotel's overall environmental management system. The Wisnu Foundation stressed to hotels that waste management was an important starting point for environmental action because of its tangible nature (e.g., compared to energy conservation). Waste management was a key component of Bali's Eco-Hotel Rating Program. Hotels participating in the Eco-Hotel Rating Program would be interested in finding a reputable company to handle their waste. This helped create a business opportunity for the HSWM program.

Given the motivation of hotels to be environmentally friendly, they turned down the potentially lucrative opportunity to sell their solid waste in favour of the polluter pays principle. By paying a fair price to guarantee proper waste management practices, hotels reduced their environmental impact and liability concerns because the program ensured that waste was recycled and residual waste was disposed of legally. The program reduced the hotel's risk of receiving bad publicity for careless waste handling. The monthly waste reports allowed the hotels to monitor the amount and composition of waste generated. These waste reports could also be sent to the hotel chain's international headquarters for monitoring progress and measuring results achieved.

The fact that the MRF maintained contracts with most of the hotels for numerous years indicated that in general, hotels were satisfied with the ongoing services provided by the HSWM program. Hotels expressed satisfaction with the monthly waste reports that could be used for comparison and communication. Hotels also expressed satisfaction with the level of monitoring and evaluation of hotel waste management practices. However, the fact that the MRF lost one of its contracts because of a misunderstanding indicated that there was a need for better supervision and communication. Hotels appreciated that the HSWM program provided assurance that waste management was more organised, that materials were recycled better, and that waste data were recorded. Some hotels were interested in receiving new ideas for improvement and conducting regular meetings to

discuss results and improvements. Some hotels were open to the idea of visiting the MRF and other hotels to compare environmental practices.

#### **4.4.6.1.4. Partnership**

Effective working relationships between the waste hauler, NGO and hotels was a key factor for the program's success. Each party contributed to the program and received benefits for their involvement. The stakeholders worked together because it was in their mutual interest to demonstrate environmental leadership. However, as with any partnership, there were elements of cooperation (interdependence) and conflict (different ideologies, agendas), as well as misunderstandings and communication breakdowns.

The communication, negotiation and persuasion skills of members of the NGO and the NGO's long-standing reputation helped the hotels and MRF work together to create an alternative waste management system. The NGO brought an awareness of environmental problems in Bali and knowledge of environmental management concepts that helped in the design a win-win situation for all stakeholders. However, credit for the program's continued success also had to be granted to the hotels and MRF that were responsible for keeping the partnership alive on a daily basis through fulfilment of commitments and dedication to improving the program. Without the ongoing collaborative efforts of the participants, the program would soon disintegrate.

The NGO depended on the MRF to implement their ideas about environmental protection through proper waste management (waste as a resource, composting, disposal at the final dumpsite) and provide income through the consulting fee. The MRF was a working model that the NGO could list as one of their activities and bring people to visit. The NGO ensured that a member of the local community took ownership of the program, both business risks and rewards.

The onsite management by the MRF director and manager ensured proper implementation of activities at the MRF and maintenance of the site in good condition. Their business interest in the success of the program meant that they were dedicated to making the program work. Without that supervision, waste sorting, processing and

disposal may not have been carried out in an efficient and effective way (e.g., workers would get tired, quit working and there would be a backlog of waste).

The MRF depended on the NGO to provide expertise and credibility. The NGO gave advice about environmental, social, economic, technical and institutional issues. The NGO helped motivate hotels to become part of the program, through negotiation skills, development of the Eco-Hotel Rating Program, and the NGO's reputation of being professional and providing an environmentally, socially and economically sound solution. The MRF was helped financially by the NGO, which allowed the MRF to delay payment of the consulting fee at the start of the program, and by a member of the NGO who invested in the program. People from the NGO had the motivation, environmental awareness and technical skills that helped to shape the program. A member of the NGO, who became employed by the MRF as the senior supervisor, strengthened the MRF's human resources.

The need for better communication with and supervision of the hotels may have been the result of the need to redefine responsibilities between the NGO and MRF. When the program began, there was reliance on the NGO to bridge the gap between the MRF and hotels, and to solve any problems that arose. However, as the operations became routine and the MRF developed its independence, it became important for the employees of the MRF to take responsibility for supervision, customer service and business development instead of the NGO. Bridging the gap between the waste hauler and hotels was challenging because of the differences between the foreigners at starred hotels and the local people who worked with the program. Cultural, educational, economic and social differences between foreigners and local people could result in different perceptions about customer service and cleanliness.

There were differences in opinion between the NGO and MRF regarding program priorities. As a non-profit environmental organisation, the NGO wanted to pursue social and environmental goals. It was difficult for the NGO to motivate the MRF to do projects based on social or environmental concerns. The NGO could advise and try to persuade but the MRF held the decision making power. The MRF tended to make



decisions based on economic considerations but did recognise the importance of ensuring the well being of employees, being environmentally responsible, and using appropriate technologies.

The MRF expressed dissatisfaction with the supervision provided by the NGO. The NGO was supposed to be supervising and improving the program, solving problems, building relationships with hotels, and involving the community, however, the NGO was mostly involved with managing monthly waste reports and yearly hotel contracts. Internal conflict within the NGO and a shortage of qualified human resources were some of the challenges identified by members of the NGO. NGO staff said that different ideas about the program's priorities within the NGO made it difficult for staff to know what direction to follow. The breakdown of the relationship between key members of the NGO resulted in changes in personnel and relationships between the MRF and NGO.

#### **4.4.6.2. Supporting Stakeholders**

##### **4.4.6.2.1. MRF Employees and Contractors**

Working with waste is not considered a high status job and the working conditions are not very pleasant. While these factors could make recruitment of MRF employees challenging, especially for positions requiring a strong skill set, other factors such as the unemployment rate in Indonesia and recruitment of employees by word-of-mouth through current MRF employees helped to balance the situation. For some employees, the desire to contribute to environmental protection and be involved with an innovative program provided motivation for working at the MRF.

MRF employees came from Java (primarily Muslim) and Bali (primarily Hindu). The truck drivers and their assistants were Javanese and Balinese. Most of the people working in the wet and dry waste sorting areas were Balinese. Most of the compost employees were Javanese. In the compost area, a lot of new workers from Java had been hired to replace Balinese workers who had not been working hard, leading to a state where compost was owed to the hotels and needed to be produced. There was a common perception among MRF employees (both Balinese and Javanese) that Balinese usually

had jobs in agriculture and tourism, while jobs involving waste were usually handled by the Javanese.

Culture and religion were factors affecting MRF employees. Javanese employees would make trips to their homes in Java for Muslim holidays. Balinese employees usually spent four days per month participating in traditional ceremonies. Before marriage, the Balinese do not have to go to many ceremonies. Once married, there are greater responsibilities. A Balinese employee said that once he got married, he would have problems balancing his work and traditional responsibilities.

Gender was another factor to consider when characterising the various work groups at the MRF. All the truck drivers and assistants were men. For the other jobs, there were both women and men doing the same type of work, however there were more women working in the sorting areas and more men working in the compost area.

There were also contractors who worked at the MRF to haul waste from hotels and sort wet waste. These contractors were the ones who hauled waste for the hotels before the hotels signed contracts with Jimbaran Lestari. Contractors for hauling waste owned their own trucks and were responsible for fuel, cleaning the truck, storage and maintenance. Some of the contractors were paid a hauling fee while others were compensated with pig feed.

#### **4.4.6.2.2. Members of Wisnu**

A number of people from Wisnu played important roles in the HSWM program's development over the years. They helped initiate the program, worked with the hotels and waste hauler, invested in the program, compiled waste data for reports, negotiated contracts and designed wastewater treatment plants. People who worked with Wisnu were motivated by concern about environmental and community issues.

Some members of Wisnu expressed disenchantment with the HSWM program since it was a business that aimed to make a profit. People working for the NGO received a

monthly salary of around 200,000 rupiah. Some members of Wisnu thought that working for an NGO and helping to increase the prosperity of certain individuals were not compatible goals. However, the commercial approach of the HSWM program enabled the MRF business to continue operations on a daily basis, expand the facilities to be able to manage larger quantities of waste, and replace staff as required when there were problems.

#### **4.4.6.2.3. Hotel Employees**

Employees from the housekeeping, food and beverage, gardening and engineering departments were involved with waste handling. Hotel employees were responsible for transferring waste to the garbage rooms. Jimbaran Lestari was contracted to collect the waste. Employees were not allowed to sell hotel waste for their own profit.

There was evidence that not all hotel staff cooperated with the hotel waste management program (e.g., bags opened to retrieve items like magazines and sunglasses, wet waste dumped on the floor, and waste brought out late for pickup). These “bad habits” demonstrated that staff at some hotels had little concern about the waste management system. The employees did not have a monetary incentive to separate waste since they were not allowed to sell recyclables. Sorting waste tended to be regarded as low priority and someone else’s job.

Some hotel managers were supportive of the HSWM program and familiar with operations at the material recovery facility. However, it was common for hotel employees and the general public to have little environmental awareness. Therefore, the environmental awareness and training programs and corporate culture at the hotels were important for shaping employee attitudes towards the environment and encouraging cooperative behaviour regarding waste management. The support of hotel managers at each outlet was necessary to ensure that waste management was carried out in an efficient and effective way.

#### **4.4.6.2.4. Pig Farmers**

A crowd of pig farmers converged at the MRF at the end of the morning and afternoon shifts, arriving by foot, motorbike or truck to pick up the sorted kitchen scraps. The food waste from hotel kitchens was deluxe food for pigs. Pigs fed on hotel food scraps could be sold in five months, weighing 125 to 200 kilograms, instead of in eight months, if fed on household food scraps. The pigs were sold locally or to international markets. According to a member of the NGO, the wastes created by the pigs were not being treated and were a cause for concern.

#### **4.4.6.2.5. Waste Dealers**

Recyclable materials were weighed at the MRF and sold to three waste dealers. The materials were piled on a truck and secured with a tarp. The recyclable materials were then sold to other dealers in Bali and Surabaya, Java, before reaching manufacturing industries, as described in Section 4.3.

#### **4.4.6.2.6. Waste Pickers**

There was an agreement between the MRF and waste pickers at the final dumpsite. The waste pickers paid a fee to the MRF for the privilege to recover items from the MRF's residual waste. Waste pickers recovered residual waste items such as wet cardboard and dirty plastic film.

#### **4.4.6.2.7. Government Agencies**

In Bali, establishments producing more than two cubic metres of waste per day are responsible for the storage, collection and transportation of waste to disposal sites. It was the government's responsibility to enforce proper laws and regulations regarding waste management. The HSWM program participants and the government shared the common goal of achieving better environmental management. Connections between the HSWM program and government systems occurred at various points such as the offsite treatment of wastewater and final disposal of residual waste. The government received payment from the MRF through fees for handling the wastewater and residual waste. The government was responsible for ensuring that supporting facilities for final waste

disposal and wastewater treatment were improved and maintained in good working condition.

#### **4.4.6.3. Background Stakeholders**

##### **4.4.6.3.1. Community Groups**

The material recovery facility was located in a residential neighbourhood, however, there were plans for the vacant land next to the facility to be developed into a market or condominiums. Since waste can be smelly and unsightly, people in condominiums may not appreciate the MRF's activities. However, if the land next to the MRF were used for the Jimbaran market, there would not be a problem because the market would have the same smell as the MRF.

The current neighbours of the MRF could be affected by odours, dogs, airborne pathogens, wastewater and noise from the MRF. If these neighbours were to protest the MRF's existence, the MRF would have a serious problem. The MRF reported that there were no complaints from neighbours. Local ownership and the supply of pig feed for local pig farmers were some of the factors that helped the MRF get community acceptance. Having high walls was important so that neighbours would not see or smell the waste. The MRF walls were decorated by a local artist.

Since hotel waste was viewed as a valuable resource in Bali for pig farmers and waste dealers, management of hotel waste represented a business opportunity for people from communities near the hotels. Competition for hotel waste could lead to conflict. The HSWM program has the advantage of being established, having experience and receiving the support and expertise of an environmental NGO. The community may lack environmental awareness, knowledge and skills related to waste management.

In general, the level of community awareness of environmental issues is low in Indonesia. Traditional waste management practices in rural areas involves feeding waste to pigs, throwing waste in the garden when it is rotten, and burning waste that does not decompose. Through site visits, discussions and presentations about the HSWM

program, the public (e.g., waste haulers, NGOs, students) could learn about an alternative model for SWM. Therefore, the HSWM program acted as a demonstration model for educational purposes. NGOs and school groups expressed interest in taking action regarding waste management issues and learning from the HSWM program's experience.

Numerous student groups visited the MRF to learn about waste management. University students from Bali studied the program for undergraduate projects. Foreign students have also studied the HSWM program using information available on the Internet.

#### **4.4.6.3.2. Tourists and Travel Agencies**

Tourists are the reason the travel and tourism industry exists. As informed consumers, tourists can make socially and environmentally responsible choices when travelling. Tourists that have an awareness of the impact of tourism activities can choose products and services that support the conservation of environmental and cultural resources. Studies have shown that tourists are willing to pay more for environmentally friendly products and services such as accommodation (Prideaux and Masau 2000).

Travel agencies and certification programs can play a key role in the promotion of companies that are environmentally and socially responsible. Demand from tourists and travel agencies for 'responsible' companies can provide motivation for the tourism industry to improve their environmental performance and support local programs such as the HSWM program.

#### **4.4.6.3.3. Foreign Agencies**

International organisations can support local environmental initiatives through the provision of funding and dissemination of information about best practices. The NGO received funding from the Asia Foundation and US-Asia Environmental Partnership (US-AEP) NGO-Business Environmental Partnership Program to approach hotels to join the HSWM program and improve the MRF. The program was recognised as a best practice by the Dubai International Award for Best Practices to Improve the Living Environment

for the year 2000 (Habitat). As part of the Best Practices database on the Internet<sup>20</sup>, information about the program is available to people around the world.

The Canadian Universities Consortium (CUC) Urban Environmental Management (UEM) Project at the Asian Institute of Technology (AIT) and Thailand Environment Institute (TEI) started an integrated hotel solid waste management project in Hua Hin, Thailand, building on the experience of the HSWM program in Bali. In July 1999, a member of Wisnu attended the project launching in Hua Hin to share Wisnu's experience with the participating hotels. Similar to the project in Bali, the project in Hua Hin involved green purchasing, waste reduction, waste segregation and onsite composting. The model was different from the Bali model, in that instead of transporting and sorting materials at a material recovery facility, source separation of waste occurred at the hotels. Since there was no material recovery facility, all composting was done onsite by the hotels. Some hotels also treated waste using anaerobic digestion.

#### ***4.4.7. Investigation of Issues***

With help from members of the NGO, a survey was designed to identify issues of importance, needed actions and management perceptions. Responses were obtained from three managers from the NGO and one from the MRF. Based on survey responses, the following issues were identified and rated according to importance:

1. Improving the wastewater treatment system
2. Improving the management of waste haulers, record keeping and end product sales
3. Improving the end products
4. Improving the work environment
5. Improving environmental awareness and morale of workers at Jimbaran Lestari
6. Improving the accuracy and meaningfulness of record keeping
7. Improving waste handling at hotels to meet current expectations
8. Introducing better separation at source
9. Improving health and safety

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<sup>20</sup> [www.bestpractices.org](http://www.bestpractices.org)

10. Improving workstations and the way tasks are performed
11. Starting new Material Recovery Facilities
12. Increasing efficiency
13. Increasing the salaries of workers at Jimbaran Lestari
14. Increasing the profitability of Jimbaran Lestari
15. Increasing the capacity of Jimbaran Lestari
16. Contributing to the residential area surrounding the MRF
17. Acting as a demonstration model

For each of these issues, survey responses of managers from the NGO and MRF are presented at the beginning, followed by an investigation of the issues connected to the topic. Information for the investigation of issues is based on interviews, informal discussions, observations and reflection.

#### **4.4.7.1. Improving the wastewater treatment system**

Survey responses recognised that additional effort was required to improve the onsite wastewater treatment system since it was a very important and sensitive issue, in particular because of the smell. Technologies were needed to improve the wastewater treatment plant. This issue is addressed in Section 4.4.5.1.

#### **4.4.7.2. Improving the management of waste haulers, record keeping and end product sales**

Survey responses recognised that recycling should be maximised, waste hauling equipment should be prepared and there should be enough workers. The recording of waste data was regarded as especially important. Survey comments also included the need for better baseline data, a new scale and one staff member to be in charge of record keeping. Management issues are described in Section 4.4.2 and data management issues are described in Sections 4.4.5.2 and 4.4.7.9.

The NGO recognised that supervision of waste management activities for three hotels was manageable (Wisnu 1998b) while management of waste from more than ten hotels was a challenge. As the number of hotels participating in the program increased, it became more difficult to supervise and manage all the issues. Managers at the MRF



recognised that additional human resources were needed to help manage areas such as waste haulers, record keeping and end product sales. Finding and retaining people with the skills and motivation to fill these positions appeared to be a challenge, given the low status and unpleasant conditions that could be associated with working with waste (as discussed in Section 4.4.7.9). To improve management, a supervisor at the MRF identified the need for people to perform the following roles:

1. *Office Administrator*: responsible for administrative tasks such as managing information for bookkeeping, databases, waste reports and communications (letters, email, telephone, fax).
2. *Customer and Public Relations Manager*: responsible for making contact with potential partners and maintaining relationships with current partners. This position would involve planning for the program's future and developing projects to benefit the community.
3. *Operations Manager*: responsible for operations at the MRF and hotels. This would involve managing human resources, equipment and facilities to ensure that standard operating procedures were being followed, and identifying ways to improve efficiency, health and safety (ergonomics), and environmental performance. This person would also be responsible for the integrity of data collection (e.g. waste and wastewater data).

#### **4.4.7.3. Improving the end products**

In survey responses, the need for better control of operations to improve results and creativity in the development and marketing of new products made from recyclable materials was identified. It was recommended that examples of products made from recycled materials be found, local artists be employed, and a worker's union formed to share the profits from these activities.

Making improvements to end products, equipment and technologies was constrained by financial considerations. The NGO was keen to make improvements, such as improving the quality and value of end products by finding creative ways to use the waste materials locally. The MRF tended to dismiss making changes that were not regarded as economic. The MRF would have liked the hotels to pay for any added costs involved with making changes, such as using effective microorganisms for composting.

The potential benefits of creating new markets for recycled products could include: job opportunities, local recycling businesses, reduced transportation costs, waste reduction, and increased revenue. Ways of improving the quantity and value of waste recycled could be identified through discussion with staff at the NGO and MRF and support of start-up recycling businesses through the provision of grants, loans, waste materials, equipment and facilities. Incentives could also help encourage employees to identify ways of increasing the MRF's revenue and developing new end products. Examples of recycling businesses include soap made from leftover oil, handicrafts<sup>21</sup> made from recycled metal, glass, plastic and paper, and fermentation of organic waste.

Awareness of the benefits of recycling may help create more demand for recycled products. For example, if hotels were committed to using recycled products<sup>22</sup>, the MRF may benefit from the greater demand for recycled products. Adding value to the compost by producing compost pellets and selling them in small packages was suggested by the NGO<sup>23</sup>. This would improve the appearance and marketability of the compost, allowing it to be sold in supermarkets. Producing charcoal to be sold back to the hotel was another possibility suggested by the NGO. For kitchen waste not suitable for pig feed, the organic portions could be fermented and the products sold or used onsite. Other examples of recycling opportunities include making soap out of the oil, candle holders out of glass or iron, and picture frames out of recycled plastic.

#### **4.4.7.4. Improving the work environment**

Survey responses indicated that the work environment of the MRF was very dirty. Better layout, infrastructure (fencing, flooring) and office information management was needed. It was regarded as the NGO's responsibility to plan how the work environment should be improved. Regarding the HSWM program's social environment, the importance of good

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<sup>21</sup> For example, decorative items, bags, hats, fans, twine, belts, slippers, flowerpots, piggy banks, and floor mats.

<sup>22</sup> Concerns about the quality (i.e., durability, sanitation) of recycled products would need to be addressed.

<sup>23</sup> Different types of compost (such as those produced with cow and bat manure) were sold in Bali for prices ranging from 1500 to 3000 rupiah per kilogram. The NGO sold compost from the MRF for 700 rupiah per kilogram.

relationships created through interaction between management and workers was recognised.

A local artist designed decorative motifs for the walls of the MRF. The principles of Feng Shui<sup>24</sup> were applied to the design of the facilities. For example, the entrance to the MRF was moved so that it would not run directly towards the living area.

Compared to North American occupational health and safety standards, some work conditions at the MRF may not be considered acceptable (e.g., temperature). MRF workers said that initially, they found the tasks and work conditions difficult, but they learned how to perform required tasks and got used to the work conditions. Some employees said that the facilities should be kept cleaner. In the following sections, issues related to the work environment are discussed.

#### **4.4.7.4.1. Odours**

There were different opinions regarding the unpleasantness of odours from the MRF. For visitors to the MRF, smell was one of the first things they noticed and it was described as shocking, causing a feeling of illness and dizziness. For employees at the MRF, they said that after the first week they were fine with the smell. MRF management said that employees did not complain because they were handling fresh refrigerated garbage that was not smelly. Odours came from the wet waste area, the wastewater treatment system (water from cleaning bins, floors and trucks), and the compost piles after new materials were added.

At the MRF, unpleasant odours were only considered to be a problem on occasions when waste was left around for a long time and rotted. The major sources of foul odours were the residue and wastewater that were not cleared out after the second shift and remained overnight. The wet waste residue was stored at the MRF overnight because there was only enough residue for half a truck. The smell was bad, especially from the residue at the bottom of the pile. The MRF would have liked to bring residual waste to the final dumpsite after every shift but were unable to because the machine for lifting waste off the

truck was not available in the evening. Therefore, the residue was only brought to the final dumpsite after the morning shift. Although the smell of the residual waste (as well as the insects and animals it attracted) were unpleasant, the MRF said it received no complaints from neighbours.

#### **4.4.7.4.2.        *Insects and Other Pests***

Another bothersome aspect of the work conditions was the presence of flies and mosquitoes. Flies were attracted to the food waste. As with the smell issue, employees said that at first they found the flies disturbing but then they got used to it. To control the number of flies, fly killer (i.e., a pesticide) was sometimes used. The flies died, the chickens ate the flies and then the people ate the chickens.

Employees in the compost area attributed the large number of mosquitoes and flies to the forested surroundings and rainy season. A member of the NGO observed that the type of mosquito that carries dengue fever could be breeding in collected rainwater. There were walled areas for storing recyclables (glass, metals and plastic jugs), coconut husks and compost residue. There was no roof covering the storage areas, therefore, rainwater could collect and provide a breeding ground for insects like mosquitoes.

It was common to find cockroaches, dogs and cats at the MRF. Dogs were considered a problem because they disturbed the employees. The dogs came in at night to get meat from the piles of residual waste that were stored overnight. The design of enclosed facilities for the new workstations was expected to keep unwanted visitors out.

#### **4.4.7.4.3.        *Climate***

The heat and humidity of southern Bali was another factor affecting the pleasantness of working conditions at the MRF. In the afternoon, it could get very hot for wet waste sorters because the setting sun shone in on the westward facing section of the wet waste sorting area. This would no longer be a concern when the new facilities were built since

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<sup>24</sup> Feng Shui is the ancient art and science of living in harmony with the environment. Elements of Feng Shui can be found in the religious beliefs of people from Bali and Indonesia (Sharp 2002:5).

the entire area would be enclosed. However, with an enclosed building, it would be very hot unless there was good air circulation provided by a ventilation system.

#### **4.4.7.5. Improving environmental awareness and morale of workers at Jimbaran Lestari**

From the survey, responses indicated that if workers knew about the vision of what they were doing, there would be better worker morale and dignity, as well as a better company image. This issue was considered to be connected to training about environmental issues, participatory planning, and the opportunity for workers to become shareholders and form a union.

MRF management expressed recognition of the importance of having motivated employees who worked together as a team. Every three months, the MRF gave an award to the best staff member. MRF employees expressed the view that there should be better team spirit instead of individuals trying to win for themselves and become management's favourite.

Management recognised the need to be attentive to employee needs, to treat them fairly, and to encourage a spirit of teamwork. Both management and workers at the MRF said that there was good personnel management.

One of the employees who lived at the MRF said that it was good living at the MRF with friends, sharing a room with three other people, being able to watch TV and use the kitchen facilities. Another said that he liked working at the MRF and did not know where else he would work. Many employees said that things were fine the way they were. An employee approached the researcher to say that she was happy with her job and glad to be helping to protect the environment in Bali.

At the NGO, staff were interested in helping their communities and protecting the environment. They seemed to be disenchanted with the HSWM program because the MRF was a business concerned with making a profit. NGO staff who did work for the HSWM program (i.e., work that helped make others wealthy) felt they should be paid

more than their NGO salary. NGO salaries were low, leading to comments about how the members of the NGO could be better off sorting waste at the MRF.

Morale and environmental awareness were issues at the hotels as well. The “bad habits” of staff at some of the hotels indicated that there were some problems obtaining the cooperation of hotel staff. In the NGO’s evaluation of the HSWM program, it was observed that staff either did not care enough or did not understand the importance of the HSWM program. The NGO observed that there were not enough management resources devoted to ensuring the waste management system was working properly in the hotels. The success of the hotels at achieving waste minimisation (i.e., less residual waste) was linked to the effectiveness of the hotels’ environmental management systems and commitment of staff to environmental goals.

#### **4.4.7.6. Improving the accuracy and meaningfulness of record keeping**

Survey comments indicated that the importance of knowing the accurate amount of waste recycled was recognised. The need for better baseline data and feedback reports to help hotels make better decisions was identified. This was to be accomplished by making more measurements, finding a better way of making measurements, buying a new scale and hiring more staff.

At the MRF, waste quantities were often estimated instead of actually measured. This made the quality of the data questionable. Keeping accurate records of waste amounts was not a simple task. Weighing the waste from all the hotels on scales at each stage of the process (collection, sorting, processing and disposal) would be time consuming. Therefore, the MRF only weighed the waste from one hotel. For the other hotels, estimates were used. The estimates may not have been accurate for the following reasons: comparison with actual measurements using the scale was not performed regularly; the scale may not have been accurate; there could have been a bias towards certain hotels; and there could have been a bias towards showing higher recycling rates and lower amounts of residual waste.

The waste from two hotels was picked up in one truckload. While this was more efficient than having separate trips, it meant that waste from different hotels could get mixed together. The MRF created designated work areas in the wet and dry waste sorting areas for the waste arriving from different trucks. This would help with tracking the amount of waste from each hotel if measures were in place to ensure that the waste from different hotels did not get mixed together on the truck. The idea of having one sorting station per hotel was not regarded as economic.

An earlier attempt to hire someone to develop a better system for measuring waste amounts did not succeed because the person quit after three days, stating that he could not deal with the smell of the waste. A new person for the job could not be found. It was difficult to find people to work at the MRF or NGO instead of working at an office job.

Improvement of the data management system was a challenging task for the following reasons:

1. waste from hotels was combined at the MRF, making it difficult to track waste quantities from individual hotels;
2. there was a shortage of bins for wet waste, causing wet and dry wastes to get mixed together;
3. if the hotels separated materials such as paper and bottles and sent them directly to other parties, there were no mechanisms for recording that amount of waste that was recycled;
4. the MRF recorded the number of containers of waste collected but the amount and density of waste contained in bins and bags varied for different hotels and for different days, therefore the estimates may not have been reliable;
5. financial resources were limited, therefore buying several large scales would not be economically feasible;
6. moving the waste onto a scale for weighing would be excessively cumbersome because the bins holding wet waste were difficult to manoeuvre, the bags holding the wet residual waste broke easily and the compost residual wastes were not in containers;
7. bottles were not always emptied of their contents, therefore, inaccuracies in weight measurements would result;
8. it was difficult to measure the amount of liquid waste leaching from the wet waste;
9. record keeping had a tendency to be viewed as a low priority, time consuming and unprofitable task;

10. there was apprehension regarding the measurement of the actual weight of the waste and the reporting the actual amount of residue because it may be discovered that recycling rates were not increasing and that residual waste amounts were not being minimised as desired;
11. analysis and reporting of waste data could be challenging because several factors<sup>25</sup> need to be considered to determine waste generation rates, understand trends and make comparisons.

#### **4.4.7.7. Improving waste handling at hotels to meet current expectations**

Survey responses asserted that the waste issue is very important therefore everybody should take their responsibilities seriously. Other survey comments indicated that while improvements were always being discussed with the hotels, there was a need for better supervision of the hotels and routine meetings. The importance of the Eco-Hotel Rating Program for the hotel's public relations and to help the hotels become more aware of the need to protect natural resources was emphasised.

The mixing of wet and dry waste, garden and dry waste, and construction and garden waste was a common problem. There were differences between the actual operations, standard operating procedures, and the responsibilities outlined in the contracts signed by the MRF and hotels. For example, in the contracts there were two categories of waste: wet waste and dry waste. However, according to the standard operating procedures, there were five categories of waste: dry waste, wet waste, cardboard, paper and bottles. There was also supposed to be an adequate number of bins that were coloured or labelled for sorting (i.e. green bin for wet waste, yellow bin for dry waste, blue bin for paper, a separate box for glass, and stacks of cardboard). The standard operating procedures highlighted the importance of separating glass from other dry waste for safety reasons.

In practice, hotels kept dry and wet waste separated but did not use the five categories of waste described in the standard operating procedures. A manager at one of the hotels

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<sup>25</sup> Factors to consider include: wet and dry seasons, occupancy rate, number of rooms available, number of guests and staff, types of guest rooms (villas or building), restaurants, conference centres, total amounts of waste produced by hotels, amounts of waste produced per room/guest, amounts of waste recycled, amounts of residual waste, amounts of liquid waste, performance of other hotels, and past performance.



said that there used to be special bins with different colours for paper, metal, glass and plastic waste when waste was sold directly to waste dealers. However, that degree of waste separation soon ended after hotel employees saw that the waste hauler mixed the different types of materials on the truck. Since the MRF staff and trucks did not have proper procedures and equipment for keeping the waste separated on the truck, it seemed pointless for the hotels to continue separating waste into different types of recyclables. Dry waste was then placed in one large box instead of separate containers. The NGO said that the trucks needed to be redesigned with separate compartments for the different materials, however, MRF staff involved with hauling did not think that compartments on the truck would work well. It would be difficult for the MRF to consider alternative systems for waste separation and collection because the MRF exists as the place for sorting waste.

Staff at some of the hotels had the 'bad habits' of dumping wet waste on the floor and/or tearing open plastic bags of dry waste to recover items of value. Hotel staff opened bags of dry waste to search for sunglasses, magazines and cloth. According to the contract between the hotel and waste hauler, this practice was not permitted because the waste hauler had right to all the waste generated by the hotel. The dumping of waste on the floor and the tearing of plastic bags made picking up waste from the hotels more time consuming.

Possible causes of the problems were identified to be a communication gap between hotel managers, engineering and stewards and the lack of staff appointed by the hotel to ensure that proper separation of wet and dry waste occurred. It was also stated that hotel managers knew about the problem but did not do anything about it. In the NGO's evaluation of the program, it said that the reason why hotel waste was getting mixed was because hotel employees did not care about or did not understand how to do reduce, reuse, recycling and source separation.

It was common for hotels to run out of bins for wet waste because bins would get broken and then not get replaced. The hotels would then place the wet waste in plastic bags or use dry waste bins for wet waste. At least one of these plastic bags would break every

day because the plastic bags were not strong enough for the weight of the wet waste. It would take a lot of time to clean up the garbage from the floor. The shortage of bins would also result in the mixing of wet and dry waste.

The program's financial wellbeing depended on the contracts between the MRF and hotels. Although the contract and manuals specified that complaints should be recorded in writing, this rarely occurred. The fact that one of the hotels decided not to renew its contract was an indication that the MRF's communication with and responsiveness to hotels needed to be improved. A communication book was introduced by the NGO to improve the documentation of complaints, problems, issues, accidents and injuries that previously were rarely recorded in writing.

#### **4.4.7.8. Introducing better separation at source**

In the survey, responses indicated an understanding that better source separation would help to maximise recycling and that a source separation system should be prepared at the hotels. To support better source separation, capital intensive changes such as coloured bins and trucks with side loading and separate compartments for the different types of waste would be needed.

Mixed waste materials could still be recovered even if they were dirtier and required more effort to sort. The amount of residual waste and inefficiency caused by mixing and contamination of waste had not been investigated. However, better sorting could increase the value of the waste materials and the possibilities for reuse and recycling, as well as increase efficiency by reducing the sorting effort at the MRF. From a health and safety perspective, properly designed source separation could reduce risks by minimising the handling of potentially hazardous items (such as broken glass, broken plates, diapers, sanitary napkins and chemicals), and inhalation of dust.

Improving source separation might be a difficult sell because one of the HSWM program's selling points was its efficiency and convenience that allowed hotel staff to concentrate on their primary tasks. Better source separation would require more effort on the part of the hotel management and staff. As compensation for performing better

source separation, hotel staff may want to benefit from the sale of recyclables. This would reduce the MRF's revenue from the sale of recyclables.

Typically, hotel staff may not regard sorting waste as being part of their job. Changing attitudes and habits takes time and effort. Therefore, unless management stressed the importance of waste separation and there were incentives for good source separation, it is unlikely that hotel staff would properly separate waste. The willingness and capacity to implement better source separation varied from hotel to hotel.

At hotels with a high degree of environmental awareness and commitment, separation of waste according to plastics, glass, metals, paper, residual waste and wet waste could be handled by trained staff with proper facilities and equipment. At other hotels, there could be an inability to properly implement the basic wet and dry separation system because of inadequate management, staff cooperation, storage space and bins. Large conferences and high occupancy rates were other reasons why hotels could find themselves too busy to do proper waste management.

More effort put into source separation would mean less effort for processing. The MRF existed as the place for sorting and processing waste. Therefore, if hotels performed better source separation onsite, there would be no need for the MRF because recyclables could be sold directly to waste dealers and residual waste hauled directly to the final disposal site. This arrangement could be more efficient and provide environmental benefits through reduced transportation, especially for hotels that were not located such that the MRF was along the route from the hotel to the disposal site or recycling markets.

#### **4.4.7.9. Improving health and safety**

Survey responses indicated recognition of the high risk of getting diseases when working with waste and the need for healthy workers to get the optimum result. To reduce health risks, the need for greater awareness of operating procedures and better work infrastructure was recognised.

The MRF was an improvement for waste workers compared to working at dumpsites because it provided better facilities<sup>26</sup>, uniforms<sup>27</sup> and protective equipment. If staff were injured on the job, the MRF paid for doctor appointments and medication<sup>28</sup>. Informal comments from the NGO indicated that health and safety was not considered to be a major concern because food waste from the hotels was not considered to be harmful or hazardous. MRF management recognised that most of the employees were young and healthy and may not have been aware of potential health risks involved with their work (e.g., chemicals in bottles). There were no formal records kept of health problems.

Some employees said that they did not have any health problems or accidents related to their work. Others said they were frequently cut by broken glass and nails (e.g. toes cut by broken glass that caused lots of bleeding and required stitches). One employee estimated that he got cut twice a month. Some concerns regarding dust inhalation were expressed. Falling off trucks or falling in the wet waste area happened because the floors were slippery. Employees said that those who were not experienced got injured. The employees tended to blame the accidents on themselves, saying that they were not being careful enough.

The NGO was interested in ergonomics. Since the waste workers handled heavy loads and performed repetitive tasks, they were at risk of incurring injuries while on the job. Employees complained about sore muscles and tiredness, but this was considered normal and not a problem.

#### **4.4.7.9.1. Safety Equipment**

To reduce the risk of injury and illness, it was important that employees use proper equipment, such as footwear, gloves and facemasks. However, safety equipment was not always used because it was inconvenient, not regarded as necessary, or not available.

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<sup>26</sup> Running water was available at the MRF, allowing employees to wash their hands and feet as required. The washroom facilities were considered to be sufficient.

<sup>27</sup> The MRF employees had to look acceptable when entering the hotels. The MRF was planning to wash the uniforms for the employees.

<sup>28</sup> The MRF had expressed interest in having all staff go to the same doctor to get a better rate and to be able to track injuries and illnesses.

Employees found that the boots were too hot, the gloves were too cumbersome and the facemasks got dirty too quickly. Employees said that they used gloves and boots if they felt like it. For example, after having a small accident such as a cut from broken glass, they were more inclined to start using gloves and boots again. The workers preferred cloth gloves (instead of rubber gloves) because the cloth gloves were better if they sweat. Employees said the masks were not comfortable. They said that masks were only needed for the people sorting dry waste. Masks got dirty and were thrown away after one use.

There were different stories about the provision of safety equipment such as gloves and boots. Management said that this equipment was supplied. Some employees said that they got equipment, while others said they did not and would like to have gloves, masks and boots. One employee said that he bought his own boots. Workers in the compost area and assistants for picking up hotel waste said they would wear boots if they had them.

#### **4.4.7.10. Improving workstations and the way tasks are performed**

Survey responses indicated that the workstations were not ergonomic. It was believed that better workstations with an ergonomic design would increase productivity and earnings. The need for monitoring was recognised.

##### **4.4.7.10.1. Work Activities and Areas**

One of the assistants for hauling waste said that the most difficult part was lifting the heavy bins of wet waste onto the truck. To move the heavy bins, they were tilted and rolled along their bottom rims instead of being dragged or lifted. During the morning shifts, bins of wet garbage would often tip over during collection because of difficulty manoeuvring them. This resulted in extra work and an increase in the quantity of residue because dry waste would get mixed with wet waste. Since the bins have no covers, waste could easily empty out if the bin fell down. The bottoms of bins broke occasionally.

More space for activities would have been helpful in all areas of the MRF (including the office). During the peak season when there was more garbage, it got crowded, especially in the wet waste sorting area. Sorting activities depended on the arrival time of waste at

the MRF. Some employees said the most difficult thing was working when the trucks were late. However, it was observed that small breaks were beneficial because they allowed workers to rest, walk around and stretch.

During interviews, workers were asked what they disliked about their jobs. Dry waste sorters said they hated handling diapers, dust and coal. Wet waste sorters said they hated it when the hotels put soup with the wet waste because the waste became slushy and difficult to sort. Sometimes the employees got itchy from the chili peppers in the waste and sometimes they got things in their eyes, but this was not considered to be serious. Employees in the compost area found it dangerous when construction waste was mixed with the garden waste.

During discussions with employees in the dry waste sorting area, they expressed the opinion that using the floor instead of a table to sort waste was clearly the best way to sort waste. A conveyor was not regarded as a good idea because it would make sorting more difficult because they would not be able to shake the material first to see broken glass. People from the NGO and MRF had considered the option of spreading the dry waste on a table for sorting. However, at this time, people at the MRF seemed content with sorting the dry waste on the floor. The idea of a conveyor belt for the wet waste was not considered to be feasible because the water would mix with the conveyor belt and cause problems. A food chopper was not considered to be a sound investment because it would chop the food too finely and pigs would not like to eat it.

Like the sorters of dry waste, the sorters of wet waste also squatted to do their work. The drains often got clogged, resulting in wet waste sorters working in puddles of wastewater. Workers said that wet feet were not a problem. Management thought that wet feet gave the workers headaches. Management wanted to improve efficiency and capacity by changing the wet waste workstations to allow wet waste workers to stand instead of squat. One of the wet waste workers said that there was no need to change the way their work was done. When their legs got tired, employees stood up to stretch. The workers were of the opinion that standing at a table would be more uncomfortable and tiring than squatting.

During the wet season, there were flooding problems in the area for compost piles. The workers said that sometimes they were up to their ankles in water. It was important to have boots. When it rained everyday, the workers could not turn or screen the compost. A member of the NGO had recommended that the compost area should have a roof and cement floor with a ditch for drainage of the leachate to the wastewater treatment plant. The roof would provide shade for workers and protect them from the rain. The roof would also prevent the compost heaps from getting too much rain during the rainy season.

#### **4.4.7.10.2. Work Load and Schedule**

Through experience, the MRF had established appropriate sizes for work groups. Employees said that there was a good balance of workers for the amount of work to be done. Both staff and management at the MRF agreed that if the amount of waste increased, the number of staff should be increased proportionately. Management said that shifts were limited to four hours because of the potent smell of the wet waste and people's legs getting tired from squatting.

Employees in the compost area worked from 7 am to 11 am, had a break from 11am to 1pm, and then worked from 1 pm to 4pm. Some compost workers said that they would like to have no lunch break so that they could go home earlier. Compost workers said that it would be better if the arrival of garden waste were spread out little by little instead of everything coming at the same time. Wet and dry waste sorters at the MRF worked from 4 am to 8 am and from 3 pm to 7 pm. The shifts for drivers and assistants started about an hour earlier because they had to pick up the waste before work could start at the MRF. Employees said that they were happy with the work schedule but would not want to work more hours. One of the supervisors said that eight-hour shifts instead of the two four-hour shifts would not be a good idea because the workers would not have enough time to rest and it would be easier for them to get stressed and have more psychological problems.

Employees who picked up waste from the hotels (truck drivers and assistants) were happy with the rolling system that meant they picked up waste from different hotels every three months. Even though picking up waste from two hotels was the standard amount, the truck drivers were willing to handle waste from three hotels. This was needed temporarily because there was a shortage of drivers, assistants, trucks and housing. It was expected that in the future, they would only have to handle the waste from two hotels. More than three hotels would be unacceptable.

#### **4.4.7.11. Starting new Material Recovery Facilities**

For the MRF respondent, increasing the capacity of the existing MRF was a priority whereas survey responses from the NGO indicated that new MRFs were needed to address garbage problems in Bali. The NGO responses indicated that new partners needed to be identified. The need for a local owner, as well as the establishment of informal and formal MRF networking (i.e., a forum or association of waste haulers) was identified. A survey response from the NGO indicated that the garbage/MRFs movement should be for political bargaining. This appeared to be linked to the need to involve the community in planning and develop waste management programs based on the socio-cultural characteristics of the local people (i.e., the banjar).

A survey response from a member of the NGO indicated that the association of waste haulers would be instrumental for establishing waste hauling standards that all waste haulers must follow and standard prices so that competition did not lead to lower prices. While competition between waste haulers is instrumental in maintaining standards (i.e., reputation for good service) and encouraging efficiency, prices that are too low may not cover operating costs. If lower prices were allowed to become the overriding concern of hotels and waste haulers, this could lead to illegal dumping of waste to reduce costs associated with transporting waste and paying fees at the legal disposal site.

In 2000, a former member of the Wisnu Foundation started a hotel waste management program with a material recovery facility in Mengwi, Bali. The program was part of a solid waste management and composting company called Bali Bersih. The program



provided hotels with training for onsite management of kitchen waste instead of transporting and sorting the wet waste at the MRF in Mengwi. A centre at the facility for environmental education and promotion of recycling activities was planned to help people interested in starting recycling businesses through the provision of resources such as free waste materials from the hotels.

#### **4.4.7.12. Increasing efficiency**

Survey responses indicated the need for better efficiency of time, energy, work and costs. This could be accomplished by evaluating and improving the way that sorting was done, job descriptions, expenses and the system as a whole.

As a business, the MRF was profit motivated and decisions were made according to what was economic or efficient. In developing countries, machinery such as vehicles is more expensive than labour, therefore, it makes sense to optimise vehicle productivity instead of labour productivity (Jindal et al. 1998:37). MRF management recognised the importance of improving efficiency through improved supervision and operating procedures. For example, the reduction of waste volume using a press for residual waste can improve efficiency by reducing the number of truckloads going to the final disposal site. The MRF's interest in improving the routing of trucks showed this emphasis on improving vehicle productivity.

Examples of changes that could improve efficiency and work conditions included: purchasing bins for a bin exchange system, using a chainsaw instead of chopping wood wastes, roofing for the compost area and storage areas, garden waste chopper for compost materials, high pressure water spray for cleaning floors and bins, and a larger office for administration. However, adoption of changes is constrained by financial considerations and views about appropriate technology.

The efficiency of compost production and the quality of the compost could be improved by reducing the amount of plastic film mixed in the compost heaps (i.e., through investigating how the use of plastic film could be reduced), adding 'effective microorganisms' (from fermentation of organic kitchen waste), investigating the addition

of materials such as manure and providing roofing over the compost area (to prevent compost from receiving too much rain and to allow compost activities to continue when it rained).

Introducing a bin exchange system at all the hotels would decrease the amount of time, effort and cleaning water involved with picking up waste from the hotels. It was recognised that a bin exchange system would be more efficient than transferring of waste from the hotel's bins to the hauler's bins. The hauler would be able to take the bins full of waste and replace them with a set of clean bins instead of having to transfer the waste to the hauler's bins, clean the bins at the hotel and then clean the bins at the MRF.

The major obstacle for a bin exchange system was the purchase of bins. It would be very expensive for the waste hauler to provide an extra set of bins for all the hotels. Already, bin shortages at the hotels were common. Good quality bins imported from Australia were expensive, costing around 1 million rupiah (US\$140). Hotels were concerned about the loss of bins if the bins were to leave hotel property. Joint ownership of the bins or MRF ownership of the bins and rental fees for the bins paid by the hotels could be investigated.

#### **4.4.7.13. Increasing the salaries of workers at Jimbaran Lestari**

Survey responses indicated that worker prosperity should be improved and affirmed that workers were getting more than the regional basic salary (salaries were set up according to local regulations). It was suggested that giving workers health/accident insurance or establishing an incentive system would be better than increasing salaries. The need to review the profit distribution system was identified. Consideration of a worker's union that would make workers shareholders of the MRF was recommended.

The program provided employees with incomes above the regional basic salary of 250,000 rupiah (US\$36) per month. The per capita income in Indonesia was estimated to be US\$1,300 in 1997 (Jindal et al. 1998:13). Salary increases every six months and yearly bonuses were provided. Additional income for employees was provided through the sale of tins, soap, novels, perfume bottles, wet cardboard, plastic residue, and money

from waste pickers at the final disposal site. Free pig food and cattle feed could also be obtained.

Over twenty employees lived at the MRF in accommodation provided by the owner. For employees who did not live at the facility, their salaries were adjusted to provide compensation. Other factors such as the number of years the employee has worked at the facility helped determine employee salaries.

MRF management recognised the value of its employees and was concerned about improving the comfort of workers and increasing worker prosperity. They realised that the program's success depended on keeping the workers happy because the program would quickly fail without the dedication and hard work of the employees. Waste would pile up unsorted, and the facility would be a mess. Some employees said they had no problem with their salary while others said they wanted raises, stating that Bali was a tourist destination and that everything was expensive.

#### **4.4.7.14. Increasing the profitability of Jimbaran Lestari**

Survey responses from members of the NGO and MRF linked profitability of Jimbaran Lestari to the economic status of workers but showed differences in the outlook of people from the NGO and MRF. From the NGO, the opinion that the MRF owner needed to be motivated to work better and that profit should not be based on worker exploitation was expressed. From the MRF, the opinion that increased profitability would help to improve worker prosperity was expressed. The use of business targets and meetings with workers about how to deal with more hotels and more waste and how to link this to salaries were suggested as ways of increasing profitability.

The NGO and MRF discussed achieving economies of scale by increasing the number of hotels participating in the program. The program was already developing its facilities and there was a keen interest in improving efficiency. To support program activities, more staff, equipment and land would be required. To prevent the loss of hotel contracts, the need for good communication and prompt problem solving was recognised.

Better management and reporting of the sale of end products may help to identify opportunities to improve the MRF's revenue. Better sorting may allow additional materials to be retrieved instead of being sent to the dumpsite. The MRF may be able to increase its revenue by improving the value of waste materials through better sorting, cleaning, storage and/or processing. If paper products were stored under roofed areas, this would prevent them from getting wet and losing value<sup>29</sup>. The MRF should investigate whether waste dealers the MRF could improve the quality of waste materials to obtain a higher price. Improvement of transportation arrangements could also be investigated to reduce distances travelled by materials and associated transportation costs.

#### **4.4.7.15. Increasing the capacity of Jimbaran Lestari**

Survey responses identified the need to determine the maximum capacity for the MRF given the existing amount of land and the use of basic, manual techniques. The best planning, management, control and monitoring techniques also needed to be determined to improve the system. The need for good infrastructure and appropriate technology was recognised. The MRF's new facilities addressed the issue of increasing the MRF's capacity to handle waste from more hotels.

#### **4.4.7.16. Contributing to the residential area surrounding the MRF**

A survey response identified the importance of contributing to the local community to help make a better neighbourhood, prevent complaints and create a better image for the MRF and hotels. Community acceptance was recognised as being critical for the MRF's survival. The MRF needed advice for how to improve community relations. Awareness and education programs and picking up waste for the local community were some of the options to consider.

Evidence of the dumping and burning of household waste is a common sight in Bali. A survey response indicated that the local community could be taught how to do

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<sup>29</sup> If office paper or cardboard got wet, instead of receiving 500 rupiah per kilogram, the MRF only received 150 rupiah per kilogram.

composting and separate recyclable, dry and wet waste. A small monthly fee per household could help cover costs. Additional workers would be needed at the MRF. Increasing MRF capacity would result in the creation of more employment opportunities for the local neighbourhood.

While the NGO was interested in improving household waste management in the community, the MRF did not express interest in handling household waste. Even though the program had been in operation for a number of years, the MRF said that it was not ready to handle household waste. Hotel waste yields better profits for two reasons: 1) hotels are able to pay for their waste to be handled properly; and 2) the waste from hotels is more valuable than the waste from households. Improving the management of household waste would also be challenging because of the low level of environmental awareness and experience with recycling.

The HSWM program was a benefit to the local community because it improved business opportunities for a local waste hauler and provided employment opportunities for men and women from the local community. Both men and women were involved with program management.

Local ownership and the supply of pig feed to pig farmers helped secure community acceptance. Onsite management by people with a sense of ownership helped ensure that the site was kept in reasonably good condition. If the facility was not properly managed, the surrounding community would complain. Continued community support for the material recovery facility was essential because the program would be in serious trouble if the surrounding community decided it did not want the noise of trucks and smell of waste any longer.

#### **4.4.7.16.1. Waste Pickers at the Final Dumpsite**

Although improved conditions for waste pickers is described as a program benefit, the waste pickers working at the final disposal site who recovered materials from the MRF's residual waste did not benefit from improved working conditions. Residual waste from the MRF was of less value than waste coming directly from hotels. In addition, payment

from the waste pickers for the opportunity to recover items from the MRF's residual waste indicated that the MRF was benefiting from selling the residual waste instead of following the "polluter pays principle" (i.e., where the MRF is regarded as the polluter).

#### **4.4.7.17. Acting as a demonstration model**

A survey response identified the importance of the MRF's role as a learning media for everybody interested in dealing with waste, since the program offered many perspectives for learning about waste (i.e., biophysical, economic, socio-cultural, political, legal, institutional and technical). Dissemination of information about the program was regarded as important so that the model could be replicated in other places. Through site visits, the program could help improve awareness about waste issues. The following groups were identified for involvement: the community, individuals, NGOs, government, universities, tourism businesses, and waste haulers.

Another survey response recognised that with more waste haulers adopting the system, the model would have a more significant impact on the island of Bali. It was suggested that the government could acknowledge good waste management and give awards so that more people would learn about the MRF and do better waste management.

The HSWM Program was a demonstration model that attracted interest locally and internationally. The HSWM Program helped to build environmental awareness and skills internally through learning to work together and externally through MRF site tours, presentations, documents, conferences, and information available on the Internet.

## **CHAPTER 5**

### **SUMMARY AND DISCUSSION OF THE CASE STUDY**

The case study examined issues of concern for a waste management program for hotels in Bali. This chapter provides a summary of key issues, and links program issues to key concepts from the literature review. Concepts from planning theory, environmental management systems, life cycle assessment, cleaner production, integrated waste management, appropriate technology and sustainable development literature will be discussed in relation to the HSWM program.

#### **5.1. Summary of the Case Study**

Various aspects of the HSWM program were described in the case study and can be used to cast the program in both a positive and negative light. To capture contrasting views of the economic, environmental and social aspects of the HSWM program, a summary of strengths and challenges of the HSWM program will be provided (see Table 29). These strengths and challenges are presented as lessons learned in the following list of topics.

1. **Local Ownership and Management:** Ownership and management of the waste hauling business by local people can help to ensure the sustainability of a SWM program. During program planning, an appropriate approach for integrating community concerns should be developed.
2. **Partnership:** The business sense of the MRF, social and environmental awareness of the NGO and environmental stewardship of the hotels enabled the creation of a mutually beneficial arrangement for improving waste management. This partnership of stakeholders enabled them to learn and work together. However, even when common goals are shared, conflicts can arise and lead to personnel changes if differences cannot be reconciled.
3. **Environment:** Improvements in waste reduction, reuse, recycling and disposal can be achieved when stakeholders share a commitment to waste minimisation (i.e., waste as a resource), continual improvement, and the polluter pays principle. A proper treatment system for wastewater is required to avoid problems with odours and

pollution. Adequate training, supervision and feedback are needed to ensure that proper procedures are followed for the storage, collection, transportation, sorting, processing and disposal of waste. Replication and adaptation of the program is needed to expand the impact of the program and address SWM problems in other locations and from other sources.

4. **Socio-economic Impact:** The participation of hotels in waste management programs can provide direct economic benefits to hotels (through waste minimisation), indirect benefits such as a better corporate image, and avoided costs (liability). Waste management programs using simple techniques and local resources can provide formal employment opportunities and better working conditions for waste workers. Further study of the program's socio-economic impacts (e.g., health of waste workers) would be required to quantify the program's socio-economic benefits.
5. **Capacity Building:** Solid waste management can be a tool for learning about the various aspects of environmental management. It can be difficult to find, develop and retain people with the communication, organisational, interpersonal and technical skills required for planning and managing solid waste programs.
6. **Management and Documentation:** Standard operating procedures can be developed to improve waste management practices. Problems can be resolved informally on a daily basis when the program is small. Implementing proper mechanisms for collecting and evaluating waste data can be challenging, but is important for monitoring results, identifying waste minimisation opportunities, and developing recycling targets. As the complexity of a program increases, more formalised environmental management practices may need to be implemented.



**Table 29: Summary of the Strengths and Challenges of the HSWM Program**

<b>Topic</b>	<b>Strengths</b>	<b>Challenges</b>
<b>Local Ownership and Management</b>	The program is owned and operated by a waste hauler from the local community. Local ownership of the waste hauling business ensures that there is proper management, operation and maintenance of the program on a daily basis, as well as expansion to achieve economies of scale.	The NGO wanted to have greater community involvement and empowerment of employees. The program helped create a local elite instead of building a community-based traditional institution. Workers do not participate in a co-operative system and do not have a worker's union. These aspects of the program were viewed as potential shortcomings by the NGO.
<b>Partnership</b>	The strengths of the waste hauler, NGO and hotels were used to create a mutually beneficial arrangement, whereby program partners were able to learn and work together.	Tension between people in the NGO created conflict. Some people decided they could no longer work together.
<b>Environment</b>	The program improved the management of hotel waste through the implementation of the polluter pays principle, use of waste as a resource (i.e., reuse, recycling, composting), disposal of residual waste at the final dumpsite, and treatment of wastewater.	Evaluation of on-site treatment options for the MRF's various types of liquid waste could be investigated to reduce wastewater, odour and pollution problems, and costs associated with off-site treatment. Better supervision of waste handling at the hotels could improve source separation. Replication of the program to address SWM needs in other locations and from other waste producers would increase the impact of the program.
<b>Socio-economic Impact</b>	The program provides employment opportunities and better working conditions for waste workers. The use of simple techniques for sorting waste is appropriate for local conditions. The participation of hotels in waste management programs can provide direct economic benefits to hotels (through waste minimisation), indirect benefits such as a better corporate image, and avoided costs (liability).	The impact of the program on the economic status and health of those who work with waste has not been studied.
<b>Capacity Building</b>	The program is a demonstration model that can be replicated and provides people with the opportunity to learn about the various aspects of waste management.	It was difficult for the program to attract and retain staff with the skills required to manage the program.

<b>Management and Documentation</b>	Standard operating procedures were developed to improve the management of hotel waste. Problems were identified on a daily basis and resolved informally. The program provided monthly waste reports to hotels for monitoring and helping to identify waste minimisation opportunities.	As the complexity of the program increased, it became more difficult to handle all the issues. The reliability of estimates for waste and wastewater quantities needed to be verified. The program would benefit from follow-up meetings with hotels and new ideas.
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## **5.2. Discussion of Concepts Related to the Case Study**

### **5.2.1. Planning Models**

The HSWM program involved the partnership of stakeholders for the achievement of environmental, social and economic goals through the implementation of waste management activities. Since there were multiple stakeholders, goals and activities, there were many issues to consider, as well as their interconnections. For program implementation, negotiation and compromise regarding the program’s priorities, and knowledge from many disciplines were needed to implement appropriate waste management techniques. Models from other countries were adapted to suit local conditions.

The NGO’s knowledge of environmental management concepts and issues in Bali and the MRF’s experience with hotel solid waste were essential for program planning and management. The NGO played the role of the planner as the program’s facilitator, mediator, coordinator, advocate and catalyst, bringing environmental knowledge, technical expertise and interpersonal skills to help solve problems and communicate program goals to stakeholders. The MRF managed personnel and day-to-day activities, and decided how resources were allocated.

As with most planning endeavours, there were multiple objectives and issues to balance, limited resources and information for achieving objectives and solving problems, and challenges surrounding the involvement, interaction, communication and coordination of stakeholders. The planning process for the HSWM program had elements of the rational

comprehensive, incremental, strategic, adaptive and transactive models. These various aspects of the planning process will be discussed in the following sections.

The planning process for the program had elements of the *rational comprehensive (synoptic) model* since it was an integrated approach to waste management based on knowledge of the context in Bali, waste management techniques and stakeholders. In other ways, the planning process did not fit the rational comprehensive model because there was not a formal overall long-term plan, nor was there any formal monitoring of plan implementation. When the HSWM program began, there was no prior experience, no blueprint and no knowledge of how it would all unfold. It was a matter of learning by doing, using intuition and knowledge about good environmental management practices (Ilham 2000, pers.comm.).

Since the program built on the existing waste hauler's activities instead of starting from scratch, the program could be characterised as *incremental planning*. The program aimed to improve the practices of some hotels through partnership with one waste hauler, instead of trying a more radical approach involving local community organisations. The NGO discussed the creation of a waste hauler association as a means of having a larger impact. The waste hauler association idea could be characterised as incremental planning since it involved expanding from working with one waste hauler to working with several existing waste haulers. Comprehensive plans involving the management of all types of waste (e.g., hazardous waste), all waste management activities (e.g., final disposal), other environmental and community issues, public awareness and regulations were beyond the scope of the HSWM program.

The program was *strategic* in nature because it targeted hotels as large producers of waste in the tourism industry and capable of paying for proper waste management. The program was sold as a strategic way for hotels to improve environmental management, since it focused on a visible issue such as waste, as compared to energy or water conservation, which may be less easily seen and understood.

The program's approach of "learning by doing" could be classified as *adaptive management*. The program recognised that improvements needed to be made over time by building on experience. The program had a trial-and-error approach since it was innovative and involved learning from experience and continually improving by making adjustments. It was recognised that the program was a work in progress to be improved over time. The participants learned from experience, accumulating knowledge and insights about how things worked, such as how to solve everyday problems, how to manage employees, how to design the facility's layout, and how to market the program.

The program was *transactive* since it involved building relationships and partnerships. The responsibilities of the stakeholders were defined in contracts and they learned how to work together for a program that aimed to bring environmental, economic and social benefits. The program's success depended on the quality of interaction, communication, and coordination.

### **5.2.2. Environmental Management Systems**

Implementation of environmental management systems (EMSs) at the hotels and MRF can help them better manage their environmental aspects, continually improve their environmental performance, demonstrate compliance with environmental regulations and express their concern about the environment. Issues concerning EMS implementation at the hotels and MRF will be discussed in the following sections.

The proactive adoption of environmental management systems to address the hotels' various environmental aspects would help further the tourism's industry progress towards integrating the goals of sustainable development. For the hotels in Bali, the Eco-Hotel Rating program that was developed with the NGO encouraged proper environmental management. As larger organisations and members of international chains of hotels, starred hotels were in a position to provide environmental leadership and to put pressure on other companies in their "product chain" to adopt better environmental management practices. If hotels participating in the HSWM program required that their contractors

have an EMS, there would be greater reason for smaller organisations such as the MRF to implement an EMS.

Applying EMS principles to the NGO's programs could be beneficial. Interest in an EMS for the MRF had been expressed and was to be gradually incorporated into daily practice (Ilham 2000, pers. comm.). Self-declaration of conformance to a standard such as ISO 14001 or Green Globe could then be made when the EMS was in order. Third party registration may be a goal in the future if external pressures could justify the effort and costs involved with external audits.

Although there may not be much external pressure for the MRF to implement an EMS, a more formal EMS could help the program improve its performance and long term success. An EMS could be beneficial for the following reasons: to ensure compliance with regulations, to implement measures to prevent pollution, to maintain a competitive advantage, to improve relations with stakeholders, and to develop the organisation's environmental awareness and stewardship.

Improving the MRF's EMS could enable the program to have better planning and management. A better management system for environmental and social issues would involve tracking information about environmental and social performance, training staff about environmental and social issues, and working to reduce environmental impacts and enhance social contributions.

For small organisations such as the MRF, additional expertise and support for EMS implementation from sources such as the government, industry associations or NGOs may be helpful. Training and partnership programs would help organisations share experiences and lessons learned as they develop and implement their EMS. Many challenging issues would need to be addressed for EMS implementation to be successful. Issues to consider include: commitment, leadership and support from senior management; resistance to change; need for flexibility and creativity; the burdens of bureaucracy; integration with existing processes and procedures; and participatory management.

An EMS for the MRF could provide valuable information about how best to minimise environmental impacts and improve the efficiency and cost effectiveness of the operation as a whole. Inputs to be assessed would be resources (e.g. water and energy) consumed during activities such as cleaning of bins and transportation of waste. Outputs to be assessed would include wastewater, residual waste and air emissions.

Based on the analysis of environmental impacts, ways of reducing waste, energy use, water consumption and transportation distances could be developed. This could be beneficial not only from an environmental standpoint, but also economically, as it could reduce fuel and electricity costs and the costs involved with treating wastewater.

### **5.2.3. Life Cycle Assessment**

Life cycle assessment (LCA) is a tool for the development of more sustainable practices that should be applied at the HSWM program. Integration of LCA with cleaner production initiatives and environmental management systems will enable the study of environmental impacts and planning of activities that improve efficiency and minimise waste through consideration of life cycle impacts. LCA provides waste planners with information to support decisions about what waste management techniques are best given local circumstances by comparing the environmental impacts associated with various waste management options. As with the other environmental management concepts, there are various system levels at which life cycle thinking can be applied.

For hotels, life cycle thinking should be applied to the purchasing, consumption and disposal of products with the objective of determining how to conserve natural resources and minimise waste, while providing visitors with a high quality experience. Life cycle thinking regarding products has already been exhibited by some hotels through green purchasing (e.g., the avoidance of plastic products). Additional opportunities to improve the sustainability of products and operations at the hotels could be identified and lessons learned shared among the hotels. Meetings of the hotels through either the HSWM program or Eco-Hotel Rating program could be arranged for this purpose.

For the MRF, LCA would help identify impacts associated with the waste management process. This would provide information for monitoring and improving environmental performance. LCA is a tool to help the MRF maintain a competitive advantage through the identification of ways of providing the same service with reduced environmental impacts and reduced costs. Solid waste, wastewater, energy use, water consumption and air emissions are some of the aspects the MRF should consider in an LCA. Funding and resources from the government may be needed to assist small organisations such as the MRF with limited financial and human resources.

LCA is an important tool for decision makers (such as waste planners in the government) seeking to evaluate different waste management options or the impact of different products. LCA would enable the comparison of environmental impacts associated with different waste management scenarios. For each of the scenarios considered, economic costs and social implications should also be considered. This would enable the sustainability of waste management options to be evaluated using knowledge about environmental effects, economic costs and social implications.

#### ***5.2.4. Cleaner Production***

Cleaner production is one of the elements to be incorporated in an environmental management system for the redesign and evaluation of program activities. Cleaner production is a preventive approach that involves the minimisation of environmental impacts through the evaluation and redesign of products, processes and services. The partnership between the hotels and MRF involved working together to reduce the amount of waste generated and maximise reuse, recycling and recovery of generated wastes.

As with life cycle assessment, the concept of cleaner production can be applied at different levels. The following discussion will interpret how cleaner production can mean different things for the HSWM program. Ideas and challenges for implementation of cleaner production will also be discussed.

For the HSWM program, cleaner production could be strictly interpreted as meaning a reduction of the amount of waste generated at source (i.e., source reduction). This would mean reducing the amount of waste generated by the hotels through purchasing and consumption patterns (i.e., purchase of durable products that can be reused). From this viewpoint, activities at the MRF could be regarded as *end-of-pipe* since the MRF deals primarily with the waste after it is generated, instead of preventing its generation at source. The HSWM program's contribution to cleaner production would be encouragement of hotels to reduce waste through the provision of waste data reports and yearly meeting to review waste data. However, the program did not have much involvement with monitoring waste generating behaviour within the hotels to help them minimise the amount of waste produced. The hotels were left to decide what to do with the waste data.

Environmental management systems and initiatives such as the Eco-Hotel Rating program would be suitable ways of monitoring waste reduction and other cleaner production activities in hotels. Cleaner production plans could be developed based on analysis of operations at the hotels, monitoring of waste data and sharing of experiences at the hotels. Staff could be encouraged to identify ways of minimising waste using incentives and special recognition. Examples of waste minimisation opportunities include: purchase of items in bulk; use of refillable containers; reuse of used linens as laundry bags.

Since the MRF's focus was on recycling and composting activities, it was not in its interest to encourage waste minimisation that would reduce its income from the sale of recyclables. However, by changing the fee structure appropriately, the MRF could arrange for an appropriate income and provide an economic incentive to hotels for waste reduction. To encourage the hotels to minimise waste through source reduction and recycling, a formula for adjusting the monthly hauling fee could be developed. The fee could act as an incentive for source reduction, therefore, a higher fee could be charged for the weight of residual waste and a lower fee for the weight of waste recycled. Since the MRF already collected and reported waste data, little extra effort would be required to determine the monthly fees.



If the concept of cleaner production were interpreted as any activity that contributed to waste minimisation, then any recycling activities at the hotels and MRF could be classified as cleaner production. Broader still, if the concept of cleaner production were interpreted as any activity that reduced environmental impacts, then all activities at the hotels and MRF would be candidates for improvement through cleaner production. Finally, if cleaner production were interpreted as the reduction of life cycle impacts of products and services, then the scope of activities could be broadened even further. It would then include down stream activities, such as the municipal wastewater treatment plant and the final disposal site, and up stream activities, such as the supply chain for the hotels.

Cleaner production at the MRF could involve minimising waste by improving the value of waste materials and developing new recycling opportunities. The quantity and composition of the residual waste could be assessed and reported. Based on this analysis, additional opportunities for reducing, reusing, recycling and recovering waste at the hotels and MRF could be identified. This could involve training about new ways to use waste materials (e.g. anaerobic digestion of residual wet waste). The program could also provide support to waste entrepreneurs through use of the facilities and provision of waste. Local use of waste materials would reduce transportation requirements and associated environmental impacts.

There were plans at the MRF for a residual waste press to reduce waste volumes and remove liquid waste. This could reduce the number of trips to the final disposal site required and solve the problem of liquid waste leaking from the trucks en route. The drawbacks would be loss of value for the materials that were recovered by the waste pickers at the final disposal site. The press for residual waste could be considered an *end-of-pipe* activity, not cleaner production, since it would involve reduction of waste volume at the end of the process instead of reduction of the quantity of waste at source.

### **5.2.5. *Integrated Waste Management***

The various components of the conceptual framework for integrated waste management (i.e. stakeholders, elements and aspects) were presented in the case study of the HSWM program. Stakeholders views, roles and responsibilities were described and the benefits and challenges involved with their partnership were discussed. As the procedural dimension of IWM, interaction between stakeholders was a key component of the case study.

The substantive components of IWM (i.e. its holistic, interconnective, goal oriented and strategic nature) were explored through the investigation of issues that had environmental/health, economic/financial, social/cultural, and institutional/managerial aspects. Issues were connected to waste management elements (e.g. source separation, recycling) and had to be considered from various perspectives to understand connections between the program and the context in Bali. The program history, goals and stakeholder viewpoints were also important for gaining a holistic understanding of the program.

### **5.2.6. *Appropriate Technology***

The program aimed to achieve maximum performance for a small facility using local technical, organisational and financial resources. Technical changes to the program were judged based on whether they involved the use of simple techniques, locally available resources and manual labour. Labour intensive techniques not requiring inputs such as electricity were preferred. In Indonesia, with its high level of unemployment, it made sense to use manual labour as much as possible and minimise capital, operation and maintenance costs associated with technology intensive approaches. For example, vehicles were required for transporting waste and it made sense to increase vehicle productivity. This understanding was demonstrated by the MRF's interest in a press for residual waste that would reduce the volume of residual waste, and hence the number of trips to the final dumpsite.

### **5.2.7. Sustainable Development**

In the literature review, different types of company orientation towards environmental management ranging from indifference to proactive approaches were introduced (see Table 3, Section 2.2, p.10). Over the course of the HSWM program, the participating organisations demonstrated characteristics of various types of organisational behaviour in response to the environmental and social concerns of sustainable development.

Output-oriented behaviour could characterise the MRF and some of the hotels before involvement in the HSWM program. Reactive behaviour was demonstrated by hotels that sought to pay for proper waste management instead of being paid for their waste only after their waste was identified by communities downstream. Reactive behaviour was demonstrated by the MRF that reacted to the potential threat of the NGO as a competitor in the provision of waste management services to hotels. MRF behaviour moved from defensive to accommodative as the NGO and MRF began working together to improve the hotel waste management system.

Process-oriented behaviour was demonstrated by the MRF through the collection of waste data for monitoring waste generation and recycling. System-oriented behaviour was demonstrated by hotels participating in the Eco-Hotel Rating program, since this involved looking at the hotels' various environmental activities and aspects. Interest expressed by hotels and the MRF in improving the waste management system indicated that they were interested in improving efficiency and doing more than just what was legally required. Leadership in environmental and community activities was shown by some hotels that supported the NGO's community activities and recognised that lack of public awareness about the environment was a challenge to be addressed.

A partnership approach was exhibited through the cooperation between the hotels, MRF and NGO involved with the program. The implementation of the polluter pays principle (i.e., hotels paying for proper waste management) was the internalisation of environmental costs by the hotels. Therefore, the participation of the hotels, MRF and NGO in the improvement of the management of hotel waste can be classified as moving towards more sustainable business practice. The NGO's mandate of conserving the

environment in harmony with local culture enabled it to facilitate the process of implementing more sustainable waste management practices.

## **CHAPTER 6**

### **RECOMMENDATIONS AND CONCLUSIONS**

#### **6.1. Recommendations**

It is far easier to describe a program than deliver it. Especially when program services depend heavily on the ability to recruit and train appropriate personnel, to retrain existing personnel, or to undertake significant changes in standard operating procedures, it is sometimes difficult to implement the intervention as designed.

Berk and Rossi 1990:66

Planning for solid waste management is a challenging task because of its complexity. Throughout the case study and discussion, recommended actions have been discussed with the recognition that implementing ideas is a challenging task. In this chapter, opportunities will be identified that could help the HSWM program improve its environmental management system and achieve the environmental, economic and social goals of sustainable development. Based on the case study and literature review, the following ten areas for improvement will be discussed:

1. Better Source Separation
2. Better Data Management
3. Training and Education
4. Health and Safety Program
5. Involvement of Employees and the Community
6. Integration of Waste Pickers
7. Morale and Environmental Awareness
8. Planning
9. Partnership
10. Management

##### **6.1.1. Better Source Separation**

The benefits of better source separation are better safety conditions for workers (i.e., less handling of potentially hazardous materials such as chemicals, dust and diapers); improved efficiency (i.e., less effort sorting); and better recycling rates (i.e., cleaner, drier materials that can be reprocessed). Therefore, a better management system should be

developed to keep waste separated at all stages (i.e. at the hotel, on the truck and at the MRF).

To improve the separation of waste at source and throughout the SWM process, adequate staffing, supervision, procedures, training, posters, verbal reminders, reporting, meetings and equipment are required. For example, equipment and procedures such as different colouring and labelling and colouring of bags and bins are needed to keep recyclable waste separated. Since the amount of waste from hotels fluctuates, having separate bins for waste (instead of separate containers on the truck) is needed to keep waste materials separated.

Better communication and prompt problem solving are needed to avoid the development of 'bad habits' (e.g. mixing and dumping of waste on the floor). Through better supervision, management, training and incentives, staff will be encouraged to cooperate in the achievement of environmental and safety goals, and to adopt and maintain better waste sorting and handling practices. Sharing revenue from the sale of recyclables with hotel staff is a way of encouraging better source separation. Fines or incentives and better monitoring to encourage hotels to sort their waste properly should be implemented.

Agreement regarding the purchase, replacement and management of bins should be reached when the contract between the hotel and MRF is signed and implemented. An adequate supply of bins reduces the mixing of wastes, and enables the operation of a bin exchange system instead of the transferring of waste from hotel bins to MRF bins. This would greatly improve efficiency by reducing the time for waste pickup, reducing the amount of water required for cleaning of bins, and reducing the mixing of waste materials.

For the design of new programs, an alternative system involving source separation at the hotels and the sale of recyclables directly to waste dealers should be considered since contamination and transportation distances could be reduced. However, this alternative system would require more effort on the part of the hotels, space and equipment for

sorting and storing recyclable materials on-site, as well as arrangements for composting of organic waste and proper disposal of residual waste.

### **6.1.2. Better Data Management**

To improve data management, there must first be a commitment to improving the reliability of the waste data and correcting mistakes that may have occurred in the past. In addition, the potential conflict of interest should be recognised (i.e., the desire to make hotels look good may interfere with the accurate evaluation of performance) and arrangements should be made to ensure the independence of the evaluator and integrity of data.

Greater confidence in the waste data would allow the program to pursue actions based on performance monitoring with more rigour. For example, hotels could provide recognition or incentives for employees based on monitoring of waste reduction and the program could provide recognition or incentives to hotels based on comparison of waste data from the hotels. To improve the data management system, the following actions are recommended:

1. there should be an employee or consultant responsible for data management and integrity who can act as an independent evaluator of the hotels' waste management practices and performance;
2. data management activities should be included in job descriptions and procedures;
3. better procedures, equipment and workstations should be designed/purchased and maintained (i.e., scales that are convenient to use, development of better estimates of waste quantities by recording how full containers are and by testing the weight of containers that are filled to different levels);
4. training and supervision should be provided to staff involved with sorting, weighing and record keeping to ensure that data management remains a priority item; and
5. audits by the NGO should be performed to check that data management procedures are followed and the data are reliable.

### **6.1.3. Training and Education**

Educational activities for the MRF, hotels, other waste haulers and general public should be conducted to expand the impact of the HSWM program and establish a 'centre of excellence'. Environmental education is a way of increasing understanding of problems, cooperation among stakeholders, environmental entrepreneurship and environmental performance. For example, if hotel staff saw how waste was sorted and gained an appreciation of the difficulty and safety risks involved, this would encourage better source separation.

Beginning first with the staff at the MRF and hotels, environmental awareness should be raised through training programs. A training program at the MRF could prepare staff to give tours, be a spokesperson, take responsibility, identify problems, and make recommendations. Training needs such as these should be identified and training activities developed based on training objectives. Training should involve active participation and be evaluated in terms of effectiveness. The training program should be appropriate and aim to modify attitudes, knowledge, skills and abilities to improve the program's performance. Environmental issues should be integrated into employee responsibilities and included in job descriptions. After training, there should be follow-up activities and positive reinforcement of proper behaviour (e.g. awards, recognition, employee of month).

After training programs for the MRF and hotels have been established, the education program should be expanded to involve members of the general public, schools, local community and foreigners. The education program's goals should be to discourage littering and open dumping, and to encourage resource conservation, waste minimisation, source separation, recycling and composting. An education program is a way of disseminating better waste management practices. Educational materials such as brochures, posters, publications and videos should be prepared. For expanding the impact of the program to other hotels, waste haulers and organisations interested in acting as facilitators, the NGO could provide a training program that addresses issues such as source separation, using waste as a resource, starting an MRF and implementing an EMS.



For the training and education programs, activities such as workshops, informal discussion and field trips would be effective. Field trips to the hotels, MRF, NGO, illegal dumpsites, polluted waterways, wastewater treatment plant, final dumpsite, and recycling companies would provide people with an introduction to the SWM context in Bali. Topics of discussion should be selected to reflect the interests of the people receiving training and could include topics such as: source separation, hazardous waste, packaging, life cycle assessment, cleaner production, the 4Rs (reduce, reuse, recycling, recovery), composting, anaerobic digestion, waste collection, waste disposal, integrated waste management, wastewater treatment, environmental pollution, waste pickers, health and safety.

#### **6.1.4. Health and Safety Program**

A health and safety (H&S) program for the MRF should be developed for the prevention of accidents, injuries, strain, absenteeism, health care costs and turnover. The H&S program should be designed to improve the work environment, job satisfaction and quality of work. The health and safety program should include:

1. identifying health risks (e.g., walk around to identify hazards),
2. implementing mitigation measures (e.g., improved workstations, cleanliness, control measures against disease vectors, safety equipment),
3. obtaining feedback about changes (e.g., modified procedures, workstations and equipment),
4. monitoring of worker health (e.g., complaints, incidents, questionnaires, checklists and regular medical examinations), and
5. building awareness of health issues (e.g., discussion of dangers and guidelines to improve safety, causes of diseases common among waste workers).

Ergonomics should be included as part of the H&S program. Ergonomics involves studying the interaction of mechanical, organisational and psychosocial factors. Risk factors the program should be aware of include: posture (bending), cognitive demands, psychosocial stresses, static and dynamic loads, reach, location, intensity, duration and repetitiveness. Training about ergonomics, surveys of work areas, observation of how

work is structured, and monitoring medical records (i.e., illnesses, incidents, accidents) should also be included in the program.

An adequate amount of safe drinking water should be supplied. The need for more drinking water was one of the concerns expressed by MRF staff. A shortage of safety equipment, such as gloves, was also observed at the MRF. Effective and comfortable safety equipment should be selected and supplied<sup>30</sup>, and usage should be monitored. Given the potential for workers to be cut by glass and other sharp objects, washbasins, soap and antiseptic should be provided to help prevent infections. Cuts should be covered with clean bandages and protected (e.g., gloves, socks).

For the canteen, measures should be in place to reduce the chance of food contamination. For storage areas, there should be roofing to prevent the collection of stagnant water that provides breeding grounds for mosquitoes that transmit diseases such as dengue fever. In sorting areas, adequate space should be provided to allow workers to spread waste on the floor for better viewing. This may help workers to sort waste faster and not get hurt because they could not see pieces of broken glass.

During the design, construction and operation of workstations, attention should be paid to worker preferences and health and safety issues. More efficient and ergonomic ways of sorting waste should be developed through experimentation with different approaches and discussion with workers. Staff said they preferred squatting to standing because they found it less tiring<sup>31</sup>. Input from the staff should be incorporated into the design of workstations and activities.

When changes are made to work activities and scheduling, there should be consideration of rest periods, shift work and intensity of work because these factors can affect the health of workers. For example, when sorters have time to rest between the arrival of

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<sup>30</sup> Safety equipment can be supplied either by the MRF or by providing money to employees to buy the equipment themselves. Measures for ensuring the replacement of used/damaged equipment should be developed.

<sup>31</sup> The squatting position was good for waste sorting because workers maintained good posture, rested their arms, moved around as required, stretched their legs by standing up or rested their legs by sitting on small stools. Workstations should be designed to avoid strain and backache that cause tiredness and inefficiency.

trucks, this gives them time to stand up and stretch their legs. This may help prevent repetitive strain injuries and the occurrence of headaches.

For workers in the enclosed workstations for wet waste sorting, there should be monitoring of adverse health effects. The enclosed area may expose employees to prolonged contact with airborne materials such as dust and aerosols. Health problems such as eye and nose irritations, respiratory diseases, fever, nausea, headaches and diarrhoea should be carefully monitored. The MRF should consider installing dust-collecting equipment to reduce the amount of airborne pathogens. To make the work environment more agreeable, there should be measures to ensure proper ventilation and cooling. To prevent injuries from slipping on wet floors, there should be non-slip surfaces in the wet waste sorting area at the MRF as well as at the waste collection areas of the hotels.

A proactive approach to H&S should be adopted that encourages employees to follow safety procedures instead of waiting until they get injured. Increasing awareness of health issues and the need to use effective safety equipment should be part of the MRF's training program. There should also be visual and verbal reminders to maintain awareness of health and safety issues.

### **6.1.5. Involvement of Employees and the Community**

Through training, job enlargement and career advancement, employees will gain a better understanding of waste management, develop new skills, increase their involvement in decisions concerning how the program is run, and contribute to the process of innovation. If employees feel that their work is significant and that their opinions are valued, they will be inclined to become more involved in improving the program.

The MRF should also initiate activities to involve the community and raise awareness of environmental and waste issues. Increased community involvement would build the program's relationships with its surrounding community. By giving something back to the community, the MRF avoids the NIMBY-syndrome. The HSWM program can play a role in strengthening the ability of local traditional institutions to improve community

SWM. However, the approach for managing hotel waste (e.g., fees, contracts, standard operating procedures) would need to be adapted to the conditions for managing community waste.

Community involvement could be increased by raising community awareness about waste management issues through outreach programs such as opening a community learning centre and providing waste management services for the local community (e.g., buying waste materials and disposing of residual waste as suggested by the NGO). For community activities, the program could make use of external resources such as volunteers, students, foreigners and hotel staff who are interested in contributing to environmental protection through community development.

#### **6.1.6. Integration of Waste Pickers**

Given that the program has claimed to improve the work conditions for waste pickers and is based on implementation of the “polluter pays principle”, the MRF should be involved with helping the waste pickers at the final disposal site who recover materials from the program’s residual waste. Instead of receiving payment from the waste pickers, the MRF (as the polluter) should be paying the waste pickers for helping with material recovery. Integration of waste pickers into the HSWM program should be investigated with the goals of improving waste recovery and conditions for waste pickers. The program should develop ways of helping the waste pickers recover materials closer to the source instead of at the dumpsite. Ways of improving the work conditions of the waste pickers should be investigated.

#### **6.1.7. Morale and Environmental Awareness**

The program should explore ways of motivating employees by recognising and connecting with people’s environmental, economic and social interests. Environmental interests of employees should be linked to the HSWM program’s contribution to conserving resources and reducing waste. Economic interests should be tapped by providing monetary incentives to minimise waste. Social interests should be linked to community development activities.

Environmental stewardship at the hotels is a key factor in the motivation of hotel staff to be environmentally conscious. In addition to environmental motivation, if hotel staff received a benefit from cooperation with the HSWM program (e.g., some of the money from the sale of recyclables could be put towards a fund available for staff loans), this could improve morale at the hotels. Demonstration of the HSWM program's commitment to environmental protection and community service could help foster a spirit of cooperation between staff at the MRF, hotels and NGO. An education program (as described in Section 6.1.3) and community activities (as described in Section 6.1.5) could be designed to improve environmental awareness of staff at the hotels and MRF, as well as in the community.

The NGO believed that it was important for staff to see the value of their work and understand its contribution to protecting the environment in Bali. The NGO wanted to build staff confidence and capacity to make decisions about their work. Greater awareness, involvement and training as part of an EMS would help the program to improve operating procedures, develop innovative solutions to environment, quality, health and safety issues, and improve employee morale. Job rotation was also suggested by the NGO as a way of increasing the variety of work tasks and improving morale. MRF employees recommended that the cleanliness of the MRF should be improved. Improving the cleanliness of the MRF would help improve morale, create a healthier work environment, and encourage employees to share other ideas about making improvements. Keeping the MRF tidy, even when there were no visitors, indicates management concern and employee pride in their work.

Increasing the environmental awareness of employees will also have a ripple effect because employees will communicate the knowledge they gain to their families and community. Trained employees should become involved in tours and education programs, describing the program's activities, sharing stories and discussing environmental impacts. An information centre for the public would also help in the dissemination of better waste management practices.

The NGO was interested in a co-operative economic system to share profits, give employees a sense of ownership and develop a higher degree of participation in decision making. This approach should be tested in new programs initiated by the NGO. For the existing MRF, introduction of this new approach would be difficult because their system is already well established (with bonuses to share profits and employee trust that management knew best).

### **6.1.8. Planning**

Although an informal approach to problem solving may have worked reasonably well while the program was relatively small, a more systematic and proactive approach to management is required when the complexity of the program increases. This would help to ensure that requirements are handled in a consistent and professional way and problems are addressed promptly and effectively.

Discussion and clarification of the program's objectives would help reduce confusion regarding the program's direction. A policy statement and list of objectives would be helpful for the clear and concise communication of the program's commitments regarding environmental, social (health and safety) and economic issues. In particular, the program's position regarding the local community and waste pickers should be clarified. The MRF and NGO also needed to define responsibilities regarding the relations/contracts with hotels and other parties, tours for visitors, and waste measurement and reporting.

A clear understanding of goals and responsibilities would guide staff and actions, and enable the evaluation of the program's performance. Based on the agreed program objectives, targets (for the short, medium and long term) could be established, needs identified, changes made and progress measured and monitored. Job descriptions should formalise responsibilities related to the environment, health and safety. Standard operating procedures for the MRF should be updated.

Better documentation and monitoring as part of an EMS would help managers determine the causes of problems and courses of action. Other potential benefits of a better

documentation system would be the reduction of opportunities to pursue illegitimate activities and reduction of the program's vulnerability if key staff leave the program.

For new programs initiated by the NGO, it may be helpful for the stakeholders to discuss and agree to program objectives (e.g. community involvement) during the planning stage. Identification of objectives, ranking the objectives in terms of priority, and designing activities to fit with the key objectives would help to clarify the approach. Based on the literature review and case study, the goals of the HSWM program in Bali are listed below. These goals can be used as a point of departure for the development of new programs or for the monitoring and evaluation of existing programs.

1. **Environment:** To protect the environment through the conservation of natural resources, cleaner production and reduction of life cycle impacts of products and services
2. **Health:** To protect human health through the provision of a clean environment and safer work conditions
3. **Efficiency:** To use resources efficiently and be cost-effective
4. **Equity:** To recognise the needs of vulnerable groups
5. **Local economy:** To provide employment opportunities and support the local economy
6. **Appropriate technology:** To use technology that is appropriate for local conditions
7. **Partnership:** To work together with stakeholders and local communities
8. **Capacity building:** To build capabilities and raise environmental awareness through training activities and support educational and research activities
9. **Culture:** To sustain the local culture (traditions, religion, art, institutions)

#### **6.1.9. Partnership**

The NGO was responsible for being the HSWM program's planner, trainer and evaluator. As the NGO's role was meant to decrease over time as the MRF gained independence, the transition from active involvement to less involvement should have been better planned and involved building the capacity of MRF staff to assume the NGO's responsibilities. The MRF requested that the NGO provide the MRF with training, however, this never materialised. Training related to environmental and social issues

would help provide the MRF with an understanding of the concepts required to sell the program's strengths and address its challenges. The MRF would then be in a better position to take responsibility for managing environmental, social and economic issues, as well as developing relationships with hotels, government, community and visitors.

As the MRF became more independent of the NGO, likewise, the NGO should become more independent of the MRF. The fact that the NGO's name was attached to the program and part of the NGO's income was based on the program's profits made it difficult (if not impossible) for the NGO to act as an independent program evaluator. If the NGO's income were not linked to the program's profits, the NGO would have been in a better position to judge the program as an independent evaluator. However, this independence may reduce the NGO's ability to work from within to bring about change since the NGO would no longer share an interest in the MRF's profitability.

The HSWM program was sold to hotels as a convenience, that is, as a way for them to focus on their main business and leave their waste to be dealt with by the MRF. While this attitude may accurately describe the hotels' priorities, it does not strengthen the hotel staff's sense of responsibility for performing source separation conscientiously.

Promotion of the image of hotels as leaders and problem solvers would encourage hotel staff to be proactive. The program should encourage that mentality and reward it by providing incentives and recognition for source reduction, use of recycled products and better source separation. The program should recognise the responsibility of businesses to not just implement the polluter pays principle but also cleaner production.

#### **6.1.9.1. Role of the Government**

The program would have a greater impact if the government took on the facilitator role for building partnerships between stakeholders. The government should encourage the development of better waste management through waste reduction, reuse, recycling and composting. As the facilitator for waste management program development (using concepts such as the polluter pays principle and cleaner production), the government should support businesses and communities through pilot projects, funding, training, technical assistance, information exchange, follow-up support and monitoring.



The government should encourage better waste management practices and help create markets for waste materials through policy making, economic incentives, regulations<sup>32</sup>, enforcement of regulations, and campaigns/promotions. By recognising and giving awards to best practices in waste management, the government would help increase the public's awareness of initiatives such as the HSWM program and encourage others to adopt similar approaches. Educational activities such as the organisation of conferences, seminars and workshops, publication of training manuals, case studies and best practices, and provision of technical and financial assistance should also be conducted.

#### **6.1.10. Management**

As the program matures, it would benefit from the formalisation of activities. This formalisation would involve identifying key elements of the program and defining procedures and responsibilities accordingly. Key areas include: day-to-day operations, customer service, environmental performance, health and safety (ergonomics), personnel management (training), and community activities.

To better manage the program's environmental impacts, an EMS should be developed (as discussed in Section 5.2.3). Development of an EMS would involve articulating program policies and objectives (targets), identifying environmental aspects and impacts, planning and monitoring activities, and striving for continual improvement.

When research and development projects have been better defined and can be broken down into smaller components, the HSWM program would benefit from volunteers (e.g. students, interns) seeking to gain experience. To increase the MRF's capacity to manage waste from a larger number of hotels, more employees need to be hired for collection, sorting, composting and management. The recruitment of new employees from the waste picking community at the final disposal site should be investigated.

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<sup>32</sup> For example, the government could develop policies, standards and regulations regarding source-reduction, source separation, disposable packaging, eco-labeling, recycled materials, littering, and private sector involvement in SWM.

For management positions, dedicated people with the ability to think critically, communicate effectively and learn independently were needed. In particular, there was a need for people with the training, skills and desire to manage relations with the hotels. The program could either try to attract these people from outside or develop them from inside. Training of staff for supervisory roles was needed to develop environmental knowledge, communication skills and problem solving skills to manage different aspects of the program. Demonstration of a commitment to environmental protection and community development, and a competitive level of compensation, would help to attract, retain and motivate staff for supervisory positions.

## **6.2. Future Research Directions**

Directions for future research emerging from this case study include a health study of waste workers, ethnographic study of waste workers, feasibility study of anaerobic digestion, and handbook for planning and managing MRFs.

An occupational health study of waste workers would increase knowledge about the impact on health of working with biodegradable and non-biodegradable waste streams. The study could include: identifying and assessing health concerns and causes of health effects, evaluating the adequacy of protective equipment, and comparing occupational risks from various professions. Findings from the study could be integrated in the health and safety program at the MRF to increase health awareness and develop strategies to reduce health risks.

An ethnographic study of the MRF employees participating in the HSWM program would provide a view of the life, stories, reality and personalities of people who sort the waste produced by tourists when they go on vacation. The study could explore the backgrounds and perceptions of waste workers. Participatory research methods such as small group discussions (focus groups) and group preference ranking could be used to understand their priorities and viewpoint. The researcher would also benefit from living at the MRF because workers would have the chance to become accustomed to the researcher.

The program would benefit from a study of how best to manage the residual organic waste (that was not suitable from pig feed and considered too smelly for composting) and wastewater (from the residue press and cleaning). A feasibility study of anaerobic digestion could investigate markets for final products, financing, technical options, environmental impacts and social issues. The potential benefits of anaerobic digestion for the MRF include waste minimisation, production of biogas, and fermentation products for organic farming, composting and killing odours.

For other NGOs, government and interested individuals, a handbook describing financial arrangements, site planning, standard operating procedures, wastewater treatment techniques and human resources management for MRFs would help with the start-up of small-scale waste management programs in developing countries. Information about how to optimise operations, looking at facility layout and scale, would help MRFs maximise profits and use resources efficiently.

### **6.3. Conclusions**

The HSWM program provides a model for learning about the conditions pertaining to solid waste management in developing countries. The complexity of issues associated with solid waste management makes solid waste planning and management a challenging task. The case study of the HSWM program helps to clarify the problem situation by providing a description of the various stakeholders, elements and issues involved with program implementation, and discussion of the conceptual and theoretical understandings relevant to the program.

The HSWM program demonstrated how an NGO acted as the facilitator between waste producers and waste haulers, helping to ensure that waste reduction, collection, recycling and disposal was conducted in an acceptable way through the development of contracts, standard operating procedures, record keeping and evaluation mechanisms. The sustainability of the program depended on the business sense of the waste hauler and the environmental stewardship of the hotels. Local ownership of the MRF and use of a

commercial approach ensured that waste management activities continued to be performed efficiently and reliably on a daily basis, and that the capacity of the MRF was expanded. The motivation of hotels to improve environmental management, as shown through participation in voluntary programs such as Bali's Eco-hotel Rating Program, enabled the implementation of the polluter pays principle (i.e., hotels paying for proper management of waste) and cleaner production (i.e., waste minimisation using the 4Rs).

The HSWM program helped improve the management of hotel waste and thereby contributed towards sustainable tourism development in Bali. However, pressing waste problems in Bali still need to be addressed. Replication and adaptation of the model in other locations and for waste producers other than hotels is needed. Lessons learned and recommendations based on the program's experience can help others replicate and adapt the model to other locations, or pursue areas for further research.

The research contributions of this study can be categorised as: theoretical, empirical and methodological. The contribution of this study from a theoretical perspective is the confirmation that concepts (such as appropriate technology, polluter pays principle, integrated waste management and cleaner production) are relevant for understanding the rationale behind the implementation of SWM programs such as the HSWM program. The study also identifies benefits and challenges related to applying concepts (such as environmental management systems and life cycle assessment) to the design of improvements for the HSWM program. The empirical contribution of this research is a case study that adds to the literature available about SWM programs in developing countries. The methodological contribution of this research is the sharing of experiences and challenges concerning the conduct of research about SWM in developing countries that will be useful to other researchers in this field.

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## **Appendix 1**

### **MRF and NGO Survey Questions**

## MRF and NGO Survey Questions

1. Please complete Table 2 (Issues and Objectives) using the importance rating system in Table 1.

**Table 1: Importance Ratings**

<u>Value</u>	<u>Importance Rating</u>
<b>1</b>	<b>Not Important</b>
<b>2</b>	<b>Somewhat Important</b>
<b>3</b>	<b>Important</b>
<b>4</b>	<b>Very Important</b>
<b>5</b>	<b>Essential</b>

**Table 2: Issues and Objectives**

Issues	Objectives	Importance Rating	Reasons why I gave this importance rating	What I think will be involved with reaching this objective
1) Workspace related	1a) Improving the work environment			
	1b) Improving health and safety			
	1c) Improving workstations and the way tasks are performed			
	1d) Increasing efficiency			
2) Human resources and management	2a) Improving environmental awareness and morale of workers at Jimbaran Lestari			
	2b) Increasing the salaries of workers at Jimbaran Lestari			
	2c) Improving the management of waste haulers, record keeping and end product sales			

3) Outputs and end products	3a) Improving the end products			
	3b) Improving the wastewater treatment system			
	3c) Improving the accuracy and meaningfulness of record keeping			
	3d) Increasing the profitability of Jimbaran Lestari			
4) Future expansion	4a) Increasing the capacity of Jimbaran Lestari			
	4b) Starting new Material Recovery Facilities (MRFs)			
5) Hotels	5a) Improving waste handling at hotels to meet current expectations (dry, wet, garden)			
	5b) Introducing better separation at source (paper, plastic, glass, etc. separate from residue)			

2. Are there other issues or objective I have overlooked?
3. Please describe the mission of Jimbaran Lestari.
4. Please describe your job and responsibilities at Jimbaran Lestari.
5. Please describe what Wisnu's role should be.



## **Appendix 2**

### **Summary of MRF and NGO Survey Results**

## MRF and NGO Survey Results

The results of the survey completed by members of the NGO (Wisnu Foundation) and MRF (Jimbaran Lestari or JL) are summarised in Table 1.

**Table 1: Survey Results**

Issues	Objectives	Importance Rating			
		MRF 1	NGO 1	NGO 2	NGO 3
1) Workspace related	1a) Improving the work environment	4	3	4	4
	1b) Improving health and safety	5	3	3	2
	1c) Improving workstations and the way tasks are performed	3	3	5	2
	1d) Increasing efficiency	3	3	4	2
2) Human resources and management	2a) Improving environmental awareness and morale of workers at Jimbaran Lestari	4	5	4	2
	2b) Increasing the salaries of workers at Jimbaran Lestari	3	2	3	2
	2c) Improving the management of waste haulers, record keeping and end product sales	5	3	4	5
3) Outputs and end products	3a) Improving the end products	4	3	4	5
	3b) Improving the wastewater treatment system	4	5	5	5
	3c) Improving the accuracy and meaningfulness of record keeping	3	3	4	5
	3d) Increasing the profitability of Jimbaran Lestari	3	2	4	1

4) Future expansion	4a) Increasing the capacity of Jimbaran Lestari	3	2	3	2
	4b) Starting new Material Recovery Facilities (MRFs)	2	5	4	2
5) Hotels	5a) Improving waste handling at hotels to meet current expectations (dry, wet, garden)	4	5	3	3
	5b) Introducing better separation at source (paper, plastic, glass, etc. separate from residue)	4	5	3	2

**Appendix 3**  
**Hotel Survey Questions**

## Hotel Survey Questions

1. Please indicate your level of satisfaction with the waste management system provided by Jimbaran Lestari and the Wisnu Foundation.

1	2	3	4	5
very	mildly	satisfied	very	very
dissatisfied	dissatisfied		satisfied	pleased

2. Please explain why you have chosen this rating.
3. Please outline the strengths and benefits of the Jimbaran Lestari / Wisnu Foundation waste management system.
4. Please outline the weaknesses and areas needing improvement.
5. Please recommend actions that should be taken by Jimbaran Lestari, the Wisnu Foundation and the hotels to improve the waste management system.
6. What have been the most important challenges faced and lessons learned by the hotel regarding environmental management?
7. Is the hotel willing to do better source separation (e.g. organics and inorganics for wet waste, recyclables and non-recyclables for dry waste)? Why/why not? What kind of incentives could be given to employees to encourage better source separation?
8. What kind of environmental awareness and environmental management training do the staff receive? What can be done to improve the staff's attitude towards waste management and make the system more efficient and effective? Would a visit to Jimbaran Lestari and other hotels be useful for training?
9. Is the hotel willing to provide bins so haulers can exchange bins instead of transferring wet waste from one set of bins to another? Why/why not?
10. Would one pick-up per day be acceptable? Why/why not?
11. How is the information in the monthly waste reports used by the hotel? How could the reports be improved to make them more meaningful to the hotel?
12. Has there been adequate monitoring and evaluation of the hotel's waste management practices?
13. Does the hotel was a summary of this study?
14. Does the hotel grant permission for the name of the hotel to be used in my thesis and reports or publications resulting form this study?

15. Additional Comments:

## **Appendix 4**

### **List of Key Informants**

## Key Informants

The key informant groups, the positions held by informants, and the data collection methods employed by the researcher are summarised in the following table.

<b>Group</b>	<b>Position</b>	<b>Number of Informants</b>	<b>Data Collection Methods</b>	<b>Total Number of Informants in the Group</b>
The Wisnu Foundation	Manager	3	Survey (3), interviews	8
	Staff / Volunteer	5	Interviews	
Jimbaran Lestari	Manager	5	Survey (1), interviews	17
	Wet Waste Staff	2	Interviews	
	Dry Waste Staff	2	Interviews	
	Composting Staff	4	Group discussion	
	Waste hauling Staff	4	Interviews	
Hotels in Jimbaran, Sanur and Nusa Dua	Manager	6	Survey (1), interviews	6
Waste Dealers and Recyclers in Southern Bali	Manager	5	Interviews	6
	Staff	1	Interview	
Pusat Pendidikan Lingkungan Hidup (PPLH) Environmental Education Centre in Sanur	Manager	1	Interview	2
	Staff	1	Interview	
			<b>Total:</b>	<b>39</b>



## **Appendix 5**

### **Photographs of the HSWM Program in Bali**

1. Sign at a Hotel



2. Housekeeping Trolley in a Hotel



3.     Sorting of Wet Waste at the MRF



4.     Sorting of Dry Waste at the MRF





5. Turning of the Compost Piles



6. Screening of Compost





7. Collection and Weighing of Sorted Glass



8. Residual Waste Going to the Final Disposal Site

