

Waste Management: Solid

Sustainable Waste Management within the British Virgin Islands

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The author is grateful to Caribbean islands contributing to this study, the Government of the British Virgin Islands in particular.

Abstract:

Purpose – The purpose of the paper is to develop recommendations for reducing waste and increasing resource management in the British Virgin Islands (BVI).

Design/methodology/approach – This research study is based on a phenomenological approach using a systems perspective. Grounded theory is used to analyse qualitative and quantitative data. Data collection techniques include participant observation, literature reviews, interviews and a waste reduction questionnaire.

Findings – This research study concludes that IWM is a potentially flawed approach to apply to the setting of the British Virgin Islands mainly as IWM relies on the continued use of landfill practices. Finding suitable landfill space in Tortola, the main island of the BVI, is challenging due to the island being only 153 square kilometers of mostly hilly terrain. Waste reduction methods that focus solely on recycling pose many challenges particularly when applied to the island setting of the BVI. Thus a broader scope of waste reduction and resource management strategies is required to ensure safe and effective waste management in the future.

Practical implications – The research study recommends that the BVI adopt a systemic approach to waste management with the ultimate aim of eliminating the need for incineration and landfill. A waste reduction and resource management strategy is outlined, in addition to possible tools that move beyond conventional recycling to include extended producer responsibility and green procurement.

Originality/value – This study develops a theory on waste, based on supporting empirical evidence, which can be applied to island settings to achieve sustainable waste management practices.

Key Words Integrated Waste Management, Waste Reduction, Systemic Resource Management, Caribbean Islands, British Virgin Islands

Paper type Research paper

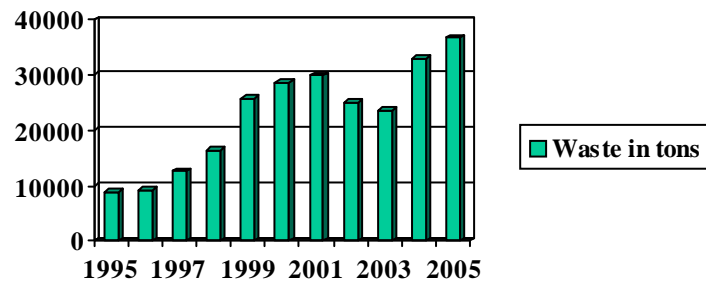
1. Introduction

The British Virgin Islands (BVI) is located in the North-Eastern Caribbean Sea, 60 miles east of Puerto Rico, at the Eastern end of the Greater Antilles. There are four main islands namely; Tortola, Jost van Dyke, Anegada and Virgin Gorda (BVI, 1999).

Increased waste volumes

No heavy industry exists on the islands and most goods (and subsequent waste) are imported from abroad with \$335 million worth of merchandise being imported versus \$25 million of goods exported (BVI, 2007). Increased growth in population, tourism and Gross Domestic Product (GDP) over the last decade has significantly increased waste generation as depicted in Figure 1:

Figure 1: Growth in waste within BVI 1995 - 2005
(Source: SWD & DPU 2007)



The decrease in waste in 2002 and 2003 is attributed to fewer American tourists visiting the islands following the terrorist attacks on the USA in September, 2001. In 2004 approximately 31 964 tons of waste was generated representing “an increase of 27% over the previous years” (BVI, 2004:12). In 2006, waste generation amounted to approximately 37 000 tons (BVI, 2007).

Disposal and treatment of waste

Waste management in the BVI is financed through revenue generated from government taxes. The Solid Waste Department (SWD) operates the disposal and treatment facilities within the territory, and is responsible for the placement of skips, the collection of waste from these skips, maintenance of road verges, street cleaning, removal of derelict vehicles, management and maintenance of the incinerator and landfills, and waste education activities (BVI, 2007a).

Waste within the territory is either landfilled or incinerated. There are four landfill sites currently in operation, situated on Tortola, Virgin Gorda, Jost Van Dyke and Anegada. The sites on Virgin Gorda (state owned) and Jost van Dyke (private land) have a life expectancy of ten years. The state owned site in Anegada has twenty years life expectancy remaining, although there is public pressure to relocate the site further away from residential zones. The landfill on Tortola is on private land and negotiations are currently underway to renew the lease on the land for another year. Open burning,

spreading and compacting of the waste are common practices and the landfills are unlined with no leachate treatment plants.

Due to the limited land space and hilly terrain of the main island of Tortola, landfill engineering is difficult and expensive. Therefore, incineration is considered the most viable option of disposal currently available to Tortola “despite the high cost of technology, and possible environmental and health effects of the emissions” (Georges, 2002:3). The Consumat CS-1600 incinerator, located at Pockwood Pond, has the capacity to burn 40 tons per day. During peak tourist seasons, waste generation is estimated at 100 tons per day (BVI, 2007a). A second incinerator is currently under construction and is expected to be in operation by late 2009. The Consumat CS-4000, costing US \$4.5 million, will have the capacity to burn 100 tons per day.

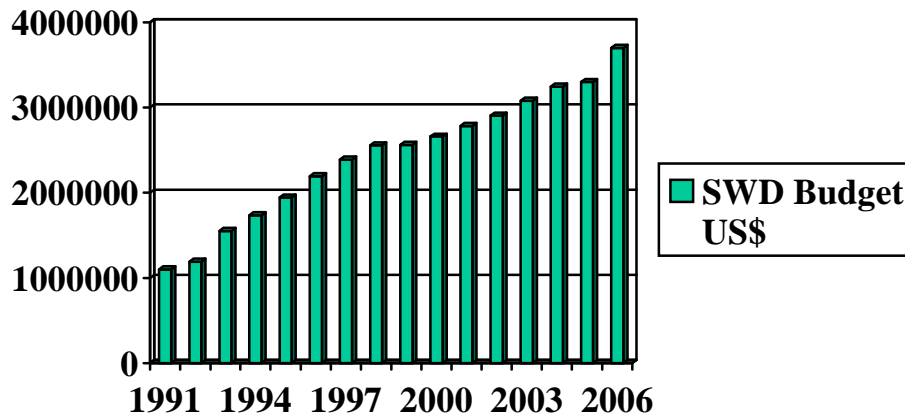
The SWD face many challenges maintaining and operating the incinerator due to a lack of human, technical and financial resources. Incinerator parts have to be imported and often take weeks to be shipped causing delays in repairs and increased downtime of the equipment. Certain waste streams prove to be problematic in incinerators. For example, glass has to be routinely chipped off the inside walls of the incinerator. No scrubbers exist to trap toxins being emitted as air pollution. Even if scrubbers were present, toxic materials would leach into the environment when disposed of as there are no hazardous waste management systems in place. Data on emissions from the incinerator and the landfills is limited and potential health implications have not yet been investigated.

Increasing costs

Figure two below depicts the increasing costs to manage waste within the BVI. The current budget falls short of the amount required to ensure the maintenance and replacement of heavy equipment required at the landfills (BVI, 2007a).

Figure 5: Solid Waste Budget 1991 - 2004

(Source: Georges, 2001. SWD, 2004)



Public and political pressure

The SWD are subject to public and political pressure to implement and encourage further recycling initiatives (BVI, 2007a). The demands, although well intended, may not be realistic. The BVI, as with many small islands, does not have the financial and technical resources, nor the associated industry to recycle materials. Also the high cost of transportation renders recycling unfeasible in many instances and is, therefore, not pursued by government (BVI, 2007a). Furthermore, economies of scale render the quantity of recyclables insufficient. Storage space to collect sufficient volumes of waste to export recyclables for processing is limited and expensive. There are, however, individuals on the island working both formally and informally with the SWD to recycle car batteries, derelict vehicles and glass.

Pending legislation

Successful implementation of pending environmental legislation regarding waste management, through the National Environmental Action Plan (NEAP), will require a prioritising of waste management and sufficient resources being made available. Without these conditions being met, targets set by NEAP as listed below, cannot be attained (BVI, 2004a:52):

- the monitoring and control of pollution from landfills and the incinerator,
- early warning systems for potential waste disposal hazards such as oil spills.
- the need for the development of a national strategy for waste management
- charging a tariff for waste disposal services and
- “an air pollution control device” being installed at the incinerator

2. Research framework and methodology

Considering these challenges, the researcher explored how waste can efficiently and effectively be reduced within the BVI. The epistemological stance of phenomenology was adopted in this research study, to facilitate an understanding of the phenomenon of waste. Within the phenomenological paradigm, reality is considered “socially constructed and subjective” (Easterby-Smith et al, 1991 in Mangan et al., 2004:567), mutable and created by maps or preconceptions of that reality.

Senge (1994) describes the “ladder of inference” as the social construction of reality, whereby the observer selects data through observation. This observation is combined with cultural and personal meanings to make assumptions. Over time, the observer adopts certain beliefs that are reinforced when data is again viewed through observation. Thus, the ladder of perception continues to be built upon, thereby creating unique, individual worldviews. Through social interactions, individual realities combine to create a shared social reality which guides understanding and behaviour within a society or situation.

Stemming from the phenomenological approach, a systems perspective is adopted and the grounded theory methodology used to analyse quantitative and qualitative data. Through a systemic exploration of waste from historical, global and local perspectives, a grounded theory of waste emerges that focuses on waste reduction and resource management. Data collection techniques included interviews, a literature review, participant observation and field notes.

The research study consisted of four phases:

- Phase 1 began the exploratory research into waste management within the BVI. Qualitative data techniques of interviews, field visits, participant observation and literature reviews, and influencing relationships were used to gather data to identify variables within the situation.
- Phase 2 consisted of exploring waste from systemic, historical, global and local Caribbean perspectives to develop a grounded theory on waste. The emerging theory on waste was used to guide the research question and phase 3 of the research study.
- Phase 3 incorporated the development and piloting of a questionnaire and face to face and telephonic interviews. Interviews were conducted with SWD officials on six Caribbean islands to determine waste reduction initiatives within the local context. A discussion of these findings can be found in this paper.
- Phase 4: Using grounded theory to analyse qualitative and quantitative data, recommendations for guiding waste reduction and resource management in the BVI were developed.

3. Theoretical Framework

When viewed from systemic (Robert, 2005) and historical perspectives (Royte, 2005; Rogers, 2005; Strasser, 1999), waste can be seen as a human creation and a direct result of linear production systems. Increasing industrialisation and consumerism have led to increasing volumes, categories, and complexities of waste, with waste management systems evolving accordingly.

One such waste management system, known as Integrated Waste Management (IWM), is the current dominant paradigm guiding waste management policy globally. IWM consists of a hierarchy of tools to manage waste, namely; reduce, reuse, recycle, incinerate and landfill (UNDESA, 2004). These are listed in descending order of importance, utilising landfill as the least desirable waste management option.

However, some argue that IWM's basic premise of waste as a necessary component of human activity, is flawed and that by redefining waste as resources - resources that provide "nutrients" or raw materials for other processes - humans can emulate processes found within natural ecosystems. McDounough and Braungart (2002) refer to this as the "cradle to cradle" concept whereby all goods and processes are designed with the life-cycle end use in mind. Closed-loop production systems would aim to continually reuse and recycle materials.

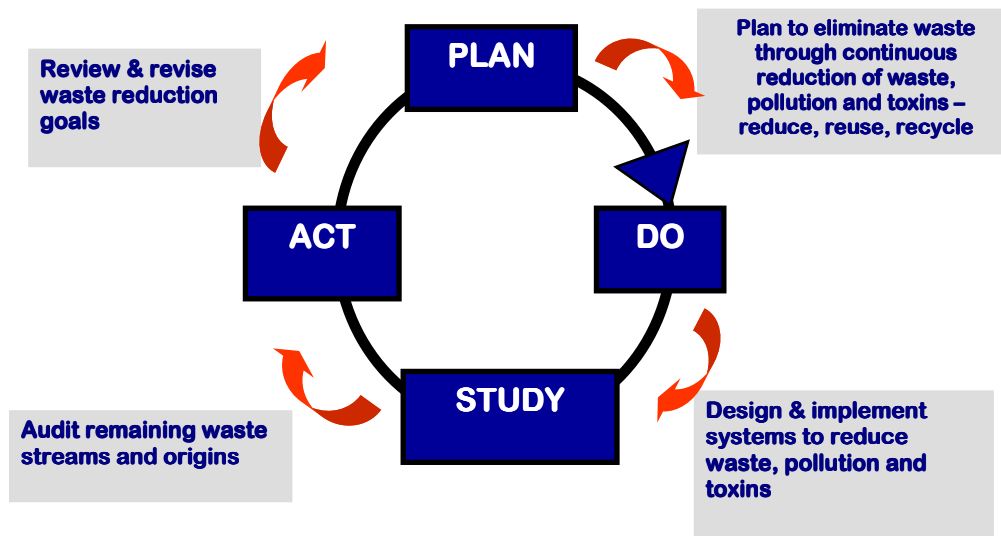
Systemic Resource Management is a term coined for the purposes of this research study and is used to describe and encompass the philosophies, paradigms and methodologies across various disciplines that aim to eliminate the concept of waste from systems. Systemic Resource Management takes a systemic approach and views waste within the context of the systems that create it. Examples would include The Natural Step (Robert,

2005), The Next Industrial Revolution (McDonough and Braungart, 2002), Zero Emissions Research Initiative (Pauli, 1996), Zero Waste (ZWA, 2007) and Natural Capitalism (Anderson, 1998; Hawkin et al. 1999).

However potentially flawed, IWM can provide a useful framework to achieve Systemic Resource Management. Utilising facets of the IWM hierarchy, with particular focus on waste reduction, applied innovation and design intent could significantly begin reducing the amount of waste requiring treatment or disposal.

Within Systemic Resource Management, landfills and incinerators would now additionally serve as monitoring stations to identify waste streams requiring upstream redesign to reduce, and ultimately eliminate these streams. Using the Action Research methodology cycle - Plan, Do, Study, Act (Scholtz, 1998), IWM can therefore be used to incrementally realise Systemic Resource Management.

Figure 3: Realising Systemic Resource Management through IWM



4. Discussion on quantitative findings

Within the sample population of Caribbean islands, it can be seen that increased waste generation is linked to the physical size of an island, increases in population and Gross Domestic Product. Although most islands have IWM plans to manage their wastes that include the 3R's – reduce, reuse, recycle, none of the islands have set waste reduction targets, indicating that waste reduction is perhaps not considered a priority area at this point in time. Considering the relative newness of SWD on the islands, this is to be expected as efforts seem to have been directed at establishing efficient collection systems and safe disposal sites.

Comparative waste audit findings of islands interviewed show the largest waste streams being comprised of organics, paper and cardboard, glass and plastic respectively. Examples of recycling initiatives of these waste streams can be found within the sample population and are mostly run by private enterprises. Composting is not done on a large

scale even though organics constitute the largest volumes within all audits. Although low in volume, hazardous waste management is being addressed on certain islands with a focus on e-waste and batteries. Economies of scale and source separation are considered the major obstacles facing recycling initiatives within the group interviewed.

International and regional legislation and initiatives are underway to guide waste reduction and resource management within the Caribbean. Waste reduction tools such as recycling, composting, bans, taxes and deposit systems are utilized to varying degrees within the sample population. Extended producer responsibility and green procurement are not currently used.

The challenge faced on islands is how to dispose of waste in the future and officials interviewed recommended the implementation of IWM with public participation. Education and inter-island collaboration are believed to be the keys in waste reduction and recycling initiatives and the islands appear to be poised to initiate waste reduction and resource management as the future focus areas of waste management.

5. Recommendations for the BVI

The sensitivity and size of the island ecosystems of the BVI make them particularly vulnerable to pollution and emissions, including those from waste facilities. It is therefore important to select waste management strategies that have the least impact on the environment whilst serving the waste management needs of the territory.

Adopting Integrated Waste Management (IWM) as the ultimate paradigm to guide waste management in the BVI is a potentially unsound approach to manage waste into the future. The most obvious concern is that Tortola lacks the physical space to develop landfills. Even with incineration as the preferred option, landfilling is still required for incinerator ash and items that cannot be burned.

Focusing specifically on recycling as a tool to reduce waste in the BVI is problematic for many reasons. Besides the variable markets for recyclables, the BVI faces other unique constraints. Land to store large volumes of recyclables is limited and expensive and the cost of transporting recyclables to markets often renders many recycling initiatives economically unfeasible, with some recyclables having no market value. Composting, a relatively inexpensive and simple waste reduction technique, requires careful management due to quick decomposition rates in tropical climates.

Systemic Resource Management could guide the BVI into sustainable waste management that significantly reduce or eliminate the need for landfills and incinerators in the long term. Based on the findings of the research study, various long and short-term strategies for waste reduction and resource management are recommended for the BVI.

Develop a Resource Management Plan

The development of a comprehensive Resource Management Plan is advised, in line with all regional and international policies and initiatives affecting waste management. The Resource Management Plan would guide resource management and inform necessary

technical, legal and fiscal instruments in addition to physical and human resources. As outlined in the WIN report (2006), the Resource Management Plan should include the following components:

- Future scenario of waste volumes, proposed costs and methods of management
- Generation of accurate data
- Set objectives, a vision and targets to reduce waste and manage resources.
- Physical and non physical instruments required
- A feasibility analysis to assess costs and appropriateness of initiatives.

The Systemic Resource Management philosophy can be applied through IWM strategies with the aim of continuously improving resource management until little or no landfill or incineration is necessary. Resources would be monitored through regular audits that would guide priorities and targets to reduce remaining resource streams.

Once targets have been set, policy frameworks and strategies can be developed with performance indicators to monitor each resource stream. An example of a strategy for organic waste is shown below in table 1:

Policy	To utilise all resources optimally and create a safe and sustainable community
Measurable Target	By Year (0 + N), reduce organic resources being incinerated and landfilled by X%
Measurable Indicator	By year (0 + N),composting facilities will be complete
Instrument	By year (0 + N), a legislative framework will be approved, educational strategies will be designed
Precondition	A baseline waste audit will be conducted to monitor organic resources

Table 1: Strategy for reducing organic waste
(Adapted from WIN, 2006:22)

Possible tools to achieve SRM

The following are suggested for further study as they may serve as valuable tools to assist in reducing waste and managing resources:

➤ ***Composting***

Windrow composting (aerobic composting in done in long rows) was the preferred methodology used within the sample population but this is not likely to be suitable for Tortola due to limited land space and mountainous terrain. However, the viability of vermiculture (worm composting) and other suitable composting techniques that would suit the tropics should be explored. Windrows may be suitable for less mountainous islands of the BVI such as Anegada so it is probable that various composting methodologies would be employed to suit specific islands within the BVI.

It would be necessary to precede the composting initiative with an educational campaign demonstrating home composting and the benefits of compost over artificial fertilisers. Economic incentives could include subsidising home composting bins and locally produced compost. Imported fertilisers could be subjected to import taxes.

➤ ***Extended Producer Responsibility (EPR)***

EPR is potentially a powerful key leverage tool that can be used to minimise waste and manage resources as it focuses on root cause of the problem. The responsibility for waste

is transferred onto producers, suppliers and consumers through economic instruments and legislation. EPR aims to challenge producers to re-conceptualise their intent for product designs to ensure a “cradle-to-cradle” (McDonough and Braungart, 2002). Once a product has fulfilled its function it is not thrown away but instead is used as raw material input for other products.

EPR would most effectively be implemented by a regional Caribbean body as the purchasing power of the BVI is small within the world market place. Legislation or policies at a regional level could enforce the return of problematic wastes that cannot be used as resources on islands back to the producer for reprocessing. EPR can be used to reduce and eliminate current problematic wastes such as e-waste and hazardous wastes thereby reducing the accumulation of toxic materials on Caribbean islands.

➤ ***Regional and internal inter-departmental partnerships***

Partnerships are required to facilitate skill, information and technology exchanges and increase synergy between departments and islands. Waste management affects economic, social and environmental facets of society and is not simply the sole responsibility of the SWD. Inter-departmental co-operation would be required to successfully implement and execute a RMP.

It is recommended the BVI actively partner with outside organisations such as Caribbean Environmental Health Institute (CEHI), the Organisation of the Eastern Caribbean States (OECS) and the Caribbean Community (CARICOM), to increase the cooperation and collaboration between islands so that resources (human and physical) can be shared. This may make recycling more viable and the potential of EPR could be explored. CEHI could assist with waste audits, the waste diversion strategy and Cleaner Production initiatives. Success stories and best practice should be shared through a coordinating body such as Recaribe or CEHI.

The BVI could partner with Jamaica, Trinidad and Tobago and the United States Virgin Islands (USVI) who are all currently dealing with electronic or e-waste initiatives and legislation to develop strategies to deal with increasing e-waste quantities. A regional strategy for e-waste would be the ideal and could be included in CEHI’s waste diversion strategy. It would be advised to learn from the strengths and weaknesses of the European Union’s Waste Electric and Electronic Equipment (WEEE) initiative and adapt necessary frameworks to suit local environments. Caution is advised to ensure that e-waste is processed by registered recyclers to ensure the safe reprocessing of this hazardous waste stream.

External partnerships and internal inter-departmental cooperation within the government of the BVI itself would strengthen and increase the effectiveness of any resource management initiatives implemented.

➤ ***Green Procurement***

Considering high volumes of imports, green procurement could effectively be used to encourage the purchase of environmentally friendly products.

Further tools include:

- *Partner with local businesses to develop best practice waste management practices*
- *Facilitate small enterprises and public-private partnerships utilising waste a resource.*
- *Plastic bag legislation,*
- *Ongoing waste education*

6. Conclusions

It is recommended that the BVI adopt a Systemic Resource Management philosophy that redefines “waste” as a resource. Through continuous improvement cycles of IWM – reduce, reuse and recycle, the BVI should aim to continuously reduce waste going to incineration or landfill. Landfills and incinerators would serve as sources to identify and measuring waste stream composition and quantities. Strategies for waste reduction and improved resource management would be developed accordingly.

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