

***Quo vadis* Solid Waste Management Legislation in the Informal Sector of Harare**

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Abstract

This study focuses on the effectiveness of the current solid waste practices and the level of compliance to environmental legislation in the informal sector of Harare. Focus is on the home industries in Mbare at Siyaso and Highfield at Gazaland since they are the largest concentrations of home industrial enterprises in Zimbabwe and to get a detailed picture on the practices and compliance issues. Questionnaire surveys and interviews aimed at generating information on the informal sector operators' level of awareness of the by-laws, policies and legislative framework guiding waste management in their areas and at the national level as well. In Harare there is a comprehensive legislative environment that could effectively address solid waste management issues in the informal sectors of Mbare and Highfield. However, the mere existence of a conducive legislative environment is not enough to guarantee an efficient waste management system and hence there is also need for an equally efficient enforcement mechanism. The informal sector operators are generally unaware of the pieces of legislation and by-laws that govern solid waste management in Zimbabwe and Harare in particular and this has resulted in indiscriminate dumping of waste resulting in environmental problems such as odours, smoke, rodents as well as land and water pollution. There is need for the Ministry of Environment and Natural Resources together with other stakeholders to come up with a Waste Management Policy. The Ministry of Local Government could ensure that local authorities that include the City of Harare adhere to the provisions of their by-laws and there is need for capacity building on the implementation and enforcement of solid waste by-laws. There should also be capacity building programmes for informal sector operators on important pieces of legislation and sustainable waste management practices. Municipal by-laws and national legislation dealing with solid waste management should encourage entrepreneurship based on waste recovery, re-use and recycling in view of the social, economic and environmental benefits associated with these activities.

Key words: Legislation, waste policy, informal sector, waste management, *Quo vadis*, Harare

Introduction

The aim of this project was to assess the solid waste management practices and policy and legislative framework governing the management of solid waste in Zimbabwe's informal sector with a special focus on Harare. The study focuses on the effectiveness of the current practices and the level of compliance to environmental legislation in the informal sector. Waste management has become one of the major challenges confronting all local authorities in Zimbabwe (Jerie, 2005; 2006a; 2006b; 2007; 2011; Tevera, 1991; 2004; Masocha, 2004; Maseva, 2005). Research on waste management in Zimbabwe has focused on domestic and industrial waste management practices and compliance to legislation in the formal sector, but no comprehensive study has been done to analyse the management practices and compliance to legislative requirements in the informal sector. Economic implosion in Zimbabwe has resulted in high levels of unemployment in Zimbabwe estimated at 80%. This has resulted in the growth of home industries in most urban centres and most notably in Harare. Activities in the home industries generate solid waste that could be detrimental to human health and the environment if not well managed and monitored by establishing compliance to environmental legislation in place. Studies have not clearly brought out the issues of generation and management in the informal sector of Harare as deserving investigation because of the belief that it is difficult to study and probably that the government does not generate any revenue from this sector. However, there is need for investigation since activities in the informal sector generate produce waste which could be detrimental to the environment by contributing to air, land and water pollution if the waste is not properly managed though an efficient waste management system that also takes into cognisance issues of compliance to environmental laws.

Solid waste management is receiving growing attention from researchers in recent years not only because of the negative impacts associated with waste, but also because of the socio-economic benefits which can be derived from waste recovery and utilisation (Ayomoh et al. 2008; Manga *et al.* 2008; Parrot et al. 2009; Wilson *et al.* 2006; Zotos *et al.* 2009). The importance of legislation, policies and local authority by-laws has been widely acknowledged not only in Zimbabwe (Tevera, 1991), but also in Tanzania and in Zambia (Makuku and Masiye, 2002). The delivery of solid waste management service has been deteriorating in most urban centres in Zimbabwe over the last decade despite the existence of both national laws and local authority by-laws dealing with waste management. According to the Urban Councils Act (Chapter 29: 15) each local authority is required to have by-laws

guiding their activities. An examination of the policies and legislation governing solid waste management in the country facilitates the identification of discrepancies between policy requirements and practice on the ground. The study would thus recommend areas of intervention in order to improve waste management systems thereby improving urban environments in general and specifically the capacity of informal sector enterprises in Harare areas to improve their well-being.

Current studies in solid waste management have focused on the waste management practices and legislative aspects in the formal sector and residential areas. This study seeks to amplify current knowledge by focussing on the informal sector which has become an important source of livelihood for most Zimbabweans since the shrinking of the formal sector that started in 2000 as a result of the economic meltdown.

Methodology

A detailed analytical study was undertaken in the informal sector enterprises of Harare with a focus on Siyaso home industries in Mbare and Gazaland in Highfield. Focus is on these home industries since they are the largest concentrations of home industrial enterprises in Zimbabwe and to get a detailed picture on the practices and compliance issues. A total of 203 questionnaires were directed at all the enterprises at Siyaso and 125 questionnaires at Gazaland again directed at all enterprise operators. The questionnaire surveys aimed at generating information on the informal sector operators' level of awareness of the by-laws, policies and legislative framework guiding waste management in their areas and at the national level as well. It also assesses the efficiency and adequacy of the waste legislation as perceived by the informal sector enterprise operators. Structured interviews were used to solicit first hand information on the status of the waste management problems faced by the local authorities as well as long-term plans in place to improve the prevailing state of solid waste management. Relevant officials in the Ministry of Environment (the Environmental Management Agency), the Harare City Council's Health Department, the Ministry of Rural and Urban Development are to be interviewed with regard to solid waste management practice and compliance to legislation in the informal sector. Secondary data sources would involve a review of policies and legislation governing the management of waste in Zimbabwe. These include the Urban Councils Act (Chapter 29: 15), the Regional, Town and Country Planning Act (Chapter 29:12), the Rural District Councils Act (Chapter 29: 13), the Public Health Act (Chapter 15:09) and the Environmental

Management Act (Chapter 20:27). This would be followed by a review of the waste management by-laws of Harare.

Results and discussion

Characteristics of waste generated in the informal sector

The solid waste generated in the home industries of Mbare and Highfield comprises organic and inorganic constituents such as paper and cardboard, plastic, glass, metal, textile, rubber, wood shavings, coal, asbestos, car shells, vegetables and putrescibles, soil and builders' rubble and miscellaneous waste such as batteries, electric appliances, windscreen wipers, electric cables and plugs. The composition of the solid waste is illustrated in Table 1.

Table 1 Composition of solid waste in the home industries of Harare (% of total volume)

Material	Description	% of total volume
Paper and cardboard	Newsprint, stickers and litter	11
Plastic	Packaging material, milk and soft drink containers	6
Glass	Clear bottles, jars and plated glass	2
Metal	Ferrous and non-ferrous metals, aluminium and steel metals from tinsmiths, empty containers of paint, motor oil, thinners etc.	10
Textile	Pieces of cloth and fabric	1
Rubber	Tyre pieces, shoes and purses	5
Wood shavings	Shavings soaked with moisture from organic waste, pieces of timber	22
Coal	Small pieces of coal coated with organic matter	3
Asbestos	Small pieces of asbestos	1
Car shells	Rusty car shells which may contain other waste	18
Vegetables, putrescibles	Fruit and vegetable waste, maize cobs, chicken waste, bones and other food waste	5
Soil, builders' rubble	High amount of sand and organic matter, bricks, few stones	13
Miscellaneous	Batteries, electric appliances, windscreen wipers, electric cables, plugs	3

The solid waste generated in the Gazaland and Siyaso home industries comprises a high percentage of wood shavings generated in the woodworking industries. The high percentage of wood shavings probably indicates the high waste generation rates by carpenters at 2.7 tonnes per week and also the low levels of recycling. Car shells disposed at the home industries account for 18% of the total volume. The shells occupy the greatest volume in the skips which contributes to the rapid filling of the skips which are heavy and weigh up to 91kgs. The home industries are also associated with a high percentage of recyclable materials such as paper and cardboard (11%), ferrous and non-ferrous metals (10%). Recycling of waste is very vital as it reduces the amount of waste that reaches the disposal sites. In terms of quantities, the highest amount comes from welding and it amounts to 39% of the total waste generated in the home industries. This is due to the relatively large number of welders operating in the home industries and the fact that the metal is heavier than other types of solid waste and it comes on the form of aluminium, ferrous and non-ferrous scrap metals. Waste from carpentry is the second heaviest and accounts for 26% of total waste by weight. The advantage of waste generated by carpentry enterprises is that it is recyclable and biodegradable, but it can cause problems in terms of storage and disposal. Although tyres contribute a small amount of the total waste produced by weight (4%) these are not biodegradable and can contribute to rapid filling of disposal sites. Tyres can also resurface years later in disposal sites and burning those does not help either as this results in air pollution.

Environmental problems associated with solid waste disposal

There are several environmental problems associated with solid waste generated in the home industries. The surrounding communities of Mbare and Highfields were not consulted in the location of skips used for waste collection and hence problems such as odours were expressed by the residents as a potential health hazard. All the respondents interviewed also claimed to dump their waste inside the skips, although from observations made some illegal dumping was taking place along Mukuvisi River. Wood shavings and tyres could also be seen burning with huge smoke coming from the informal enterprises. There was also concern over some informal traders operating illegally in front of the Mbare home industry premises who dump waste illegally on the ground outside the skips.

Waste collection in the home industries is undertaken by the Cleansing Section of the City Health Department of the Municipality of Harare. Up to 58% of the home industry operators regard the rate of waste collection as erratic. Observations also indicated that waste was accumulating in most parts of the home industries

indicating that waste had not been collected for a long time. The Department of Works noted that waste collection needed to be undertaken once a week, but due to vehicle breakdowns and shortages of spare parts, there are challenges faced in collecting waste once every week and this has tended to worsen the waste management problem in the home industries. According to the Cleansing Section of the Health Department 25.1 tonnes of waste are collected every week from an average of 36.8 tonnes generated in the home industries per week.

Perceptions on the awareness of environmental problems associate with solid waste indicated that there was generally low appreciation of the environmental impacts that could emanate from improper disposal. Table 4 shows the perceptions of the operators on pollution of air, water and land.

Table 4 Perceptions of enterprise operators on different pollution areas (% of total responses)

Type of pollution	Negative impact	Little/no impact	Don't know
Air	56	13	29
Water	11	28	25
Land	14	55	25
Visual environment	19	4	21
Total	100	100	100

The majority of home industry operators indicated that solid waste was associated with negative impacts on air quality (56%) and the visual environment (19%). This is because the respondents were able to detect the smell and smoke from the burning of solid waste. Respondents also indicated that solid waste had little or no impact on water (28%) and land (55%). The home industry operators in these two spatial locations do not have direct access to ground and surface water, but get their water from taps hence they do not think the waste produced can pollute these water sources. The land surface within Mbare and Highfield home industries is not used for any agricultural purposes and is therefore not a critical resource to the operators. The home industry operators believe waste has an impact only on those resources they can see. It is therefore vital for the enterprise operators to be made aware of the impacts of solid waste they generate on the environment.

Waste management and the legal framework

Zimbabwe does not have an overall waste act that provides the essential legal basis for a consolidated waste management strategy in the country. However, there is a comprehensive legal framework that guides waste management in both urban and rural areas. A number of Acts of Parliament and regulations deal directly and indirectly with environmental pollution in general and waste management in particular. A number of ministries are involved in the administration of the Acts, but the Ministry of Environment and Natural Resources takes overall responsibility and accountability. In addition to the Acts of Parliament and policies on waste management most local authorities have by-laws which they employ to effectively regulate activities in the areas under their jurisdiction. In the home industries, 79% Of the respondents indicated that they were not aware of the existence of these any regulations that govern solid waste disposal.

The pieces of legislation pertaining to waste management in Zimbabwe are discusses in the sections below.

The Harare Waste Management By-Laws (1979) [Statutory Instrument 477 Of 1979]

The city of Harare has a comprehensive set of laws covering virtually all functions and activities. The by-laws on waste management date back to 1948 when they were adopted as the Salisbury Sanitary and Refuse Removal by-laws of 1948. They were amended 8 times between 1953 and 1978 before being repealed by the Salisbury (Waste Management) by-laws in 1979. The latter by-laws together with the Anti-litter by-laws of 1981 are the two most important sets of by-laws on waste management currently in use in Harare. The Harare Waste Management by-laws of 1979 generally deal with regular removal of domestic and industrial waste but do not deal with standards for safe handling. They also lack clear objectives of waste minimisation, recycling and resource recovery. The City of Harare also has by-laws of 1986 (clause 4) which state ' no person shall deposit or abandon or cause or permit to be deposited or abandon, any litter in a public place, except in a receptacle, especially provided for the receipt of such litter'. 'Litter includes any containers, wrappings, cartons, cigarette-packers, paper, vegetable matter, garden waste, dead animals, ash tins, rubbish, bricks, stones, rubble, soil and any other matter or substance which is unwholesome, offensive or untidy. Public place includes any bridge, enclosure, footpath, garden, car park, open space, pavement, road, service lane, side walk, square, subway, street, mall or undeveloped land, or any section the public has accesses. Paragraph five section five states, 'any person

who contravenes these by-laws shall be served with a written notice by a member of the Zimbabwe Republic Police offering the opportunity of the discharge of any liability to conviction of that offence by payment of a deposit fine'. However, these by-laws have lacked the enforcement as evidenced by heaps of litter in the home industries of Mbare and Highfield as well as the fact that very few people are aware of the existence of these by-laws.

The Environmental Management Act: Chapter 20:27

The Environmental Management Act (EMA) was enacted in 2002 to become the principal Act that addresses environmental management in Zimbabwe. It provides for the sustainable management of natural resources, protection of the environment and the prevention of pollution and environmental degradation. The Act also addresses the preparation of the National Environmental Plan and other plans that ensure management and protection of the environment. These provisions of the EMA Act address issues of waste management at various levels. In cases where any Act comes into conflict with EMA the provisions of EMA prevail making it the supreme law that governs the management of waste.

The environmental rights and principles of environmental management are stipulated in Section 4 of the Environmental Management Act and some of these address the following waste management issues:

- Every person shall have a right to a clean environment that is not harmful to health
- The right to protect the environment for the benefit of the present and future generations is everyone's responsibility as this will prevent pollution and environmental degradation
- Environmental management must place people and their needs at the forefront of its concern
- Any person who causes pollution or environmental degradation shall meet the cost of remedying such pollution or environmental degradation and any resultant adverse health effects as well as the cost of preventing, controlling or minimising further pollution, environmental damage or adverse health effects. Through this, the Environmental Management Act embraces the polluter-pays-principle, widely used as a tool for environmental management.

The Act clearly stipulates that people have a right to a clean environment that is not harmful to health and these rights need to be enshrined in the Zimbabwean

constitution so as to demonstrate the extent to which the nation values these environmental rights.

In Section 9 of the Environmental Management Act there is provision for the setting up of the Environmental Management Agency and several functions of this Agency address waste management issues. These functions are spelt out in Section 10(1) (b) (ii), (vii), (viii), (xii) and (xiv) and these include the following:

Subject to this Act and any other enactment, the functions of the Agency shall be:

- i. (a) To formulate quality standards on air, water, soil, noise, vibration, radiation and waste management;
(b) To assist and participate in any matter pertaining to the management of the environment, and in particular
- ii. To regulate and monitor the collection, disposal, treatment and recycling of waste
- vii. To regulate and monitor the management and utilisation of ecologically fragile ecosystems
- viii. To make model-by laws to establish measures for the management of the environment within the jurisdiction of the local authorities;
- xii. To undertake any works deemed necessary or desirable for the protection or management of the environment where it appears to be in the public interest or where in its opinion an appropriate authority has neglected to do so;
- xiii. To serve written orders on any persons requiring them to undertake or adopt such measures as are specified in the orders to protect the environment;
- xiv. To carry out periodic environmental audits of any projects including projects whose implementation stated before the fixed date for the purpose of ensuring that their implementation complies with the requirements of this Act.

The functions of the Agency indicate the crucial role of the Environmental Management Act in addressing waste management issues in Zimbabwe. The fact that the Director- General, Officers and Inspectors have powers to enter premises and serve written orders for the protection of the environment as set out in section 37 (4) (b) as well as their monitoring functions as set out in section 36 (c), (d) and (e) places waste management responsibility on the Agency staff and ensures effective enforcement of waste management legislation. It is stipulated in Section

114 (3) that a Ministerial order may be served for the purpose of removing and disposing of litter or refuse from any land or premise. A Ministerial order supersedes an order issued by an Officer or Inspector of the Agency, which further strengthens the monitoring and co-ordination of waste management issues in Zimbabwe. Although the Agency staff has immense powers in undertaking its duties, the use of the terms 'may serve an order...' in section 115 (1) could imply that it is not mandatory for the Agency staff to serve written orders (Maseva, 2005).

A vital aspect of the Environmental Management Act with regards to waste management is that it provides for the formulation of waste standards in section 69 (1), prohibition against discharge of wastes (section 70, minimisation of waste through treatment, reclamation and recycling in section 70 (3), classification of hazardous waste in section 70 (1-2) and prohibition against littering in section 83 (1-4). The other pieces of legislation are silent on the issue of solid waste management standards, however, the major problem with the Environmental Management Act is in the enforcement of the standards. The other problem is that while section 70 (3) of the Act encourages sustainable waste management practices it does not mention the crucial role of other methods such as re-using, reduction and composting that are vital methods in sustainable waste management practice.

The Act does not consider important aspects of waste minimisation and these include sorting of waste at source. Separation of waste is important in reducing the amount of waste that is disposed at landfills enabling the landfills to last longer. Income generation opportunities are also created through recovery and sale of paper and other non-biodegradable materials and the sale of manure produced from the composting of biodegradable materials.

The Urban Councils Act

The Urban Councils Act regulates waste management in centres designated as urban, but is in many ways similar to the Rural District Councils Act. In Section 218 (b) it makes provision of the council to charge for the removal of refuse where this service will have been provided. The monetary of the charge is not mentioned in the Act hence giving the council powers to set the monetary value for the services provided in refuse collection. The major problem though faced by councils is in that whenever it drafts a budget it has to be approved by the ratepayers and thus the council may find it difficult to charge market related values for the services it provides due to resistance from the stakeholders. Urban councils are controlled

by the Ministry of Local Government who may not approve the budget since it may be felt to be heavy for the rate payers. The result is that there may not be enough resources for frequent waste collection and disposal. There are also provisions made in section 227 (1) on matters to which the council may make by-laws as listed in the Third schedule of the Act as sewerage, sanitary fittings, effluent and refuse removal, cleansing of private sewers, streets and yards as well as crops, vegetation, rubbish and waste material. The details are listed below:

Third schedule-Matters for which Council may make by-laws

Part V11- Sewerage, Effluent, the Destruction of Insects and Vermin and the removal of Refuse and Vegetation

Effluent and Refuse Removal

79 (1) The removal or disposal of

- (d) Human waste
- (e) Effluent, water or refuse, whether trade, domestic or otherwise
- (f) Decaying and other offensive or unhealthy matter and requiring the use by persons of any system or undertaking provided by the council for the collection, removal or disposal thereof.
- (1) The specification of the type of container to be used by the owner or occupier of any premises for the storage of refuse pending removal and the supply of such type of container in circumstances where such containers are not provided in sufficient numbers or of adequate size or construction.
- (2) The regulation of the positions where the containers referred to in subparagraph (2) shall be placed
- (3) The prohibition or regulation of the arrangement, construction and siting of any building or appliance appertaining to the disposal of human waste or domestic or trade effluent

Crops, vegetation, rubbish and waste material

80. (1) The prohibition or regulation of -

- (a) The cultivating, accumulation or existence on any land of any crop, vegetation, rubbish or unwholesome or offensive matter or thing which-
- (i) Constitutes or is likely to constitute a fire hazard or a danger to public health or the natural resources of the council area; or

- (ii) Is such that it may give rise to circumstances in which a danger to public safety or security may arise or
 - (iii) Is unsightly in the area or locality
- (b) The accumulating, dumping, depositing, abandoning or dropping on or in any road, street, sidewalk, drain, land, premises or place of rubbish or waste material of any description, including, without derogation from the generality of the foregoing, machinery or vehicles or parts thereof.
- (2) Requiring the removal or clearing of crops, vegetation, rubbish, waste material or any unwholesome matter or thing referred to in subparagraph (1) and on the failure of any person to do any act to comply with his duties in that regard, empowering the council to do the act at his expense.

The Minister has powers to make model by-laws as stated in section 230 and he/she is also can also make and adopt by-laws on behalf of councils as given in section 233 of the Act. This helps to address areas in cases where council may fail to make such by-laws. The Act further addresses the issue of ensuring that the environment is free from waste by making provisions in section 235 (3) (s) for the drafting of regulations for the proper administration of any water supply, sewerage, rubbish removal services or other like services within the council's jurisdiction. The Urban councils Act confer certain powers upon urban councils with respect to waste management. In the Second Schedule, section 23 sub- section (1), the Act gives the Urban Council the power to provide and operate a service for removing and treating trade or other effluent, refuse and human waste for the council area or any portion thereof and to make use of the service compulsory. This ensures that Urban Councils will provide waste management services in their areas.

The major weaknesses of the Act are that they are silent on key sustainable waste management practises such as the use of the three Rs-reduce, recycle and re-use. It is also does not mention what council would do with the waste collected and when council failed to fulfil its obligations.

The Water Act: Chapter 20:24

The Water Act addresses the issue of waste management in Section 68 (1) where it prohibits the discharge or disposal of any organic and inorganic matter into any surface or ground water, either directly or indirectly so as to cause pollution of the

water. This is vital in the sense that whoever disposes of waste, including local authorities, should do so in such a way that it does not cause pollution to surface and groundwater resources. Local authorities are required to construct and manage waste disposal sites so as to avoid causing pollution. The Act requires polluters to pay the costs of cleaning up polluted water resources.

The Public Health Act: Chapter 15:09

The Public Health Act, Chapter 15.09, 1996 makes reference to the collection, transportation, storage, treatment and the disposal of waste. In Section 83 of the Public Health Act, it is stated that it shall be the duty of every local authority to take all lawful, necessary and reasonably practical measures for maintaining its district at all times in a clean and sanitary condition, preventing the accumulation of refuse which may be injurious or dangerous to health. Waste producers and municipalities are also expected to take responsibility for collection, transportation, storage and the treatment of waste. The local authorities can contract out the collection of industrial and liquid waste to the private sector. There is no mention of the procedures in the collection transportation and disposal of solid waste generated in the enterprises. According to the Public Health Act municipalities have the obligation for the safe removal and disposal of residential waste.

The Public Health Act delegates waste management to the producers of wastes and this causes problems where no clear waste management standards and procedures exist. While the Public Health Act addresses the issue of waste by prohibiting a person from causing a nuisance on land, which he occupies, owns or controls, it does not prohibit people from causing nuisances on land over which they have no control. According to this Act, therefore, people can cause nuisances on open spaces or other land over which they have no control and get away with it. Sections 87 and 88 describe the procedures and penalties for someone failing to comply with notice to remove a nuisance. The penalties for this crime include very low fines and these are unexceptionally low. In the informal sector enterprises of Harare, there are no clear standards, or regulations and procedures in the management of waste. As a result waste is at times dumped in the backyards and in open pits resulting in serious environmental problems such as the breeding of flies and unpleasant odours. The Public Health Act has therefore been not effective in providing adequate standards in handling of solid waste in the institutions.

Conclusion

In Harare there is a comprehensive legislative environment that could effectively address solid waste management issues in the informal sectors of Mbare and Highfield. However, the mere existence of a conducive legislative environment is not enough to guarantee an efficient waste management system and hence there is also need for an equally efficient enforcement mechanism. The informal sector operators are generally unaware of the pieces of legislation and by-laws that govern solid waste management in Zimbabwe and Harare in particular and this has resulted in indiscriminate dumping of waste resulting in environmental problems such as odours, smoke, rodents as well as land and water pollution. Furthermore, the environmental legislation that governs waste management in the informal sector enterprises of Mbare and Highfield was enacted on health grounds and as a result it has not been effective in addressing waste management challenges being experienced. There has also been no planning for solid waste management in the informal industrial enterprises. The mechanisms in place for addressing waste management have been implemented as a result of preserving the visual environment to make it presentable to visitors.

Recommendations

The original aim of regulating waste disposal should be to reduce the introduction of polluting substances into the atmosphere since protection of the environment is a major challenge facing developing countries such as Zimbabwe. International policies are, in the main, aimed at regulating the disposal of waste rather than addressing and preventing its generation (Tromans 2001). In EU countries though attention seems to have shifted toward policies and legislation designed to minimise the generation of waste and to secure its beneficial reutilisation (Tromans 2001).

The central role of legislation is to monitor waste management activities, prescribing conditions by its regulations to avoid contamination of the environment. Legislation is thus a meta-level activity, which monitors the base level activity and sets targets for activities upon waste. From the object-oriented view, this happens by communication between the objects. Activity upon a target disaggregates into two sub-activities: the management activity communicating mainly with a meta-level description or prescription of the target; and the activity manipulating the target and /or its model directly-in this context, management is used in its meaning as control of activities for a purpose. On the most generic level, an activity upon a

target can be modelled as a couplet of objects communicating with each other as shown in Fig. 1 (Pohjola and Tanskanen, 1998).

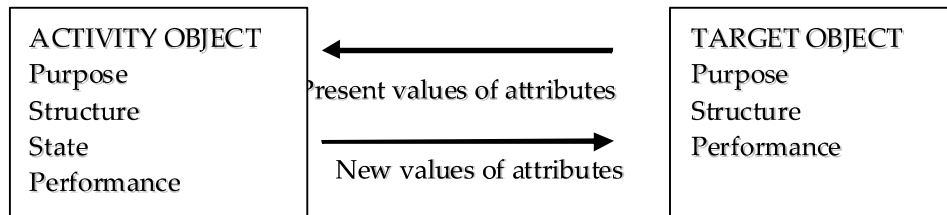


Fig. 1 Object oriented representation of an activity upon a target

Source: Pohjola and Tanskanen (1998).

The activity object monitors the current values of the four attributes of the target object and is capable of sending messages to update these. In Fig. 6.1 the management activity monitors the current State of the target through the model of the target. It builds up an impression of the State of the target object and sets new sub-goals for the manipulating activity. The target is a waste-related process or product. The three objects communicating cyclically can be viewed as a generic model of waste management (Pongracz and Pohjola, 1998). Waste manipulation is here understood in accordance with the definition of waste management: control of waste related activities with the aim of protecting the environment and resources conservation. In this triplet of objects, also referred to as a design cycle by Pohjola and Pongracz (1998), the management level activity refers to the role of legislation. Legislation sets the goals for waste management such as fixing recycling rates to be achieved, setting targets to reduce emissions, prescribing the goal of stabilising waste production at a given level, or banning the export of certain categories of waste.

In Zimbabwe, there is need for the Ministry of Environment and Natural Resources together with other stakeholders to come up with a Waste Management Policy. The Ministry of Local Government could ensure that local authorities that include the City of Harare adhere to the provisions of their by-laws and there is need for capacity building on the implementation and enforcement of solid waste by-laws. There should also be capacity building programmes for informal sector operators on important pieces of legislation and sustainable waste management practices. Municipal by-laws and national legislation dealing with solid waste management

should encourage entrepreneurship based on waste recovery, re-use and recycling in view of the social, economic and environmental benefits associated with these activities. All in all there is need for multi-stakeholder participation in legislation review as well as provision of grants to municipalities for capacity building initiatives in legislative and policy reviews and drafting.

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