

Full Cost Accounting in Solid Waste Management: The Gap in the Literature on Newly Industrialised Countries

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Abstract

The concept of sustainable development has heightened awareness across a range of industries including solid waste management (SWM) of the need to integrate social and environmental costs into the accounting management system. Full Cost Accounting (FCA) is an approach for including social and environmental costs in decisions. Several studies have confirmed the effectiveness of this approach, yet very few studies have analysed the applicability of FCA in SWM in newly industrialised countries.

This paper provides a review and critique of the existing literature relating to SWM, FCA and newly industrialised countries. It contributes to the general lack of clarity in the literature of the factors that facilitate and hinder the adoption of FCA. The paper concludes that there is a need for research capable of providing evidence of FCA as a tool for measuring the social and environmental costs of SWM in newly industrialised countries.

Keywords:

**Solid Waste Management (SWM)
Full Cost Accounting (FCA)
Newly Industrialised Countries (NICs)
Sustainability**

Introduction

“ ... assessing experience from different countries and regions on policies, strategies and regulations. With solid data to draw upon, The International Solid Waste Association will develop a sound basis for recommendations that would accomplish optimum waste related GHG emission reductions, both locally and globally. This work might include formulation, implementation, enforcement and compliances tools as well as transparent and accurate accounting methodologies.” (Waste and Climate Change, ISWA White Paper, 2009)

Solid Waste Management (SWM) is a necessary part of life, and effective management of this has been identified as essential for sustainable development. Effective SWM is of concern to developed countries and newly industrialised countries alike, although the former has a longer history of concern with adverse effects of SWM upon social and environmental factors. It has been argued that such adverse effects can be reduced by assigning them a monetary value and that the identification and measurement of these effects assists in controlling the social and environmental costs of SWM facilitating movement toward sustainable development. Therefore, the need to integrate social and environmental costs in the accounting management system is widely recognised in SWM, and Full Cost Accounting (FCA) is a well accepted approach for achieving this objective. Several studies confirm the effectiveness of FCA, finding that it provides a common sense approach to identifying social and environmental costs.

Although there is urgent need for integration of waste management into strategies for sustainable development, the degree of success with which developed countries and newly industrialised countries cope with the problem differs. Most newly industrialised countries are still in the early process of the concept of sustainable development. Therefore, practices have been slow even though there appears to be initiative within the SWM industry to implement such a concept. In this context, this paper aims to contribute to literature on the lack of adoption of FCA in SWM in newly industrialised countries. The objective is to review the available literature with a view to deriving the gap in knowledge and suggestions

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for future research directed at filling the gap. Specifically, this literature paper aims at identifying the gap in the existing literature of the use of FCA in SWM in newly industrialised countries. The paper is not an evaluation of FCA and is therefore limited to conclusions that can be drawn about the reasons why FCA is not used in SWM decision making in newly industrialised countries.

This paper takes the goal of the significance of issues relating to SWM and sustainable development as its starting point. The next section provides a review on sustainable development and regulation of SWM. The review then establishes a gap in knowledge that existing research does not address the reasons why FCA, as a tool for measuring social and environmental costs, has not been adopted by SWM in newly industrialised countries. Then, a survey of research about FCA in developed countries is used to provide potential explanations for the lack of adoption of FCA by SWM entities in newly industrialised countries. Summarising comments are provided in the concluding section collectively with suggestions about using what we do know to undertake future research directed at filling the gap in our knowledge.

The Solid Waste Management Issue

Solid waste management is defined as:

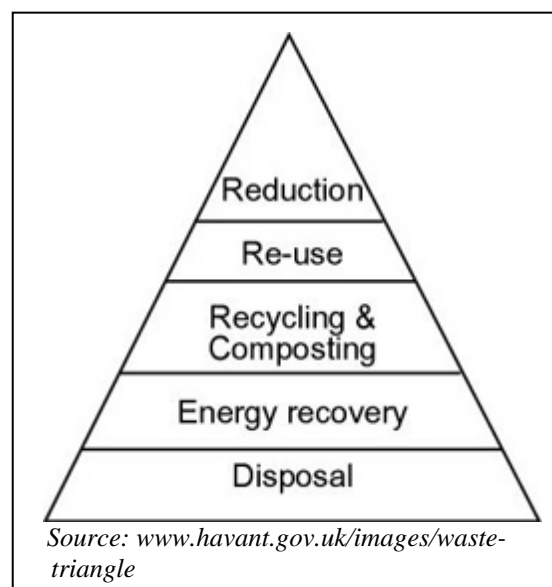
... the control of waste generation, storage, collection, transfer and transport, processing and disposal of solid wastes consistent with the best practices of public health, economic, financial, engineering, administrative, legal and environmental considerations (Othman, 2002, p.2).

Solid wastes include all the discarded materials from municipalities, households and non-hazardous solids from industrial and commercial establishments (Kaseva and Gupta, 1996). It has been argued that solid waste is a misplaced resource to be tapped for the benefit of the generating society (Collins, 1998). Reducing the volume of waste reaching disposal sites means lower resulting pollution to the environment.

A widely adopted, conceptual solid waste hierarchy, which gives priority to types of SWM, based on concepts of sustainability is

illustrated in Figure 1. This conceptual hierarchy can be viewed as a set of management plans for solid waste as a means of achieving sustainable development. The hierarchy sets forth several waste management strategies or options according to importance and preference in a descending order. The aim is to extract the maximum practical benefits from the products and manage solid waste in the best possible manner, so that the minimum amount of solid waste is generated. It is an internationally accepted and recommended prioritised ranking of waste handling using an ascending order of preference. The hierarchy moves from landfilling and incineration without energy recovery, the least preferred to combustion with energy recovery, then to recycling/composting, finally to source reduction and reuse, the most preferred. Several authors identify a more detailed order of preference: open burning, dump, landfill, incinerate, recycle, reuse, prevent (Henry, Yongsheng, and Jun, 2006; Achankeng, 2004; and Maldonado, 2006). A waste management hierarchy is a widespread element of national and regional policy and is often considered the most fundamental basis of modern solid waste management practice (Achankeng, 2004; Chang and Davila, 2007).

Figure 1: Solid Waste Management hierarchy.



The waste management hierarchy is aimed at ensuring waste management practices are as environmentally sound as possible. This concept has been adopted in various forms by most developed countries.

SWM is an integral part of the urban environment and planning of the urban infrastructure to ensure a safe and healthy human environment while considering the promotion of sustainable economic growth (Tränkler, Visvanathan, Kuruparan and Tubtimthai, 2005; Visvanathan, 2007). SWM is a system for the handling of all garbage. Municipal waste collection is SWM as are recycling programmes, dumps, and incinerators. Achankeng (2004) argues that it is time urgently to review the existing system of SWM in an urgent manner so that these wastes are disposed of using environmentally friendly technology in order to provide a sustainably developed society. New ways to improve solid waste management for communities focuses upon economic, social, and environmental issues (Kaseva and Gupta, 1996).

Effective waste management requires that someone take responsibility for the removal and management of solid waste. It further requires appropriate levels of funding. In most countries government is responsible for the total management of solid waste, although there is a growing trend towards privatisation in this area requiring citizens to pay for waste collection. In rural areas citizens may be required to bring their waste to dumps and recycling facilities (Achankeng 2004). For most industrialised nations today, SWM is a multibillion dollar business which is also crucial to survival. The end goal is to reduce the quantity of waste (whether that garbage is disposed of or recycled into something useful) and to reduce the environmental pollution associated with it.

Sustainable Development and Regulation of Solid Waste Management

Sustainable development rose to prominence in 1987 with the publication of the Brundtland Report. In this report, sustainable development was defined as “development that meets the needs of the present without compromising the ability of the future generations to meet their own needs” (WCED, 1987; Herath, 2005). In 1987, the World Commission on Environment and Development (WCED, 1987) warned that we must begin living sustainably to avoid

future resource shortages. A cornerstone of sustainable development is the establishment of affordable, effective and truly sustainable waste management practices. Bogner (2006) further noted that it must be emphasised that multiple public health, safety and environmental co-benefits accrue from effective waste management practices. He argues that this concurrently reduces Greenhouse Gas (GHG) emissions and improves the quality of life, promotes public health, prevents water and soil contamination, conserves natural resources and provides renewable energy benefits. As revealed in the ISWA White Paper (2009), the waste industry occupies a unique position as a potential reducer of greenhouse gas (GHG) emissions.

The problems of SWM are well documented. Solid waste is becoming a major public health and environmental concern in many developing countries due to rapid urbanisation and this is gaining increased political awareness (Ogawa, 2007). The costs of municipal SWM services have risen steadily over the past decade (Macve, 2000). Local governments try to control SWM costs through a variety of measures, including restructuring waste services and encouraging waste reduction. However, making effective decisions and developing cost-effective waste management strategies can be difficult without complete cost information (USEPA, 2006).

Morrissey and Browne (2004) proposed that sustainable waste management be environmentally acceptable, economically effective, and socially acceptable. The need for these factors was supported by Rathi (2006) who found that an effective, sustainable solid waste management requires economic, social and environmental elements. Marchettini, Ridolfi, and Rustici (2007) state that an effective waste management policy should be based on the principles of sustainable development, in accordance with which refuse is not simply regarded as something to eliminate but rather as a potential resource. Waste is an unavoidable by-product of human activities. The accumulation of waste becomes an issue of great concern when the solid waste management system is overwhelmed or inadequately managed (Rathi, 2006). There is a need to work towards a sustainable waste management system to ensure the system is effective and this leads to environmental,

institutional, financial, economic and social sustainability. Gutberlet (2010) states that a new model of inclusive waste management, a radical approach capable of tackling poverty and contributing towards recovering environmental health, should be established.

The role of local governments is to take a proactive approach to environmental management by providing a regulatory framework. In the past local governments have only requested that manufacturers try to do their best to reduce their impact upon the environment. Regulatory frameworks include voluntary and compulsory programmes to control and monitor production processes (EPA, 2004). Frameworks provide an important opportunity for governments to ensure that future regulations will be socially, economically, and environmentally appropriate (Lim, 2004; Glasbergen, 1998; and Karamanos, 2001). By developing convergent social, economic and environmental agendas, local government can send clear signals to individuals, businesses, and interest groups of the importance of improved decision-making for sustainable development (USEPA, 2006).

According to Beaver and Prince (2002), local governments can create the right economic, fiscal and regulatory conceptual framework within which innovation and business can flourish. Although businesses are challenged to accomplish these goals with diminishing financial and human resources they can benefit from participating in these programmes if government provide financial resources, and support services to waste management. Several authors have argued that local governments will be required to look beyond their own concerns and integrate various perspectives about environmental issues into their business and pay more attention to environmental problems and issues (Wong, 2004; Paton, 2000; Glasbergen, 1998; Lim, 2004). Local governments need to actively promote the relevant information about issues relating to these regulatory programmes to industry. Local government should provide clear information about the various voluntary and compulsory programmes and the aims and requirements of each programme.

In a large number of countries, the local authorities launch education projects and awareness-raising initiatives. Most local

councils have in employment a waste minimisation officer or recycling officer. Campaigns in relation to waste management are provided with the aims of raising awareness and giving more detailed and specific information to the public. Hung, Ma and Tang (2007) argued that the two main issues contributing to sustainable solid waste management system in Taiwan are social and public participation factors in the decision-making process. Rathi's (2006) study supports this, finding that participation by the community and public/private organisations is essential to effective solid waste management.

The Accounting Challenge

Movement toward an integrated approach for measuring economic, social and environmental factors in policy and decision-making has taken a number of different pathways over the past 20 to 30 years (Gale and Stroke, 2001; Jasch, 2003; and Hung et al., 2007). Sustainable development is perhaps one of the most universally known of these paths, having been accepted and adopted by many influential international bodies (Wong, 2004; Joseph, 2006; Morrissey and Browne, 2004; Achankeng, 2004; and Kerr, 2004). This is consistent with Bebbington's (2009) view that sustainable development could be argued to be the unifying theme/normative ideal that is being used to motivate and integrate social/environment/ethical concerns within corporate social responsibility and social accounting.

The emergence of the concept of sustainable development, which places considerable importance on the maintenance of natural resources requiring mandatory inclusion of natural resource values, has posed many challenges to those involved in accounting for the natural environment (Gray, 1992; Gray, Kouhy and Lavers, 1995). Overall, the objective of sustainable development is to satisfy basic needs for all humans in balance with a healthy natural environment.

The fiscal responsibility of those managing solid waste is of concern to the SWM fraternity as evidenced by the previous discussion. As discussed, complete cost information is required for cost-effective waste management strategies. The concern with sustainable development has heightened awareness of the

needs to consider environmental and social costs. Within the accounting literature these are identified as external costs.

Many researchers have recently focused on the need to quantify external cost and several research studies have identified the benefits of and difficulties in applying various models. Some researchers have attempted to evaluate various methods of external cost reporting including Environmental Management Accounting (Jasch, 2003; and Rubenstein, 1994a, 1994b), Triple Bottom Line reporting (Elkington, 1997) and Fair Value Accounting (Barlev and Haddad, 2003). Several researchers have focused on identifying the problems associated with implementation (Gale, 2006; Herbohn, 2005; and Antheaume, 2004). Other researchers have theorised alternative models of assessing external cost (Bebbington, Brown and Frame, 2007; Litman, 1997; and Bebbington and Gray, 2001b).

The most prevalent method or tool for incorporating external costs in decision-making is FCA. FCA generally refers to the process of collecting and presenting information for each available alternative course of action or plan in order to reach a decision. FCA aims at recognising, quantifying and allocating the cost related to a process, or a product, including where appropriate, the environmental and social cost (USEPA, 1996; Karagiannidis, Xirogiannopoulou and Tchobanoglous, 2008). There have been numerous examples of the use of the FCA method for solving real life external cost applications with the aim of achieving sustainable development. These are such as the Ontario Power Generation, a Canadian utility (USEPA, 1996); the environmental report of BSO/Origin (Huizing and Dekker, 1992); and a Swedish car manufacturer; and Power Gen, a UK power generator (Atkinson, 2000). Kerr (2004) states FCA is currently understood to be one of the most comprehensive forms of environmental accounting incorporating conventional, social and environment costs. Karagiannidis et al., (2008) further state that within the present work, FCA was used for comparing different schemes of waste collection and related charging in an Hellenic urban municipality, by comparing the cost of waste services for the authority and the total waste charge that citizens will be called upon to pay.

The U.S Environmental Protection Agency (EPA) supports the use of FCA to help municipalities improve the cost-effectiveness of their solid waste programmes. A set of six case studies was developed by the EPA to illustrate the ways that different agencies developed unique FCA systems and applied those systems to address local issues. One of the case studies is the Indianapolis solid waste division that began using FCA in 1993 with the aim to facilitate the adoption of market mechanisms. This implementation of FCA has enabled the development of performance indicators and has successfully facilitated competitive bidding by public employees for solid waste collection contracts. Since the division began competing against private haulers to provide trash collection services, the city's solid waste costs were decreased by over \$5 million (USEPA, 1998). As demonstrated by the case of Indiana solid waste division, there is a need to obtain full cost information as, for example, agencies might reject potentially cost-effective options or overlook opportunities to expand recycling and waste reduction programmes (USEPA, 1998). Tanaka (2006) has stated that the major cause of the continued deterioration of the global environment is the unsustainable pattern of consumption and production, particularly in industrialised countries. According to Rubenstein (1994a, 1994b), an accounting-driven solution is needed to help manage a difficult business situation, namely corporate sustainability for companies operating in the renewable natural resources industry.

Further, the special report to the Indiana General Assembly, Indiana Institute on Recycling outlines the 1993 findings of Indiana's state-wide law requiring all cities and towns that provide solid waste services to calculate the full cost of service annually. Findings showed that 211 Indiana cities and towns indicate they avoided \$3.3million in dumping costs through yard waste and recycling program; yard waste diversion programs were found to be the least costly solid waste management program provided by cities and towns; and the percentage of costs associated with specific services are 41% for garbage collection, 23% for garbage disposal, 22% for recyclables collection, and 14% for yard waste program (EPA, 1996). By using FCA, a community can determine the full costs of solid waste management, as well as its

component costs. Further the cost drivers can also be identified by FCA. Table 1A in Appendix One illustrates how the costs of SWM activities can be used to build up the costs of MSW.

Bebbington et al. (2001a, 2001b) and Antheaume (2004) have shown that FCA has been widely used in countries such as the United States and Canada. However, while some of this research has been undertaken within solid waste management entities there is little available evidence that anyone has sought to understand FCA in a newly industrialised country solid waste management entity.

A significant number of SWM studies are based on developing countries, and as previously stated, few of these have drawn from newly industrialised countries. Table 1B in Appendix Two provides a brief review of SWM research concerned with developing countries.

Addressing the Knowledge Gap

The problem of concern to this paper draws from a gap in our existing body of knowledge. FCA has clearly been identified by the UN as a factor in facilitating movement towards recognition of the social and environmental impacts of SWM. Moreover, there is evidence that at least some newly industrialised countries are concerned with these impacts. Yet SWM entities in newly industrialised countries have not adopted FCA. We are unable to explain why SWM entities in newly industrialised countries have not adopted FCA, or a similar tool, for incorporating external costs in decision making. We do not know whether or not conditions within newly industrialised countries support adoption of FCA or, indeed, whether or not SWM entities in such countries are ready to adopt such a tool.

The existing literature does provide some potential insight into why newly industrialised countries have not adopted FCA as a way of helping to address their concerns with the social and environmental cost of solid waste management. However, as stated previously, the literature from developed countries where infrastructure is highly developed, living standards are high and regulatory frameworks exist. It may be that without external conditions like these, there will be insufficient

support for the adoption of FCA. A possible explanation for the lack of adoption of FCA by SWM in newly industrialised countries is that there are conditions that exist in developed countries that facilitate or support FCA that do not exist in newly industrialised countries. None of the existing studies reviewed for this paper focused specifically on any such conditions, although Gale et al. (2001) identified three general factors that they felt were important: regulation, moral commitment and the desire to promote good relations with the residents.

Studies exploring the success or otherwise of FCA in developed countries (Bebbington, Gray, Hibbitt and Kirk, 2001a; Bebbington et al., 2007; Bebbington, 2007; Herbohn, 2005 and Karagiannidis et al., 2008) have helped to identify certain conditions that may be necessary for the successful adoption of FCA. These conditions can be grouped into external and internal conditions. External conditions are those outside of the control of the organisation. These consist of regulatory requirements for environmental reporting (specifically, regulation aimed at reporting environmental and social costs of solid waste management), pressure from government and lobby groups, standards arising from professional associations, environmental sensitivity and awareness in the community, and changes in populations and economy. Bebbington, Gray, Hibbitt and Kirk (2001a, pg.5) argue:

The impetus for accountants to provide full cost accounts comes from the call [from] the European Commission's Fifth Action Programme, for the profession to develop FCA.

Carter, Perruso, and Lee (2006) argue that environmental regulations are intended to internalise a large range of external opportunity costs in the decision making processes of individuals and businesses. FCA captures information about social benefits and external opportunity costs. This is supported by Bebbington et al. (2001a) who also identify that regulations help to internalise external costs and go on to say that in many cases such internalisation is at present only partial. Herbohn (2005) argues that environmental sensitivity within an industry is influenced by lobby groups and state government legislation. Conway-Schempf (1998) argues that

organisations and governments are increasingly aware that the environment should be managed for prolonged use and that negative environmental impacts are costly to individuals, organisations and society.

Bebbington et al. (2001a, 2001b) identify national government support as an important factor for FCA. The importance of awareness of external costs within the community is identified by Niemi (2003). These authors argue that the impact of poor environmental management is widely perceived by the community and that this is underpinned by scientific evidence. They found that local governments are recommending the adoption of an accounting system that integrates the potential costs and benefits of different environmental management alternatives suitable to the industry.

The dimensions of the costs to be considered are also affected by changes in the community population and ecology. In discussing FCA in forestry management ECONorthwest (Niemi, 2003, pp 1-2) stated:

Actions that were acceptable in the past ... are now seen as unacceptable. Communities where family income once depended solely on the timber industry ... may find ... [their] incomes depend on an unlogged forest's contributions to the local quality of life.

Only two of these external conditions were mentioned in studies concerned with developing countries. Changes in community and economy were found to put pressure on SWM entities to change their practices (Ogawa, 2007; Visvanathan, 2007). The need for community participation was also identified as affecting SWM practices (Bartone, Leite, Triche and Schertenleib, 1991; Rapten, 1998; and Joseph, 2006). However, neither of these studies was concerned with the measurement or tracking of external cost.

Internal conditions are those within the control of the organisation. These consist of the ability of the existing accounting system to incorporate measures of external cost, the level of discomfort among decision-makers within the organisation about external costs being transparent, and the need for full commitment to FCA from management and staff including resources allocation and support. USEPA

(1998) undertook six case studies about the use of FCA in SWM in the United States. They found that there was a need for full commitment from management and staff if FCA was to be effective. Specifically, they found that the accounting system should be consistent across the entire organisation; that there should be standard forms and procedures to facilitate FCA; there should be adequate allocation of resources; the system should be updated on a regular basis; and that there should be commitment across the entire organisation. Herbohn (2005) found that it was important that the ability of the existing accounting system (or otherwise) to incorporate external costs be considered.

Some authors have found that resistance to adopting FCA is based in the level of discomfort among decision makers about the transparency of external costs. For example, Bebbington et al. (2001a, p.120) found that managers believed that FCA was unlikely to tell a comforting story, but, that it would "generate 'bad news' about those organisations undertaking FCA". Specifically, they identify two important reservations. The first was that disclosing external costs would create perceived responsibility for management and secondly that disclosing such costs would highlight the extent of the environmental problem. These are seen as barriers to the use of FCA. Several authors have identified other barriers. For example, Herbohn (2005) found that FCA failed when managers were overly optimistic about what could be achieved and did not provide adequate resources for FCA implementation. She found that this was aggravated by a high level of staff turn over. Bebbington et al. (2001a, 2001b) found that the cost of gathering the information needed was a barrier to the use of FCA as was the inability to identify the impacts of some activities, particularly long term impacts. They also found that implementing FCA was time consuming and required resources and expertise. These studies however were largely undertaken with organisations in developed countries and very few studies have analysed SWM in newly industrialised countries. The most prominent research in newly industrialised countries has been that which deals with evaluating the benefits of curb-side recycling for households (Othman, 2002, Ogawa, 2007; Caplan, Grijalva, and Jakus,

2002, and Begum, Siwar, Pereire, and Jaafar, 2007).

The review of studies exploring the success or otherwise FCA (in developed countries) helped to identify certain conditions that may be

necessary for the successful adoption of FCA. These conditions are summarised and presented in Table 2. Table 3 shows the advantages and disadvantages of FCA.

Table 2: Summary of External and Internal Conditions for Adoption of FCA

<i>External Conditions</i>	<i>Internal Conditions</i>
Regulation	Moral Commitment of Management
Pressure from lobby groups and associations	Comfort with transparency
Changes in populations and ecology	Cost of gathering information
Environmental sensitivity	Senior management support
Awareness in the community	Staff turnover
Regulation	Existing accounting system
National and Local Government Support	Percentage of Waste Costs to Total Costs

Table 3: Advantages and Disadvantages of FCA

<i>Advantages</i>	<i>Disadvantages</i>
Identify the costs of MSW management	Require expertise and knowledge
See through the peaks and valleys in SWM cash expenditures	Social and environmental costs are not measureable
Explain SWM costs to citizens more clearly	Discomfort with transparency
Adopt a businesslike approach to SWM	Require support from senior management
Evaluate the appropriate mix of SWM services	Time consuming and costly

As there is little information concerned with newly industrialised countries within this body of literature. It can be theorised that the lack of FCA in newly industrialised country SWM entities may be due to non-existence of certain external and internal conditions necessary to facilitate or support FCA. Further, that the non-existence of these conditions may create barriers to the adoption of FCA.

It is evident that SWM concerned with external costs or specifically incorporating FCA are largely situated in developed countries such as the US and Canada. While useful to the understanding of SWM issues in newly industrialised countries, this research is largely anecdotal and is not concerned with external cost. Hence this paper contributes to existing literature by Bebbington; Gray and others by addressing the lack of research concerned with the use of FCA by SWM in the newly industrialised countries.

Conclusion

In conclusion, the management of solid waste is an integral part of the urban environment. Despite concern for sustainable development, modern societies generate solid waste at an

increasing rate. In most countries government is responsible for the total management of solid waste, although there is a growing trend towards privatisation in this area. The end goal is to reduce waste quantity and the environmental pollution associated with it. Sustainable development has been advocated as a policy goal by many influential international bodies. The emergence of the concept of sustainable development has posed many challenges to those involved in accounting for the natural environment particularly in solid waste management. Effective sustainable solid waste management requires an understanding of economic, social and environmental impacts of this activity. Within the accounting literature these impacts are identified as external costs. The most prevalent method or tool to incorporate external costs in decision making is FCA. The conclusions about internal and external conditions were all drawn from studies solely conducted within organisations in developed countries. There were no studies reviewing FCA in any other country. This leads directly to the concern of this paper. We are unable to explain why SWM entities in newly industrialised countries have not adopted FCA, or a similar tool, for incorporating external

costs in decision making. We do not know whether or not conditions within newly industrialised countries support adoption of FCA or, indeed, whether or not SWM entities in such countries are ready to adopt such a tool. There is a need for research to provide potential explanations. Further, the paper is not an evaluation of FCA and is therefore limited in the conclusions that can be drawn about the importance of the existing conditions.

Effective SWM is an issue for newly industrialised countries and there is evidence that newly industrialised countries are fully aware of the need for sustainable development. Developed countries such as Canada and America have identified FCA as a key tool in assisting them achieve sustainable development in many areas, including SWM. The literature suggests that certain conditions may need to be present before FCA can be successfully adopted. There is, however no firm theory regarding this. Therefore, future research should aim to contribute to knowledge by addressing the lack of research concerned with use of external cost information in SWM in newly industrialised countries and the general lack of clarity in the literature of the factors that facilitate and hinder the adoption of FCA or similar tools. Specific objectives to be concerned which include the extent to which conditions within newly industrialised countries, but external to SWM entities, support the adoption of FCA as well as the extent to which conditions internal to such entities are such that they are capable of adopting FCA. Case studies of SWM entities in newly industrialised countries that explore the reasons why FCA has not been adopted will contribute to our understanding and help to fill the gap in the literature.

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Appendix One

Table 1A: Illustration of FCA for MSW

<i>Hypothetical Illustration of FCA for MSW (in thousands of dollars)</i>				
	<i>Recycling</i>	<i>Composting</i>	<i>Landfilling</i>	<i>Total</i>
Activity Costs				
Collection	2,750	600	4,237	7,587
Transfer Station (s)	200	0	400	600
Transport	384	0	725	1,109
Facility	1,040	489	4,030	5,559
Residual Disposal	280	47		327
Education/Outreach	600	224	25	849
Overhead Costs	1,400	349	2,580	4,329
Total Costs	6,654	1,709	11,997	20,360
By-Product Revenues	(1,566)	(400)	0	(1,966)
Net Costs	5,088	1,309	11,997	18,394
Tons Received	60,000	20,000	110,000	197,000
Net Cost Per Ton	\$84.81	\$65.43	\$109.06	\$93.37

Source: Full Cost Accounting for Municipal Solid Waste Management: A Handbook

Appendix Two

Table 1B: Annotated review of Solid Waste Management in Developing Countries

<p>Abert, J. G. (1985) <i>Municipal Waste Processing in Europe: A Status Report on Selected Materials and Energy Recovery Projects</i></p> <p>Main Contribution: This report deals with municipal waste processing in Europe. It is intended for those, primarily in developing countries, interested in the potential application of industrial country techniques for reuse and recycling of solid wastes.</p> <p>Conclusion: It is a status report on selected material and energy recovery projects.</p>
<p>Barnard, R. and Olivetti, G. (1990) <i>Limiting Environmental Impact by Waste Management</i>.</p> <p>Main Contribution: This paper describes a data base that has been developed to allow developing countries to predict the amount of industrial waste generation.</p> <p>Conclusion: These predictions are based on waste production per employee in other location.</p>
<p>Rathi (2006) <i>Alternative approaches for better municipal solid waste management in Mumbai, India</i>.</p> <p>Main Contribution: Rapid growth of population and industrialisation degrades the urban environment and places serious stress on natural resources, which undermines equitable and sustainable development. Municipal corporations of the developing countries are not able to handle increasing quantities of waste, that results in uncollected waste on roads and in other public places.</p> <p>Conclusion: Mumbai needs to work towards a sustainable waste management system that requires environmental, economic and social sustainability.</p>
<p>Bartone C., Leite, L., Triche, T. and Schertenleib R. (1991) <i>Private Sector Participation in Municipal Solid Waste Service: Experiences in Latin America</i>.</p> <p>Main Contribution: This article summarises four case studies of the private provision of municipal solid waste services in four large Latin American cities (Buenos Aires, Caracas, Santiago, and Sao Paula). These and other studies in the region suggest that local authorities should establish operational and environmental regulations and standards to guide private contractors, and have the capacity to oversee these activities. Supervision and payment should be based on specific performance measures.</p> <p>Conclusion: Found that private service provision can be successful in terms of cost containment and quality of service as long as the service contracts are awarded through a competitive bidding process.</p>
<p>Cointreau, S. J. (1990) <i>Environmental Management of Urban Solid Wastes in Developing Countries: A Project Guide</i>.</p> <p>Main Contribution: Information on solid waste generation rates and composition for countries of various levels of economic development is provided as well as case study information on the formal and informal sector refuse collection and disposal activities prevalent in cities of developing countries.</p> <p>Conclusion: This project guide provides information and procedures for planning and implementation of solid waste collection and disposal improvements in developing countries.</p>

Diaz, L. F., and Golueke, C.G. (1985) Solid Waste Management in Developing Countries.

Main Contribution: This article includes a summary of practices commonly followed in waste management and offers a few suggestions and "solutions" whereby the pollution.

Conclusion: Environmental problems associated with waste management in less developed countries can be somewhat alleviated.

Joseph, K. (2006) Stakeholder participation for sustainable waste management.

Main Contribution: Highlights the fact that the involvement and participation of all the stakeholders such as the waste generators, waste processors, formal and informal agencies, non-governmental organisations and financing institutions is a key factor for the sustainable waste management.

Conclusion: Sustainable waste management provides a comprehensive inter-disciplinary framework for addressing the problems of managing urban solid waste, in the resource constrained developing countries where quality of such services are poor and costs are high often with no effective means of recovering them.

Gabriel, B. C. (1989) Improving Solid Waste Management in the Context of Metropolitan Development in Metro Manila.

Main Contribution: The aim of this study is to analyse the environmental sanitation conditions, practices, and services in the Metro Manila area, and examine the capabilities, problems, weaknesses, and needs of the existing solid waste management systems, and review the current solid waste management policies and laws.

Conclusion: An outline of the various options for dealing with the problem.

Furedy, C., and Yang, S. (1993) Recovery of Wastes for Recycling in Beijing.

Main Contribution: Both the formal and the informal system are described as well as environmental benefits and current policy dilemmas.

Conclusion: This article describes the recovery of recyclable materials in Beijing.

Hung, M. L., Ma, H. W., and Tang, W. F. (2007) A novel sustainable decision making model for municipal solid waste management.

Main Contribution: Reviews several models developed to support decision making in municipal solid waste management (MSWM). A case study for food waste management in Taiwan is presented to demonstrate the practicality of this model.

Conclusion: The proposal model combines multi-criteria decision making (MCDM) and a consensus analysis model (CAM).

Furedy, C. (1990) Waste Recovery in China

Main Contribution: China is the only country with an extensive state-controlled waste recovery system. Nevertheless, there is an informal economy of solid waste collection and disposal which has become more important as administrative and economic changes have eroded the base of the state system.

Conclusion: This article describes the waste management system in China.

Furedy, C. (1993) Working with the Waste Pickers: Asian Approaches to Urban Solid Waste Management.

Main Contribution: Street children, who lack access to schooling since they have no permanent home, pick waste for a living.

Conclusion: Community-based projects in Asian cities strive to improve pickers' earnings, health, living conditions and security.

Holmes, J. R. (1984) Managing Solid Wastes in Developing Countries.

Main Contribution: This book details solid waste management practices in developing countries and compares these practices with those undertaken in the developed world.

Conclusion: Waste composition, generation, and waste collection, transfer, and disposal activities are highlighted.

Simpson, M. (1993) Lapaks and Bandars Convert MSW in Indonesia.

Main Contribution: This article summarises a project run by a team of specialists from Harvard University and the Indonesia Center for Policy and Implementation Studies to improve solid waste management in Jakarta.

Conclusion: As a result of this project, the informal private sector now captures 88 to 98 percent of higher valued materials, and has become the core of an urban composting process in Jakarta.

Bartone, C. (1991b) Institutional and Management Approaches to Solid Waste Disposal in Large Metropolitan Areas.

Main Contribution: This paper examines a model of decentralized solid waste collection and centralized transfer and disposal that is in place in Norfolk, Virginia U.S.A. and which is being applied in the Federal District of Mexico City.

Conclusion: Lessons are drawn for the application of such a model to metropolitan areas in other developing countries.

Achankeng (2004) Sustainability in municipal solid waste management in Bamenda and Yaounde, Cameroon.

Main Contribution: There is hardly any approach used in the developed countries that have not been experimented with in the developing world. Waste reduction has been given highest priority in many industrial countries with high standards of living.

Conclusion: The hierarchy advocated by these countries may not be appropriate for most communities of developing countries. The waste management hierarchy is a widespread element of national and regional policy and is often considered the most fundamental basis of modern MSWM practice.