COST ANALYSIS OF THE PSYCHOLOGICAL EFFECTS OF WASTE DISPOSAL

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ABSTRACT

This paper quantifies the cost involved due to the psychological effect of waste disposal. The major costs are quantified as management and personnel costs. Management costs refer to those associated with awareness, recovery and recycling, taskforce and experimental. On the other hand, personnel costs are related to tax and health. The approach utilized is the algebraic sum of these component costs, since dimensional consistency of the formulation is observed. The results obtained indicate that the framework presented could beneficially add to the tool kit of the environmental decision makers. This would make it possible to generate scenarios that would give the decision maker adequate information before decisions are made. The implication of this research is that intuitive decision-making on cost is replaced with scientific backed up decision making. The idea proposed in this work is new since it provides a unique way of measuring cost of the effects of waste disposal on the stakeholders in the system.

Key words: Waste disposal, cost analysis, psychological effect, environmental impact, environmental consciousness, human health

INTRODUCTION

There is a growing awareness of the value of clean, emission free products, which forms a firm foundation for continued manufacturing operations, and even potential for new plant construction. However, the possible effect of products on human health needs to be investigated as a guideline towards improved product design and production. Thus, the psychological effect of waste disposal on human health is investigated. The cost dimension is of prime interest here. Scientific work involving both theoretical and numerical fundamentals of waste disposal has been studied for decades (Hamer, 2003; Attrill and Gibb, 2003a,b). Inappropriate waste disposal by subjects is seen to come about as a result of environmental, physiological, mental and biological issues as studied in the factorial experimentation (Romualdo *et al.*, 2002 and Chattopadhyay *et al.*, 1995). The result of this is to induce a stress reaction, which could take forms of impaired well being, physiological dysregulation, and the ten observed factors, which results into diseases. There is no

way management and control of inappropriate waste disposal will be discussed without mentioning the cost involved in undertaking the processes and steps to be followed, with the objective of disease prevention and environmental protection (Berkhout, 1991; Calijuri *et al.*, 2004; Jain *et al.*, 1981; Laureysens *et al.*, 2004a,b).

In this study attempt is made to analyse the cost implications of the results obtained from the factorial experimentation, which revealed that factor '*b*' environmental factors contribute more to the psychological effects of waste disposal. Then the management would concentrate on this environmental issue. The kind of environment considered for disease prevention is one in which facilities for proper waste disposal is available. These are some of the factors considered:

- Efficient waste system involving designated areas where waste can be collected on a daily basis.
- Safe waste transportation system.
- Provision of landfills for solid waste
- Regulatory measures or policies for industries producing gaseous and liquid waste.

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- Effective procedures on waste management to reduce, the toxicity of their waste.

An important aspect, which has a direct bearing on the study of wastes, is the quality and quantity to be disposed of. This is important in the management and control of the waste problem. They include, volume of waste, toxicity of waste, concentration of waste; area of the waste/area covered by the waste; constituent of waste (solid, liquid, or gas).

The quality, quantities, features, and characteristics of waste can be used to develop the mathematical model, which can be of use in the management and control of wastes. Irrespective of the major contributory factors whether, environmental, physiological, mental or biological issues discussed in the factorial experimentation the cost analysis may be used to establish a policy which would promote waste avoidance, minimisation, recovery for reuse and recycling and also to encourage implementation of waste reduction measures.

MATERIALS AND METHODS

The basic approach utilised in this work is the modelling of the waste disposal problem in terms of the cost associated with it. Usually, an algebraic sum of the costs is made in order to obtain the overall cost of measurement. The approach consider the following costs among others:

- Management Cost (M_c)
- Personal Cost (P_c)
- Awareness Cost (AC)
- Recovery and Recycling Cost (RRC)
- Tax force Cost (TFC)
- Experimentation Cost (FC)
- Tax Cost (TC)
- Health Cost (HC)

RESULTS

For the important objectives of disease prevention the cost involved that would be discussed in this analysis are

- Management Cost (M_c)
- Personal Cost (P_c)

Management cost

This includes all cost associated with disposal, treatment, reduction, recovery and recycling, segregation and modification of wastes. This cost is considered to help the policies made for waste management and control. Objective, recovery activities and major constraints are discussed in the introductory notes.

Listed below are some of the costs associated with management cost

- Awareness Cost (AC)
- Recovery and Recycling Cost (RRC)
- Tax force Cost (TFC)
- Experimentation Cost (FC)

Personal cost

These are the cost incurred directly by the individuals (subjects) of the community towards disease prevention. The prominent ones are

- Tax Cost (TC)
- Health Cost (HC)

Conclusively it can be observed from these discussions, we note that

Direct Personalized Cost (DPC) = MC + PC

$$MC = AC + RRC + TFC + FC + EC \qquad (1)$$

$$PC + TC + HC \qquad (2)$$

Assumptions and Equations for Each Cost
Awareness Cost (AC)

In organising an awareness program which include, seminars, publications, broadcast, etc. the cost is assumed to take an arithmetic progression over the years (n)

$$AC = C_1 + d(n-1) \qquad (3)$$

Where C_1 is the initial cost to organise the program

and *d* is the ratio of C_2 to C_1 is $d = \dfrac{C_2}{C_1}$

Recycling Cost (RC)

Cost of recycling machine (R) and Labour Cost (L) will be used for this analysis.

They are both assumed to be the product of the Initial Constant Value and an exponential function, since, purchase is made before recycling can

commence. Then some logic is applied to labour, therefore

$$RC = R_o e^n + L_o a^n \qquad (4)$$

i.e. when $n = 0$

$$RC = R_o + L_o$$

Facility Cost (FC)

Over the years (n) it is assumed that cost for purchasing facility remains constant:

$$TFC = K_2 \qquad (5)$$

Experimentation Cost (EC)

This cost can only come about if an experiment is performed to investigate the effects of inappropriate waste disposal. Therefore if n = o, the experimentation cost mush have a value of zero.

$$EC = E_0 \log_{10} e^n \qquad (6)$$

Conclusively,

$$MC = C1 + \frac{C_2}{C_1} (n-1) + R_o e^n + L_o a^n + K_1 + K_2$$
$$+ E_o \log_{10} e^n \qquad (7)$$

Health Cost (HC)

The individuals themselves purchase things for themselves that will help them to prevent diseases which will result from inappropriate waste disposal; we assume a direct variation with their income (M), inflation (β) and standard of living (S) as follow:

$$HC + M\beta S$$
$$HC + ZM\beta Sn$$

Z = the constant of proportionality

Tax Force (TF)

This is also assumed to have a direct variation with income, since a tax system is pay as you earn

$$TC \; \alpha \; nm$$
$$TC = K_3 nm$$

K is the constant of proportionality

Conclusively:

$$HC = ZM\beta sn + K_3 nm \qquad (8)$$

The final Cost Equation is therefore:

$$DPC = C_1 + \frac{C_2}{C_1} (n-1) + R_o e^n + L_o a^n + K_1 + K_2$$
$$+ E_o \log_{10} e^n + K_3 nm + zm\beta sn \qquad (9)$$

$$DPC = C_1 + \frac{C_2}{C_1} (n-1) + R_o e^n + L_o a^n + K_1 + K_2$$
$$+ E_o \log_{10} e^n + mn (K_3 + z\beta s) \qquad (10)$$

Limitations on the cost model

The cost analysis is limited to the features mentioned in the scope of this work. Future investigations and analysis might include other parameters. Also the cost is directed towards disease prevention.

DISCUSSION

This paper focuses on the areas where investments are made so as to help the problem of psychological waste disposal to be solved. Waste control schemes should be put in place and organisation with state of the art technologies and practices, which promote better technical, environmental and social benefits compared with traditional landfill disposal. Government policy should promote waste avoidance, minimisation, and recovery for reuse and recycling. It should encourage waste reduction measures with the objective of reducing the amount of waste produced that require disposal, prolong the life of landfills and reduce the increasing cost of transportation, treatment and waste disposal.

The major constraints on waste recovery and recycling and awareness, promotion of waste avoidance on purely environmental reasons is not sufficient for there are many other factors waste disposal affect such as health which in turn affects productivity due to psychological and physiological imbalance. All these factors were analysed in this work. The understanding of the correlation presented a better and more effective approach to the solution of waste disposal problem.

There are training programmes that should be organised by the government to establish structures that can control waste disposal in various sections of the community. The

establishment of committee or task forces would be helpful. These personnel are to work with the public so as to achieve objectives such as facilitation of public participation, food and environmental hygiene, leisure and cultural services and increase awareness on the need to dispose waste following regulations. Public areas such as schools, bus terminals, and recreation centres should be managed to monitor inappropriate waste disposal. Also, setting up waste recovery programmes may also help. Other things that may be considered include the control of industrial sites and industries to avoid dumping their wastes in appropriate places.

Measures should be taken to ensure regulations are followed to manage wastes. This includes transportation and handling of industrial wastes by qualified personnel.

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