IMPROVING WASTE MANAGEMENT IN A DEVELOPING COUNTRY THROUGH A PROCESS OF LEARNING: THE SOUTH AFRICAN WASTE INFORMATION SYSTEM

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Keywords: waste information system, learning, impact, developing country, waste management

Abstract: Piloting of the South African Waste Information System (SAWIS) provided an opportunity to research whether the collection of data for a national waste information system could, through a process of learning, change the way that waste is managed in the country, such that there is a noticeable improvement. The interviews with officials from municipalities and private waste companies, conducted as part of the piloting of the SAWIS, highlighted that certain organisations, typically private waste companies, have been successful in collecting waste data. Through a process of learning, these organisations have utilised this waste data to inform and manage their operations. The drivers of such data collection efforts were seen to be financial (business) sustainability and environmental reporting obligations, particularly where the company had an international parent company. However, participants highlighted a number of constraints, particularly within public (municipal) waste facilities which hindered both the collection of waste data and the utilisation of this data to effect change in the way waste is managed. These constraints included a lack of equipment and institutional capacity in the collection of data. The utilisation of this data in effecting change was further hindered by governance challenges such as politics, bureaucracy and procurement, evident in a developing country context such as South Africa. The results show that while knowledge is a necessary condition for resultant action, a theoretical framework of learning does not account for all observed factors, particularly external influences.

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Abstract

Piloting of the South African Waste Information System (SAWIS) provided an opportunity to research whether the collection of data for a national waste information system could, through a process of learning, change the way that waste is managed in the country, such that there is a noticeable improvement. The interviews with officials from municipalities and private waste companies, conducted as part of the piloting of the SAWIS, highlighted that certain organisations, typically private waste companies have been successful in collecting waste data. Through a process of learning, these organisations have utilised this waste data to inform and manage their operations. The drivers of such data collection efforts were seen to be financial (business) sustainability and environmental reporting obligations, particularly where the company had an international parent company. However, participants highlighted a number of constraints, particularly within public (municipal) waste facilities which hindered both the collection of waste data and the utilisation of this data to effect change in the way waste is managed. These constraints included a lack of equipment and institutional capacity in the collection of data. The utilisation of this data in effecting change was further hindered by governance challenges such as politics, bureaucracy and procurement, evident in a developing country context such as South Africa. The results show that while knowledge is a necessary condition for resultant action, a theoretical framework of learning does not account for all observed factors, particularly external influences.

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1. Introduction

The environment outlook for South Africa for 2006 showed that levels of municipal waste service delivery only improved by 2.7% between 1996 and 2001, with almost 50% of the South African population not receiving a regular waste collection service (DEAT, 2006). In addition 59.7% of the 231 local municipalities indicated that they could not perform their waste management functions (Godfrey & Dambuza, 2006). While it is acknowledged that there are many well operated sanitary landfill sites in South Africa in line with international best practice, of the 1280 known public and private landfill sites (general and hazardous) in the country, only 44% are authorised through permits (DEAT, 2006b). Of those permitted, compliance with permit conditions is seldom audited and often unknown. The result is that while pockets of compliance exist, waste is currently not being duly
managed in South Africa, resulting in a negative impact on the environment and this requires intervention. The need exists for public and private waste organisations to improve the effectiveness of current waste management practices.

The South African Department of Environmental Affairs and Tourism (DEAT), in its White Paper on Integrated Pollution and Waste Management (IP&WM), identified the need to develop waste information systems (WIS) to “provide accessible information to interested and affected parties that will support effective integrated pollution and waste management” and in so doing, “ensure informed decision making, measure progress in policy implementation and enable public participation in the governance of integrated pollution and waste management” (Republic of South Africa, 2000:42). The DEAT developed the South African WIS (SAWIS) between 2004 and 2006. It has been shown that the impact of environmental information is increased through understanding the end users and their needs for information (Denisov & Christoffersen, 2001). As such, the SAWIS was based on specific needs identified by key stakeholders from both public and private waste institutions (Godfrey, 2008). The identified needs for waste data include strategic requirements at national and provincial government level with more operational needs at local government and at the waste facility level (Godfrey, 2008). For waste information to support policy objectives (Republic of South Africa, 2000) and the needs of stakeholders (Godfrey, 2008), the routine collection of data must move beyond simple collection to also include data assimilation and interpretation, and conversion to knowledge.

This paper explores whether, through the conversion of data to knowledge, these original intentions for a WIS can be fulfilled in a developing country such as South Africa. In particular the paper aims to explore the research question “Can the collection of data for a national waste information system, change the way waste is managed in South Africa, such that there is a noticeable improvement?”

Unlike studies which have focussed on the role of information technology, i.e. the waste information system, in influencing individual and organisational behaviour (de Man, 2006; Chiasson and Saunders, 2005), this research focuses on the waste data and information, and through this process of learning, changing personal behaviour.

2. Knowledge as a precursor to action

A dichotomy exists between theorists who propose that making data and information available to individuals has the potential to influence actions by building knowledge and capacity – the ‘information-action’ theory (Denisov et al., 2005; Stephan et al., 2005; Denisov & Christoffersen, 2001; Bruch 2000), and those who argue that a tenuous relationship, if any, exists between knowing what to do and acting on that knowledge (Weiss, 2002; Pfeffer & Sutton, 2000; Miller & Morris, 2000).
Environmental information disclosure, science communication and environmental education, which draw from behavioural psychology, are three disciplines which have provided significant theoretical contributions to understanding the impact of environmental information on decision-making processes (Stephan et al., 2009; Denisov et al., 2005; Weiss, 2002).

Information disclosure is a recognised environmental policy instrument capable of 'eliciting' or 'inducing' desired outcomes (Stephan et al., 2009; Denisov et al., 2005; Kolominskas & Sullivan, 2004; Antweiler & Harrison, 2003). Research has shown that information can make people aware of the consequences of their behaviour and influence their awareness, opinions, attitudes and knowledge (Denisov et al., 2005; Weiss, 2002; Howes, 2001). In so doing, policy makers then rely on people to use this newly acquired knowledge to change their behaviour so as to meet the required policy intention.

While information disclosure has been used internationally in many domains ranging from public health, energy conservation, environmental management to family planning (Denisov et al., 2005; Weiss, 2002), perhaps the most well known example of successful information strategies, is the Toxic Release Inventory (TRI) implemented in the United States in 1986 in response to the chemical accident at a Union Carbide plant in Bhopal, India (Stephan et al., 2005; Nauman, 2004). Based on the principles of community-right-to-know, the TRI requires that certain listed industries report on the quantity and types of pollutants released to air, water and soil, and transferred off-site for disposal, which are then made available to government and the public. The empirical evidence suggests that TRI information disclosure has had positive impacts in reducing the volumes of pollutants discharged to the environment, through raised industry awareness of wasteful processes (Kolominskas & Sullivan, 2004; Howes, 2001) and social pressure (Stephan et al., 2009; Antweiler & Harrison, 2003; Weiss, 2002).

The proposition put forward by those researchers in favour of 'information-action', is that information can make people aware of the consequences of their behaviour and influence their awareness and knowledge regarding this behaviour (Weiss, 2002; Howes, 2001). The underlying assumptions in information strategies are that people respond to information; respond to information out of their own accord; that people have 'limitless capacity' to absorb new information; and that people have endless motivation to alter their behaviour based on what is considered 'optimal behaviour'; and that knowledge is linked to action (Weiss, 2002).

Unlike information-disclosure strategies such as the TRI, the SAWIS does not make facility specific information available to the public. As such, the issue of public pressure as a driver of change (Stephan et al., 2009) is not considered within this research question. Instead this research focuses on resultant change from only those actors involved in collecting and reporting the data. In addition,
those actors expected to implement change, are not necessarily directly at risk from the waste, as in the
case of vulnerable communities (Barr, 2007; Tietenberg & Wheeler, 1998). Unlike America, where
implementation of the TRI has been largely successful (Stephan et al., 2005), this paper focuses on
solid waste management specifically in the South African context as a developing country, and not
broader pollution management. At the time of this research, reporting to the SAWIS was not
regulated, but voluntary in nature, although regulations to enforce reporting to the SAWIS were under
consideration (Republic of South Africa, 2009).

3. Preliminary theoretical framework

Organisational learning provides an additional perspective on the role of knowledge informing action
(Lai et al., 2009). Organisational learning is shown to be a means of influencing actions through
improved knowledge and understanding thereby affecting organisational outcomes and effectiveness
(Lai et al., 2009; Robey et al., 2000). In terms of a resource-based view of organisations, knowledge
is considered the “most significant strategic resource for organizations” (Lai et al., 2009:543). Since
organisational learning can be measured at the individual, group or organisational level (Robey et al.,
2000), knowledge is considered critical in improving personal knowledge of employees and raising
their levels of awareness, thereby influencing organisational learning and in so doing driving
organisational action and effectiveness.

Miller and Morris (1999) note that decision-making today is often based on data and information “to
the near-total neglect” of knowledge, with information often being mistaken for knowledge (Moeletsi
analysed, linked to other information, and compared to what is already known”. Knowledge is
therefore seen as being an important component of attitude formation and of behaviour. According to
Allee (2003:264), knowledge is considered as the ‘capacity to act’.

The process of learning provides a preliminary theoretical framework for interpreting the case study
data, as discussed in the Sections 3 and 4 (Figure 1) (Miller & Morris, 1999). The process of learning
allows for collected data to be assimilated, interpreted (converted to information) and together with the
application of existing theory (which puts that information into the correct context) and experience of
real world applications, builds up a knowledge base (Poch et al., 2004; Miller & Morris, 1999; Allee,
1997). Learning is considered to be a process of "gaining knowledge, comprehension or mastery",
"acquiring or creating knowledge" (Allee, 1997:50) or as a relatively permanent change in behaviour,
or behaviour potential (Baron, 1995).
The paper focuses on three sub-questions guided by the theoretical framework: Do organisations have the ability to collect data? Do persons have the ability to assimilate and interpret the data, building knowledge? Do persons (and organisations) have the ability to convert this learning into impact (potential to implement change in managing waste)?

4. Materials and methods

According to existing research (Denisov and Christoffersen, 2001; Jones, 2001), the impact of information on resultant actions often cannot be directly observed or measured. This may be due to time lags between providing information and resultant action, and in singling out the impact of one piece of information from a multitude of behavioural influences. For this reason, this paper adopts an exploratory, interpretive approach so as to rather seek understanding through the application of the pre-conceptual framework, specifically as it relates to waste management (Leedy & Ormrod, 2005). Due to the exploratory nature of this research, a detailed explanation of the research methodology, as outlined in the following sections, is deemed necessary.

4.1 Positionality

A postpositivist, interpretive research approach in the social sciences, recognises that the investigator and investigated are not independent entities (Mottier, 2005; Henning et al., 2004), and any knowledge gathered through the research is ‘marked by its origins’ and needs to be situated or positioned relative to both the researcher and that which is being researched (Rose, 1997). In so doing, it makes the position of the researcher known, thereby limiting the potential for overgeneralizing or universalizing from the research findings (Rose, 1997). This section presents the role of the first author in the SAWIS pilot study.

In support of the development of the SAWIS, the system was piloted in two provinces in South Africa, Mpumalanga and Eastern Cape between 2005-2006. A review of the pilot project was conducted by the author at the end of the piloting period, to assess five elements fundamental to the long-term success of SAWIS, namely anchoring and ownership; capacity development; resource requirements; communication and outreach; and system sustainability. The findings of this review are summarised in a report by the primary author to the Department of Environmental Affairs and Tourism (DEAT, 2006c). The SAWIS pilot project review therefore provided a unique opportunity to undertake a preliminary exploration of the potential for impact of data collected for the SAWIS on the way waste is managed in South Africa.

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1 Ms Linda Godfrey was appointed by the Department of Environmental Affairs and Tourism between 2004 and 2006 as Local Support Consultant: Waste Information System, to oversee the development and piloting of the SAWIS.
It is recognised that access to specific individuals within organisations is often difficult to obtain, especially within government departments where access may be denied due to senior management or political concerns around highlighting internal governance weaknesses. Direct access to persons responsible for the management of waste and/or those responsible for the implementation of the SAWIS within their organisations was facilitated by the author being part of the national government project team, tasked with piloting the SAWIS, which made data collection easier. The primary author’s involvement in the South African waste sector over the past 15 years, which resulted in her being known to most individuals who participated in the SAWIS pilot study, further facilitated engagement with respondents and supported the research approach.

4.2 Sampling

The municipalities and private waste companies participating in the SAWIS pilot study were identified by means of a set of predetermined selection criteria, which were developed to ensure that a fair and transparent process was followed in evaluating the suitability of the nine provinces in South Africa. The aim was to identify two suitable provinces and associated participating municipalities and private waste companies. The selection criteria included both institutional and technical criteria, as outlined in Table 1.

The criteria for selecting the participating institutions were based on their suitability in terms of the SAWIS testing which therefore provided a purposeful sampling frame in terms of the research requirements. Based on the evaluation criteria, two provinces, Mpumalanga and the Eastern Cape, and three municipalities, Mbombela, Buffalo City and Nelson Mandela Metro were selected for piloting of the SAWIS. Seven private waste companies and three municipalities, operating a total of 16 facilities (waste landfills, treatment facilities or reprocessing facilities), volunteered to participate in the study (Table 2). A total of 12 organisations were selected for further research, as part of this project. The SAWIS pilot project therefore allowed for a multiple case study design (Yin, 2003).

4.3 Data collection

Case study based research provides a variety of means for data collection and evidence gathering, e.g. direct observation, participant-observation, interviews, and the review of documents and artefacts (Yin, 2003). For the purpose of this research, primary qualitative data was collected. Such primary data included personal observations of SAWIS pilot project participants made during the course of the one year pilot project (September 2005 to November 2006); data collected through one-on-one
interviews with waste officers in both public and private institutions; and the review of consultant reports prepared during the SAWIS pilot project, technical reports and government publications.

Interviews with waste officers from participating organisations were the main source of primary data. The interviews were conducted by the author as part of the pilot project review task (DEAT, 2006c). Since the SAWIS was implemented in only selected pilot organisations that fulfilled certain initial requirements, limited persons were available to interview. Of the 18 persons contacted two did not agree to be interviewed and two had not participated sufficiently in the pilot projects. A total of 19 interviews were held with representatives of 12 organisations, 7 industries, 2 provincial departments and 3 municipal departments (DEAT, 2006c). The number of participating organisations and resultant interviews provided a relatively small sample of respondents from appropriate organisations who were able to share insights into the successful piloting of the SAWIS. The organisational status of respondents ranged from senior line managers responsible for waste within provincial and municipal departments, to technical managers in municipalities, hospitals and private waste companies, to waste officers and clerks appointed by the municipalities or waste companies to oversee the collection and submission of data to the SAWIS.

Interviews provide an appropriate means of obtaining information on personal beliefs, opinions, experiences, attitudes, behaviours and conscious reasons for actions (Leedy and Ormond, 2005; Kitchin & Tate, 2000; Kerlinger, 1986). For the purposes of this research, and given the qualitative approach (Coolican, 2004; Yin, 2003), data were collected by means of semi-structured interviews (Whitley, 2002). This instrument for data collection has the advantage of following an interview guide with specific themes related to the aim of the study. However, there was typically no specified order in which the topics or questions were covered (Whitley, 2002) given the exploratory nature of the study. This flexible approach gives the appearance of a guided conversation as opposed to a structured interview (Yin, 2003). The interview schedule with its specified themes did however allow for the comparability of data between interviews (Whitely, 2002). At the same time, the open-ended questions in the interview schedule provided a more relaxed atmosphere and a more conversational approach (Whitley, 2002). Respondents were in this way provided with an opportunity to raise issues related to the research question which may not have been recognised prior to the interviews.

While interviews provided a direct means of gathering information from people, they are not without their shortcomings. The most critical shortcoming in interviews is that of social desirability in which a respondent provides the interviewer with what he or she feels is most socially acceptable or desirable rather than what they may truly feel or believe (Allen & Santrock, 1993). This was of particular concern given that the project was seen as a national government initiative and interviews were conducted with representatives of ‘subordinate’ provincial and municipal departments. This is also often experienced with interviews which are recorded (Leedy and Ormond, 2005). While notes were
taken during all interviews, the interviews were recorded. This freed the author up to follow the
discussions and pose new questions prompted by the direction of the conversation (Coolican, 2004),
while at the same time ensuring that no subtle information was missed. Every effort was made to
make the interviewee feel relaxed so as to overcome any nervousness associated with the recorder. In
addition, all interviewees were guaranteed confidentiality to reduce voluntary censoring of responses.

To ensure that all participants had an opportunity to provide input into the research, without bias from
colleagues or supervisors, single person interviews were conducted. While it is preferable that
interviews are conducted in a suitable location, preferably one where the respondent is unlikely to be
distracted or interrupted (Leedy and Ormond, 2005), this was not always possible. All persons
interviewed are responsible for ongoing waste management activities which require their attention
during office hours. All interviews were therefore conducted in the workplace of the respondent.

4.3 Analysis and interpretation

This research adopts an interpretative approach to data analysis, which includes description,
classification and connection; categorising and interpreting the data in terms of common themes, and
synthesis of data into an overall portrait of the cases (Leedy and Ormond, 2005; Kitchin & Tate,
2000). Data analysis involved sorting and categorising a large body of interview transcript data, into a
small set of pertinent themes (Leedy and Ormond, 2005). In the thematic analysis, two techniques
were chosen for interpretation of the research data; pattern matching and explanation building (Yin,
2003). In the case of pattern matching, the author examined the collected data to see if they supported
the preliminary theoretical framework and associated research questions (Yin, 2003; Whitley, 2002).
The research question and sub-questions formed the basis for initially defining the three themes and
the subsequent relationship between these themes (connection). In the case of explanation building, a
particular type of pattern matching, the author used the transcribed data to find emerging patterns or
themes, thereby building an understanding of the case (Spencer et al., 2003; Yin, 2003). While the
research was framed with a preliminary theoretical framework of learning (Figure 1) the interpretive
approach allowed for the emergence of themes and sub-themes not originally identified in the
interview schedule.

5. Results and discussion

The interpretation of the interview data focussed on the aim of the paper, which is to gauge the likely
impact of collecting data for the SAWIS on improving the way waste is managed in South Africa. As
such, the results are discussed within the three broad themes. These being: the ability of organisations
to collect data; the ability of persons to assimilate and interpret the data; and the ability of persons and
organisations to convert this learning to impact.
5.1 Ability of organisations to collect data

With regards to the ability of organisations to collect data, the interviews revealed three sub-themes: differences between facility type (public or private); drivers to successful data collection; and constraints to successful data collection (Figure 2).

The interviews and review of documents highlighted that eight of the 12 organisations were already collecting some waste data prior to the start of the SAWIS pilot project. What was evident from the interviews was that a difference existed between private and public facilities, particularly with regards to data collection prior to the implementation of the SAWIS. Only one of the five public institutions that participated in the pilot project had a prior data collection system in place, whereas all private facilities had some prior system for waste data collection (Table 3). Private waste companies appeared to be generally more successful at collecting data than the public facilities (hospitals and municipal landfills). As noted by a senior provincial official responsible for waste “for the [private] industries yes we are [comfortable with the reliability and accuracy of the data], cause like it’s a true reflection of what they’re doing” but “it’s only the public institutes that are experiencing a problem, they choose any person randomly [and decide] you are going to assist us’ in capturing the data and uploading the data” (Respondent N, 23/10/2006).

The drivers of data collection, as a sub-theme, were further explored with respondents. It was found that the main drivers for organisations having already implemented data collection systems prior to the piloting of the SAWIS were organisational, external to the respondent. These factors included financial sustainability, e.g. revenue recovery (billing) and reduced operational costs; or environmental reporting obligations e.g. ISO14000, particularly where the company had an international parent company (Table 3).

Financial reasons for data collection were particularly evident amongst recycling companies who are paying to buy in waste (Respondent L, 1/11/2006). Respondents from all of the recycling companies interviewed highlighted the importance of keeping sound records of the quantities of waste purchased. As pointed out by the manager of a waste recycling facility “every transaction has a value and therefore the value has to be recorded and the [waste] volume, so, you know, just through clear business sense you’ve got to contain that” [Respondent J, 31/10/2006]. The manager of another waste recycling company highlighted though that it was not about collecting data, that the data collection was rather a product of collecting the waste. “It’s not to get the data; it’s more to actually get the waste, because it’s a requirement of our business. We obviously keep data on that, but it’s really records from a business perspective” [Respondent L, 1/11/2006]. The collection of waste data for
business purposes also means that data has to be accurate and remain up to date, as stressed by the technical manager of a recycling company “we know exactly what the waste is because we’re paying for it, so it’s accurate, and it’s kept up to date for our own records” (Respondent M, 1/11/2006).

The importance of data on waste tonnages was also highlighted by all three private landfill operators. As pointed out by the technical manager of a private waste landfill site “well, we want to reduce our waste and if you can save on your waste, you save money. The operating costs at [the] landfill is expensive and if we can expand the lifespan of [the] landfill the better for us, we can save a lot of money” (Respondent R, 24/10/2006). The high costs of operating a landfill site were confirmed by another technical manager for waste management and recycling. Their data collection is “predominantly cost driven, a transport cost and airspace cost and the estimated figures for replacing or making a new landfill is just too much to bare” (Respondent S, 24/10/2006). This drive for data collection in private waste companies is based on a paradigm of financial sustainability. This was emphasised by the manager of a private landfill facility that “there has to be a cost focus, economic focus, very much so, because if you are not performing, then the shareholders want to know why” (Respondent F, 31/10/2006).

Environmental reporting obligations, e.g. ISO 14000 or reporting to international holding companies was found to be a driver of data collection amongst the majority of private organisations (Table 3). The technical manager for an industry running its own private landfill site noted that “fortunately because ISO expects you to have that balance, what’s coming in and what’s going out, it must balance otherwise you can’t give evidence of what happens to your waste. And that’s where we had to implement [data collection] systems to make sure that we comply” (Respondent R, 24/10/2006). The same respondent also noted the pressure placed on their company from their international parent holding company. The parent company regularly requires information on waste management and sends in audit teams to assess levels of waste management compliance within the organisation.

The third of the sub-themes is the current constraints to data collection within both private and public waste facilities. These constraints to data collection hinge specifically around lack of equipment, particularly IT (computers, internet and email connectivity) and institutional capacity (availability of staff, the high staff turnover experienced and a shortage of skills within the organisations to collect and interpret the data) (Figure 2). The constraints created by a lack of equipment and institutional capacity are not unique to this study but were also found in an independent research project conducted by the author, on challenges facing local government, which adopted a systems approach to exploring institutional constraints facing waste management in local government (Godfrey & Oelofse, 2008).
Equipment constraints hinged around two specific issues, the lack of computers, email and internet, typically within municipalities, and the lack of weighbridges at landfills to capture data on waste entering facilities. The lack of IT equipment appeared largely to be a problem within municipalities in both provinces, as noted by Respondent N (23/10/2006): “[the] challenge which I think is going to be dealt with by other municipalities, they don’t have internet, they don’t even have a computer. For other municipalities, I foresee problems if they are not going to have computer systems.” Officials within municipalities were often found not to have computers, and where they did have computers, they did not have email or internet connectivity (Respondent A, 30/10/2006; Respondent N, 23/10/2006). This makes the transfer of data to the SAWIS difficult, and often means that data has to be transferred in hardcopy by fax or mail, which has the potential to negatively impact upon data analysis and interpretation.

A further constraint is the lack of equipment at waste facilities for accurately recording tonnages of waste, e.g. weighbridges (Respondent A, 30/10/2006; Respondent B, 30/10/2006). This impacts upon the reliability and accuracy of data collected for the system, which impacts upon the quality of use of the data (Figure 2).

From the interview data, institutional capacity was seen as a predominant constraint within municipalities. This lack of capacity, but particularly the lack of experienced and skilled capacity, within government has been recognised locally and internationally (Le Roux, 2004; Moeletsi & Novella, 2004; CEC, 2004; Sissell, 1998) as a constraint to successfully implementing waste information systems. The need for capacity building in government and reporting industries is recognised as a priority for successful system implementation (IFCS, 1997). One of the reasons for this lack of capacity is the high turnover of government officials (Nauman, 2004), a challenge currently facing South Africa (Godfrey, 2007), and confirmed by respondents in both provinces. A provincial waste officer observed that “the people that are collecting [the data], today they’re in, tomorrow they’re out. So there’s no consistency” (Respondent N, 23/10/2006). The manager for waste in the province also noted that “the turnover is … just unbelievable of staff within the department, especially at a regional level.” (Respondent C, 30/10/2006). The same manager also noted that the turnover of staff was found to impact negatively on the implementation of the SAWIS in that “the change of guys within the district municipalities… sometimes it’s unfortunate that you’ll be working with someone on that particular project such as this, and then there is an election and then you have new guys and there is no continuity” (Respondent C, 30/10/2006).

It is not only having all available positions filled that is important, but also having staff with the appropriate technical skills. According to the manager for municipal solid waste in one of the local municipalities “the challenge [of data collection] is still with us in terms of technical skills and
approach because we don’t have the adequate resources” (Respondent P, 23/10/2006). This lack of skilled capacity within public facilities was also identified by the provincial waste officer where he found that “people that are collecting [the data], [some] they don’t even have [Grade 7], others they don’t even have [Grade 4]. So they’re just the cleaner” (Respondent N, 23/10/2006). This lack of skilled capacity at waste facilities was seen to impact upon issues as simple as staff not being able to identify the type of waste being generated or received, or estimating the tonnages of waste carried by vehicles entering municipal landfill sites (Respondent A, 30/10/2006).

5.2 Ability of persons to assimilate and interpret the data

The second theme is around the ability of persons to assimilate and interpret the collected waste data, building knowledge through a process of learning, which would give them the ability to act. The interviews revealed three sub-themes: evidence of data interpretation; data not used; and poor understanding of data use (Figure 3). With regards to the first sub-theme, the interviews showed that in instances, respondents have assimilated and interpreted the collected waste data, and in so doing, recognised areas of intervention, or possible uses of the data to improve the way in which waste is managed within the facility. Evidence of particular applications of the information, include managing the vehicle fleet; planning for current and future waste facilities; costing of operations; and ongoing site operation and maintenance.

In one instance, a municipal landfill site had records on vehicles entering the landfill for the first time since data collection for SAWIS began. The assimilation and interpretation of the collected data is evident in the information provided by Respondent O (23/10/2006) “I can see now why is this vehicle for the time not entering the site. Then I see, it’s broken down and they didn’t fix it. I told ( ) the other day, now we can see the management side of the vehicle maintenance” (Respondent O, 23/10/2006). This information on vehicles entering the site provided the same respondent the opportunity to monitor the operation of their transfer station. “I know now for a fact, the transfer station is not operating properly for the last month, because all the rear end compactors [are] going out to the landfill site. And that’s a lot of extra cost. Now normally on our landfill site it’s only the garden refuse trucks and the roll on vehicles [which are] supposed to enter the landfill site, now all the tractors and trailers and everything is now entering the landfill site”. The interpreted data also provided the municipal official with trends in the different types of waste entering their landfill site. “But what is nice, you can see the trends in the winter months, the garden refuse is much lesser than the summer months. The building activities, it’s much higher in the first six months of the year, especially on building rubble than the last 6 months” (Respondent O, 23/10/2006). Respondent O (23/10/2006) also noted that the limited data the municipality had to work with prior to the SAWIS pilot project had been a ‘thumb suck’. This lack of reliable waste data in the municipality prior to the SAWIS, and the noted applications of
the data now being collected, was pointed out by the provincial waste officer: “[the local municipality] was not having this data, it was only estimations and projections that they were making in accordance to the population, but now it’s much simpler, now they know how much is it. So for the new landfill site, they know how much airspace they have to prepare” (Respondent N, 23/10/2006).

Many municipal landfill sites are currently not charging for waste disposal, due to a lack of capacity or fear of increased illegal dumping (Godfrey & Nahman, 2008; Godfrey & Oelofse, 2008). While all participating private landfill sites, and those in the larger metropolitan municipalities were charging for the disposal of waste at the time of this research, one of the local municipalities which participated in the pilot did not charge. Because of data collection for the SAWIS, this municipality was now looking into disposal tariffs for the new planned landfill site. Respondent O (23/10/2006) felt that for the first time they now know “the tonnage [of waste] that’s going in, so [how] much we must ask per ton, to balance the books of the new landfill site”.

The application of data for site operation was identified by respondents from both public and private waste facilities. Operational issues for landfill sites centred on managing remaining airspace in landfill sites (Respondent O, 23/10/2006; Respondent R, 24/10/2006; Respondent S, 24/10/2006) as well as planning the airspace needs for future planned landfills (Respondent O, 23/10/2006).

The interviews similarly highlighted the fact that some organisations do not use the data after having collected it, and therefore have no concept of the usefulness of having the data available to them, or alternatively have a poor understanding of the potential use of this data. The technical manager of a waste recycling company that previously commented on the importance of collecting data as part of their business accounting systems, later pointed out that he “personally [doesn’t] use [the waste data] for anything else, the only reason I ever request it is for the reporting [to SAWIS] and I know that it’s not something that is reported on regularly because whenever I ask [my company] to provide me with it, they’ve got to go and run reports. Download it, collect it, they don’t have that information on hand” (Respondent H, 31/10/2006).

5.3 Ability of persons and organisation to convert this learning to impact

The third theme revealed in the data is the ability of persons and organisation to convert learning to impact, and in so doing bring about change in the way waste is currently managed. The interviews highlighted few areas of direct positive impact leading from the SAWIS data collection, as well as areas of no or little noticeable impact in operations (Figure 4).
Positive impacts noted by respondents included the placement of new staff at landfill sites to improve the flow of vehicles onto the site, thereby freeing up existing staff to collect the required data. In one particular case, the security guard at the entrance of the landfill had previously been tasked with both directing vehicles to the tipping face as well as collecting waste data (Respondent B, 30/10/2006). The data also revealed a more aggressive drive towards finding new sources of recyclables for one of the recycling companies (Respondent M, 1/11/2006). However, since data showed that all participating private waste companies had already been collecting data prior to the SAWIS, it is difficult to distinguish the impact of the SAWIS data collection from that already implemented through existing management practices.

According to the provincial waste officer (Respondent N, 23/10/2006) the collection of data by the municipality has not had any positive impact on landfill management “cause like if it did really, they would have even put a new fence up”. Even at the public hospitals, data collection has had no impact on waste management: “No ways, no difference [at the hospitals]. It’s just that they’re collecting it because we want that information. So like, they’re not utilising it for any of their benefits” (Respondent N, 23/10/2006).

In instances, collected data was not being used at all after submission to the SAWIS, with no potential to generate knowledge or cause change. As pointed out by the technical manager of a waste treatment facility, I’ve “no [use for the data] at the moment, but I’ve got it there should we [need it]” (Respondent Q, 23/10/2006). This was confirmed by a respondent from provincial government who also noted that the data “was not necessarily [being used] right now” (Respondent A, 30/10/2006).

This raises the question as to why in certain circumstances individuals with acquired knowledge act on that knowledge to implement changed waste practices, while in other instances, this acquired knowledge does not lead to impact? According to Miller & Morris, (1999:74) "there is a commonly held myth that providing individuals or groups with information will lead them to appropriate personal and organizational actions and performance, but this is far from true." According to Pfeffer and Sutton (2000), while information and knowledge are ‘crucial to performance’, knowledge of an issue is often not sufficient to cause action: "there is only a loose and imperfect relationship between knowing what to do and the ability to act on that knowledge." (Pfeffer & Sutton, 2000:25). This frequent inability to transfer knowledge of what needs to be done into action or behaviour which is consistent with that knowledge, is referred to by Pfeffer & Sutton (2000) as the 'knowing-doing gap' or the 'performance paradox' (Cohen, 1998 in Pfeffer & Sutton, 2000). While it was believed that the 'knowing-doing gap' was due to a lack of personal knowledge or skills, research conducted by Pfeffer & Sutton (2000) suggests that while personal knowledge is important in ensuring action, it is not as important as having management systems and practices in place. According to Pfeffer & Sutton (2000) the gap between
knowing and doing is more significant than the gap between ignorance and knowing. This is due to the fact that considerable knowledge already exists, which is either already known to an individual, or can be readily sourced, yet lack of implementation persists.

This lack of impact from waste data collection to changed waste practices may result from a communication ‘gap’ between those who collect and interpret the data, and those who have the responsibility and ability for decision-making and effecting change. This is evident in the response provided by a municipal officer: “I send [management] the monthly data sheet. I don’t know if they look at it at all, but I send it through to them as well” (Respondent O, 23/10/2006). The result is that data collection may generate knowledge, but not at the point of decision-making within the organisation.

The interviews also highlight a number of external factors which make it difficult for staff within municipalities and private waste companies to use data to improve the management of waste. These external factors hinge around governance, due particularly to the low priority often given by politicians and senior government officials to waste in South Africa (politics, bureaucracy and procurement). According to Howes (2001), the long-term sustainability of any pollutant and waste information system is dependant foremost upon the political will of the country to support such initiatives:

“But again it’s this political willingness to turn things around at a local level, I mean its worse at a local level than it is at provincial level. If there is no political buy-in on any activity it will not fly at a local level and that’s just a reality. All these processes must have a political endorsement through their councils before it moves otherwise it just doesn’t go” (Respondent C, 30/10/2006).

The external influences and apparent frustrations of politics, bureaucracy and procurement were only noted by respondents from municipalities and not from private waste companies. Long approval processes and the centralisation of decision-making to councils and municipal managers were noted by waste officials:

“It becomes difficult to go around the bureaucracy [in the municipality], because sometimes it has to go through the municipal manager for signature, before it goes to him, he [wants] to make sure that a legal adviser is happy with the content and then once they are happy with that, then it must go through the council, and it takes months” (Respondent B, 30/10/2006).
The frustration experienced by municipal waste officers who need to wait for lengthy bureaucratic approval processes was noted by Respondent C (30/10/2006): “they still haven’t come back to us so I understand there are processes because its tied in with the political process at a local level and it gets frustrating I know for [the municipal officials responsible for waste] who like to do this but their hands are tied” (Respondent C, 23/10/2006).

Another external factor is the strong influence of unions on municipal workers. A provincial officer stated that: “[data collection] is putting more pressure on the people that are collecting it from the [hospital] ward. And then they’re asking us, did we talk to the unions that we adding more responsibilities, because their duties [are] to get in and collect [the waste] and put it aside. But we say it’s not an additional job, it’s what the hospital was supposed to do” (Respondent N, 23/10/2006).

While the responsibility for decision-making about waste is often elevated to council and the municipal manager, accountability for action remains with the subordinate waste officials and line managers. A manager for municipal solid waste expressed his frustration by stating: “I know that its not because of me, its because of the internal bureaucracy that does not allow me to implement that, so maybe certain instances where I say I need a person to do one, two, three that person could not be appointed. But when you audit me, you audit me as if I failed to do my work, not knowing why I couldn’t implement the Act” (Respondent P, 23/10/2006).

Similarly, the ability to procure services has been removed from line staff, making it difficult for them to implement the necessary changes in waste management through appointment of contractors, or purchase of equipment: “I can tell you, procurement is a nightmare, it’s a nightmare. In the past I could obtain quotations from the best people to do the job. Now we can’t even ask for quotations. People from the first floor, clerks gonna get the quotations. They’re gonna get the quotations, they’re gonna award it, you’re not gonna have any say in it” (Respondent O, 23/10/2006)

While little direct evidence was provided by respondents for resultant changes directly due to data collection, the reasons and influences for no or limited change were perhaps more insightful into understanding the research question, and in particular the constraining factors external to the individual.

6. Conclusions

Previous research has shown that the need for waste data in South Africa reflects “greater, currently unfulfilled needs in the sustainable management of waste in South Africa. These needs, which, if fulfilled through reliable, accurate waste information [have] the potential to lead to the improved
management of waste in South Africa” Godfrey (2008:1667). This conclusion formed the basis for the research question explored in this paper: “Can the collection of data for a national waste information system, change the way waste is managed in South Africa, such that there is a noticeable improvement?” The research question was explored in this paper through a preliminary theoretical framework of learning (Miller and Morris, 1999).

The research addressed three sub-questions which formed the basis for defining the initial themes used to analyse and interpret the interview transcript data: Do organisations have the ability to collect data? Do persons have the ability to assimilate and interpret the data? Do persons (and organisations) have the ability to convert this learning into impact (potential to implement change in managing waste)? Applying a qualitative, interpretative approach provided an opportunity to identify further sub-themes which emerged from the interview data (Figure 5).

In terms of theme 1, the ability to collect data, the interviews highlight differences in an organisation’s ability to collect data, with private waste companies having successfully implemented waste data collection systems. It is evident that there are external factors, or drivers, which have resulted in these organisations already implementing data collection systems well before the piloting of the SAWIS. The main drivers were found to be financial sustainability e.g. revenue recovery (billing) and reduced operational costs; and environmental reporting obligations e.g. ISO14000, particularly where the company had an international parent company. However, participants also highlighted the current constraints to data collection, typically within public waste facilities, specifically focussing on the lack of equipment, particularly IT (computers, internet and email connectivity) and lack of capacity (availability, turnover, skills) to collect and interpret the data. These constraints are not however unique to waste data collection and utilisation, but constrain municipalities in terms of broader waste service delivery issues (Godfrey & Oelofse, 2008).

The data showed that in terms of theme 2, ability to assimilate and interpret data, certain persons interviewed have assimilated and interpreted the waste data collected for SAWIS, utilising this data to inform and manage the organisations operations, including vehicle management; facility planning, costing of operations, and ongoing site operation and maintenance. The result is that certain persons and organisations have been able to use the data and convert this learning to impact (potential to implement change in managing waste) leading to changed practices within the organisation. Similarly, there are organisations that do not use the data after having collected it, and therefore do not see the usefulness in having the data available to them, or have a poor understanding of the potential use of this data, resulting in no or little noticeable impact on operations.
It was also found that in terms of *theme 3, ability to convert learning to impact*, little evidence was found for resultant change in waste practices as a result of data collection during the piloting of the SAWIS. While the desire may exist within individuals to implement change based on this raised awareness around waste management practices, the point of knowledge generation may be removed from the point of decision-making within organisations due to a break in communication, or may be constrained by organisational bureaucracy and administrative procedures. These external factors have made it difficult for persons, particularly within municipalities to both collect waste data, or from the raised awareness associated with the interpretation and internalisation of data, to implement the necessary changes within their organisation. These external factors hinged largely around governance.

While the preliminary theoretical framework of learning provided a means for interpreting the interview findings, the results showed that knowledge is a necessary but insufficient condition for resultant action. The conceptual framework of learning was shown to be simplistic for understanding the role of waste data in a developing country context such as South Africa, and did not account for external influences. It is proposed that further research is necessary to establish a more conceptually inclusive framework, which explains the complex nature of learning, behaviour and potential for action and impact from environmental information, and specifically waste information, within the South African context.

### 7. Acknowledgements

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### 8. References


Interviews
Respondent D. (30/10/2006). Administrative clerk
Respondent E. (31/10/2006). Municipal officer: waste information
Respondent F. (31/10/2006). Manager: landfill facility
Respondent G. (31/10/2006). Administrative clerk
Respondent J. (31/10/2006). Manager: waste recycling facility
Respondent K. (31/10/2006). Administrative clerk
Respondent N. (23/10/2006). Provincial Waste Officer
Figure 1. Process of learning (adapted from Miller & Morris, 1999).

Figure 2. Theme 1: The ability of organisations to collect data

Figure 3. Theme 2: The ability of persons to assimilate and interpret the data
Figure 4. Theme 3: The ability of persons and organisations to convert learning to impact

Figure 5. Summary: The ability to change the way waste is managed through data collection
Table 1. Selection criteria for SAWIS pilot provinces and municipalities (adapted from Borg et al., 2004; Fischer & Godfrey, 2005)

**Institutional requirements:**
- Political support
- Resources
- Support
- Time frames
- Communication

**Technical requirements:**
- There should be at least one G:M:B or G:L:B landfill\(^1\) in the province
- There should be at least one hazardous landfill site or treatment facility in the province
- A large percentage of landfills in the province should have weighbridges
- A reprocessing facility for one of the identified priority recyclable waste streams (paper or plastic) should be located within the province

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Table 2. Number of participating organisations and waste facilities

<table>
<thead>
<tr>
<th>Organisation Type</th>
<th>Number</th>
<th>Number of waste facilities</th>
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<tr>
<td>Private waste companies</td>
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<td>1</td>
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<tr>
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<td></td>
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<tr>
<td>Provincial Department of Environment</td>
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<tr>
<td>Municipal waste department (public)</td>
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<td>Total</td>
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\(^1\) G:M:B – General landfill site of medium size (150-500 T/d maximum rate of deposition); G:L:B – General landfill site of large size (> 500 T/d maximum rate of deposition).
<table>
<thead>
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<td>public</td>
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