

Environmental Governance for Sustainable Computer E-Waste Disposal Management in Nairobi City County, Kenya

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Abstract

E-waste, whose components are hazardous and hence toxic, has become a risk to human health and the environment and is the fastest-growing urban solid waste stream in the world. This paper explores the environmental governance for sustainable computer e-waste disposal management (CEDM) in Nairobi City County. Increasing volumes, toxic components, the influx from the high-income countries and lack of specific policies, legislations and enforcement of existing regulations, especially, in the low-income countries have contributed to challenges in disposal management of e-waste such as waste from computer components and accessories. Primary data was obtained through the administration of questionnaires, interviews, and physical observation. Interviews were conducted with key informants in public institutions responsible for human health, environment, relevant policies, regulations, and enforcement. Environmental governance tools were found to be crucial for CEDM without reference to risks to human health and the environment. The study observed that the government was responsible for public awareness, formulation of policies, legislation and enforcement of compliance while businesses must segregate e-waste. 85.4% of respondents indicated that CEDM issues were not highlighted in their internal management quality assurance statements while 77.1% were optimistic about the possibility of including them in their service charter. The study concludes that the Nairobi City County has not adhered to the socio-economic and environmental aspects of CEDM as required of sustainability. The study recommends the establishment of a computer e-waste disposal management system that will provide for the formulation of a Zero e-waste policy. The proposed system would be coordinated by a County E-Waste Management Authority (CEDMA) whose mandate will be to implement the Zero E-waste Policy in the Nairobi City County.

Keywords: CEDM, CEDMA, Computer E-waste Disposal Management System, Environmental governance tools, Human health and environment, Zero-e-waste.

INTRODUCTION

There is no generally accepted definition of e-waste but Porter (2002) defines it as electronic products that have ceased to be of any value for the current user or any appliance using an electric power supply that has reached its end-of-life. The [computer] e-waste has increased due to advancements in technology, changes in style and infiltration from high-income countries. Computer e-waste is considered hazardous due to the presence of toxic substances such as mercury (Hg), lead (Pb) and cadmium (Cd) and brominated flame retardants which have potential effects on human health and the environment. This is compounded by lack of specific policies and legislations for their disposal management. The study focused on computer e-waste from desktop computers with cathode ray tubes (CRTs) display monitors or traditional

screens, liquid crystal display (LCD) monitors or flat-screen monitors and laptops – selected due to the presence of hazardous elements in their constitution.

The increasing use of computer technology has, therefore, resulted in increasing volumes of e-waste not only in high-income countries, but also in low-income countries. This study explored the current environmental governance that can promote sustainable CEDM in Nairobi City County. The options have been highlighted as views presented by respondents from solid waste management policy domains and frameworks on computer e-waste disposal management practices. To further determine whether the views and concerns raised by key decision-makers are consistent with those in the lower cadre, their views are also presented.

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For this study, environmental governance refers to interventions that result in changes in environmental management incentives. It refers to the set of policy and regulatory processes, plans, mechanisms and institutional frameworks through which policy-makers influence environmental actions and outcomes.

THEORY

Policy Restriction of use of Hazardous Substances (RoHS) in Electrical and Electronic Equipment (Directive (2002/95/EC) restricts the use of hazardous substances in electronic equipment (European Commission, n.d.). The RoHS, however, allows exemptions for lead in high melting temperature type solders and copper alloy containing up to 4% lead by weight. According to Lindhqvist (2000), the promotion of Extended Producer Responsibility (EPR) removes responsibility from consumers to the manufacturers and therefore minimises potential effects on human health and the environment.

The Bamako convention bans imports of hazardous wastes into Africa and provides for the control of the trans-boundary movement of the wastes. However, it exempts the trans-boundary movement of hazardous wastes generated within Africa thus creating a major gap and setback towards sustainability as more developed countries within Africa can willingly transport computer e-waste to less developed countries within the continent.

Vision 2030 provides for harmonization of environment-related legislation for enhanced environmental governance and planning (GoK, 2007). However, these are not explicit to provide a window for reviewing the relevant laws specifically for the inclusion of elements to protect human health and the environmental degradation of the urban area. Besides, lack of operationalisation of the e-waste management guidelines and clear policy has created a gap in CEDM in the County (GoK, 2010). Likewise, the Kenya Health Policy (2014-2030) provides for the promotion of good health and prevention of environmental threats by computer e-wastes. Further, the Water Policy (GoK, 2012b) provides for the prevention of pollution of water bodies by enforcing existing regulations through the polluter-pays-principle.

Other provisions are stipulated by Water Act (2016b) and advocated by EMCA (2015) and other relevant legislation.

The polluter-pays-principle has remained a mirage and has not translated to a reduction of pollution by toxic chemicals leached to the water sources. Although the water policy fails to commit to pollution prevention, it recognises water as a socio-economic good and, therefore, determines financial payments for water resource management to water users and the polluters. However, inadequate information sharing and reporting; inadequate funding for water resource management; weak regulation and enforcement; and different institutional mandates have remained a challenge.

Haregu et al. (2016) observe that sector-specific waste management policies are usually formulated and implemented by different sectors at the country level. The writers reiterate that although the harmonisation of these policies may be safeguarded through the policy formulation process and validation, there is often no evidence for their integrated implementation. The United Nations (2011) stipulates the need for an all-inclusive policy framework that encourages reuse and recycling of special waste streams (such as computer e-waste) as resources.

The Environmental Management Coordination Act (EMCA) (2015) is the supreme environmental governance statute in Kenya aimed at facilitating a coordinated response to environmental management. The Act commits to the principle of public participation, particularly in issues of environmental impact assessment and audits. It provides for the use of the precautionary principle of the polluter-pays-principle.

While EMCA is not clear on pollution prevention, it has several subsidiary regulations relevant to computer e-waste disposal management from a human health and environmental sustainability perspective. They include Water Quality Regulations (2006); EIA/EA Regulations (2003); and Waste Management Regulations (2006). The E-waste Regulations (2016a) advocates for the extended-producer-responsibility (EPR) for manufacturers to be responsible for the cost of

reprocessing of the products. The regulations provide that importers of new or used electronic products should shoulder the cost of their reprocessing or refurbishing once they reach the end-of-life to prevent risks to human health and the environment instead of leaving the burden to the public or the County. Quantity of equipment imported by product type is also required to enable NEMA to monitor the quantity of waste from computers likely to be generated.

Despite these subsidiary regulations advocating for the protection of human health and the environment from pollution by various types of wastes and providing for the appropriate disposal management, the promotion of human health didn't receive direct attention. However, analyses of most of these regulations are still scarce and almost absent in the literature. There is a need for Nairobi City County (NCC) to adopt specific acts and regulations with robust enforcement mechanisms to govern the end-of-life of computers.

The County Government by-laws do not mention computer e-waste, and hence the need for a review to specifically cater for the handling of the e-waste. Despite this provision of segregation wastes from non-hazardous materials (Article 8(4)), the NCC has a limited capacity for enforcement and knowledge of computer e-waste and thus presenting a challenge of its disposal management. Section 68 of the Public Procurement and Asset Disposal Act [PPADA] (GoK, 2015b) provides for the development of an inventory of stores and assets management system; disposal management committees; disposal procedure and compliance of disposal for unserviceable and obsolete computers. However, the bureaucratic process on the implementation of this act has created a burden of the computer e-waste stockpiles at the institutions.

Besides, Section 88 provides for licensed persons to dispose and handle the e-waste (EMCA, 2015). However, by the time of data collection, the Act had not been operationalized especially to the institutions, which continue to store computer e-waste in their premises from 1-3 years before being disposed of. EMCA, however, is guided by principles for PPADA for state departments, agencies and public entities based on values

stipulated by the Constitution of Kenya - which stipulates maximisation of value for money and incorporation of local content.

Section 126 of the Public Health Act (GoK, 2012a) entrusts the Minister in charge of human health with policies to award powers and execution of activities towards enforcement by local authorities, magistrates, owners (Part 126d) - the disposal of offensive liquids and the disposal of trash including all waste matters. However, the Act does not provide for mitigation towards prevention of risks to human health and the environment, public-private-partnerships, access to information and public awareness on issues that impact on human health and the environment.

The Kenya Medium-Term-Plan (2013-2017) provides for review of relevant policies and legislation for purposes of harmonisation with sectoral policies, legislation and regulations. The plan aims to strengthen the relevant institutions in human health and environmental regimes that are charged with computer e-waste disposal management.

Despite the provisions of the above-mentioned platforms, the challenge is how to ensure that these elements translate into plans, policies and legislation relating to CEDM to provide a shift towards sustainability of waste management systems approach. With the development of the National Environment Policy (GoK, 2014) and in compliance to the Stockholm and Rio Declarations Principle 21/Principle 2, which give responsibility to countries to exploit their natural resources according to their environmental and development policies, the County in liaison with the National Government can drive the environmental agenda and operationalise the Vision 2030 through adherence to the Medium-Term Plan.

Finally, in considering human health and environmental sustainability performance, Adams (2013), identifies two categories- 'it's the right thing to do' and 'it's good for business'. Institutions or companies which make the most improvement towards sustainable practices, therefore, have leaders who believe that the right thing to do is good for business.

RESEARCH METHODS

The field setting for this study was the Nairobi City County (NCC). The City was selected owing to its pre-eminent position as the largest and most urban ecosystem, headquarters of most central Government administration offices and the hub of educational, training and business activities in the Country. The City is viewed as the largest consumer of ICT equipment. Under this characteristic, the City County is most prone to human health and environmental challenges associated with the computer e-waste disposal management approaches.

The descriptive research design approach, as stipulated by Creswell (2005), was used because it enabled profile of the population by collecting exact information and in-depth study of the problem within a limited time scale (Bell, 1999). Random sample rather than the entire population was used to obtain information (Kerlinger, 1983, 1993) from the private companies. The samples had a spatial distribution and the sampling sites were geographically distributed. To address the research question - *What are the environmental governance tools that can promote sustainable computer e-waste disposal management in Nairobi City County?* - it was necessary to first underscore the reality that urban waste disposal management is a constellation of socio-economic aspirations and ideological positions that have historically constituted the fabrics of sustainability (Moore, 2015). This includes the built-up environment and human health aspirations in various urban ecological settings (Hammal et al., 2005).

The methodological approach pursued for the study was a mix consisting of both quantitative and qualitative data collection, analysis, interpretation and presentation of findings (Charmaz, 2006). This strategy adopted to unveil a systemic view on the interface between human health, environmental factors and computer e-waste disposal management. The study examined 48 randomly sampled institutions consisting of 30 private companies, 9 universities (both public and private), 7 purposively sampled research institutions and 4 government ministries. In addition, 9 purposively sampled e-waste policy and regulatory institutions were sampled. Face to face interviews, using semi-structured questionnaires, was used to ensure

high rate of response of data collection. Interview schedules were conducted with key informant and with top management staff at the policy/legal domains of relevant institutions. Observation guides were also used to collect information on internal environmental management systems. Based on the recommendation by scholars, such as Bell (1993) and Mugenda (2003), that one-third is a reasonable representation of the target population, a sample size of 30% was drawn from the Universities and Private companies. Purposive sampling was carried out for cases (e.g. Ministries in charge of science and technology and ICT) that had the required information related to the CEDM (Creswell, 2005). The information obtained and review of relevant documents with a focus on human health and environmental sustainability provided data for the study. The data were analysed using IBM Statistical Package for Social Sciences (SPSS) Version 21.

To complement the views and opinions of the key informants, policy instruments, strategic plans, institutional and regulatory frameworks were examined for alignment with fundamental requirements for a sustainable systems approach to computer e-waste disposal management. The study intertwined experiences from other countries available from published literature in the discussions for purposes of positioning the arguments within international perspectives on e-waste disposal management.

RESULTS

Existing human health and environmental governance tools and structures

The views of respondents regarding the scope and relevance of existing human health and environmental governance applicable to computer e-waste disposal management were sought. Responses from key informants attested to the position that environmental governance is the major determinant of CEDM approaches, with no attachment to human health and environmental sustainability values.

Consideration of relevant environmental governance tools on computer e-waste disposal management revealed that the policies, strategies, laws, and plans are non-existent (though implied), at the county level. Although the constitution

provides for public awareness, the study observed that there is lack of coordinated approach to the policy-making process perhaps due to the different times of their formulation and due to funding by external partners whose main agenda may be different to county interests. Furthermore, there was lack of evidence on impacts, strengths and weaknesses of the relevant existing policies and hence the failure for consideration of the same in the new policies and legislations.

Participatory approach towards computer e-waste disposal management

The sustainable systems approach to waste management underscores the need for a participatory approach as a key solution towards the problem of CEDM. According to a key-informant (WEEE Centre), the Government is expected to play a facilitative role by developing policy, regulatory frameworks and enforcement mechanisms; funding for research and development; conduct public awareness on risks of computer e-waste on human health and the environment; and engagement of public-private-partnerships in implementation of a computer e-waste disposal management system, a fact that is attested by Schlupep et al. (2009); Sikor et al. (2014); Moore (2015); Thyberg et al. (2015).

Level of public awareness on risks to human health and the environment

Despite the provision for public awareness in the Constitution and EMCA, the study observed the existence of gaps in the level of public awareness regarding CEDM at the institutions, businesses and household levels (Maimba et al., 2019). The study established that computer e-waste disposal management is the responsibility of all stakeholders. Besides, the government has the responsibility of formulating of policies and strict enforcement of legislation while institutions have the responsibility to segregate the e-waste.

Computer e-waste disposal management responsive to human health and the environment

The internal human health and environmental management systems for computer e-waste disposal management were examined in this study. Hence the question of the existence of written formal requirements and guidelines for reducing the accumulation of computer e-waste in

the institutions was raised. It was found that the majority of the institutions (97%) had not put in place official systems for CEDM while only two institutions (3%) out of 48 gave an affirmative response.

As presented in **Figure 1**, 55% of respondents reported that their institutions did not have clearly defined channels for computer e-waste disposal management and could take any direction or form. There was an explicit expression in favour of the view that human health (13%) and environmental aspects (32%) were the major cornerstones of the approaches embedded in the disposal management channels (n=48).

This confirms the position that for many institutions, human health and environmental implications of computer e-waste disposal management are recognised, but establishing an enabling environmental governance structure for their disposal management remains elusive.

Another dimension of institutional re-engineering examined in this study was the presence of internal environmental performance policies that embrace computer e-waste disposal management aspects. The management quality assurance (MQA) statements of the institutions were examined for highlighting CEDM attributes with a focus on their internal policy statements, rules and regulations. The results indicated that a large proportion (85%) had not highlighted computer e-waste disposal management dimensions in their internal MQA statements. Out of 15% who responded in the affirmative, only in three cases were human health and environmental sustainability considerations mentioned. Instead, other factors featured were attempts to adhere to County directives/by-laws, promoting an effective computer e-waste disposal management culture within the institutions and response to public concerns about computer e-waste. Thoughts on the possibility for future inclusion of computer e-waste disposal management in their internal MQA statements, yielded the results as presented in **Figure 2**.

Most of the respondents (89%) were optimistic about prospects for the inclusion of CEDM components in their internal service charter and

only 11% were in the non-promising category. The responses on the major reason they considered it important to integrate computer e-waste disposal management aspects is as presented in **Figure 3**. The most outstanding reasons advanced were compliance with national legal frameworks (46%) and compliance with County directives/by-laws (33%). Human health (4%) and environmental sustainability (17%) related reasons were provided by few respondents.

Fundamental issues pointing to weaknesses in institutional orientations to computer e-waste disposal management were unveiled from interviews with key informants. First was the lack of technical, financial and material resources needed to fulfill the mandates. Besides, lack of mechanisms for collection, disposal and absence of treatment sites hamper the waste disposal management activities. The presence of several informal waste collection sites and cultivating uniformity among them presents a big challenge

(Key Informant, NCC, 2016). Low public awareness of environmental and human health implications of unsafe computer e-waste handling was also a major drawback to efforts by various institutions (Key Informant, NEMA, 2016).

Stewardship on computer e-waste disposal management approaches

Robust stewardship platforms are central to many successful environmental sustainability programmes. Conventional environmental governance space also constitutes several stakeholders, each of them bringing in their unique interests, capabilities and power influences that determine the outcomes of decisions. The role of government in providing leadership has recently emerged in the waste disposal management literature as an important driver of sustainability. Hence, assessing perceptions about this role in completing this stewardship loop was important for the study objective. Results of the views on the government being more involved in CEDM

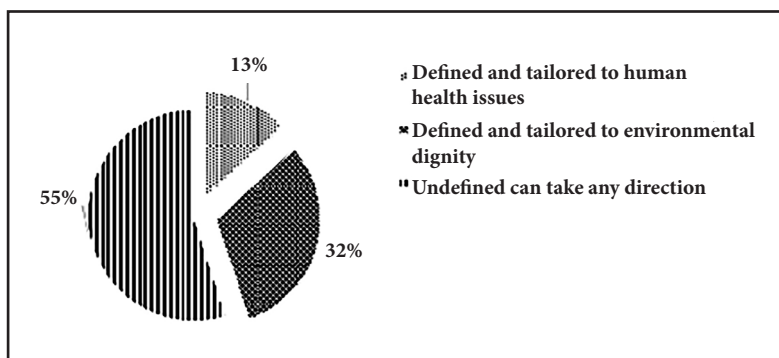


FIGURE 1
Computer e-waste disposal management approaches channels status within Institutions
Source: Field survey 2016

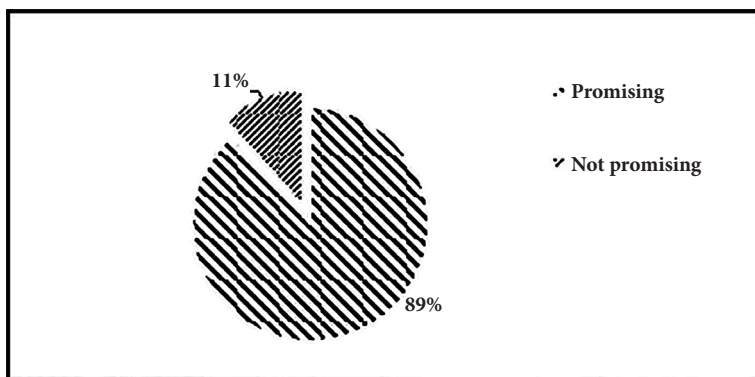


FIGURE 2
Prospects for integration of computer e-waste disposal management approaches in internal MQA statements
Source: Field survey 2016

indicate that the majority (66%) agreed with this position while only 34% fell on the contrary.

Examination of suggestions from institutions on preferred specific roles of the government concerning public awareness and legislation yielded results as presented in **Figure 4**.

The management of computer e-waste have been hampered by lack of: coordinated approach across line ministries and agencies; public awareness on the need for computer e-waste disposal management system; commitment to establish mechanism to implement the policy interventions; national capacity to process and separate the e-waste from the county solid waste stream; proper guidelines and capacity to manage the e-waste; and national e-waste policy. The country has not

embraced the principle of EPR and the purchase of new IT has continued to be a mirage to many citizens. These challenges, therefore, have led to the stockpiling of computer e-waste in homes and offices (Key informant, MENR, 2016).

DISCUSSION

Environmental Management Systems and Computer E-Waste Disposal Management Approaches

An institution or business with environmental management systems (EMS) in place is differentiated from a traditional one mainly by how it integrates pollution prevention and resource conservation into its decision-making activities. According to the findings of this study, EMS is crucial to computer e-waste disposal management. It was observed that the

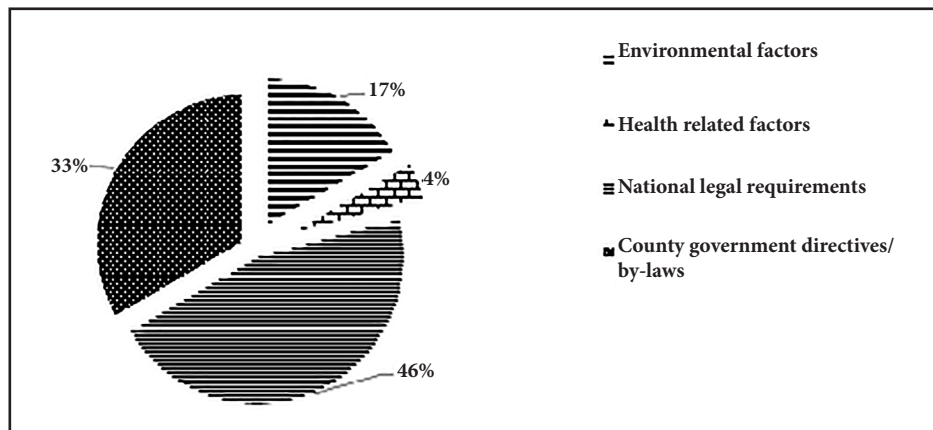


FIGURE 3
 Rationale for including e-waste disposal management approaches aspects in the MQA statements
 Source: Field survey 2016

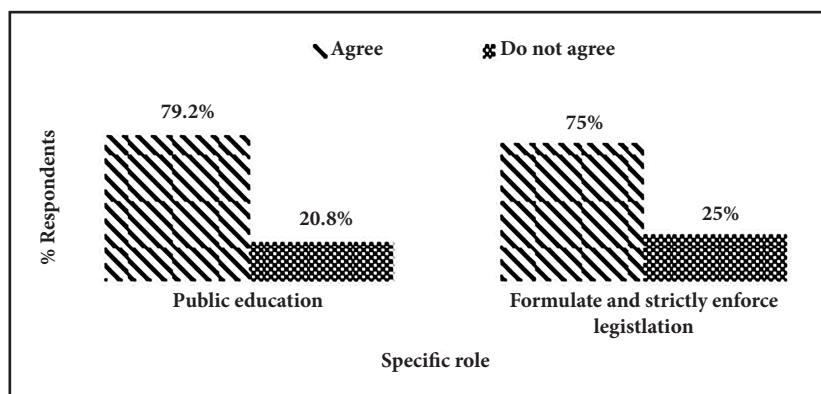


FIGURE 4
 Preferences for greater focus on public education and legislation as roles of Government in computer e-waste disposal management approaches
 Source: Field survey 2016

existing environmental governance of the NCC to sustainably facilitate CEDM was very weak especially the sector-specific regulations. This scenario, however, mounts a major challenge in enforcement especially in the emerging problem of computer e-waste, which had not been taken care of by EMCA.

Participatory Approach towards Computer E-Waste Disposal Management

According to the respondents from institutions and businesses, the government represents change concerning the provision of infrastructure, development of policies and implementation, legislation, and enforcement of regulations relating to computer e-waste disposal management. Similarly, the NCC is responsible for planning and identification of disposal sites for waste emanating from its areas of jurisdiction. This position confirms the proposition that cities of low-income countries are still over-reliant on governments as the chief driver of change, with very minimal inputs from other stakeholders (Njeru, 2006; Oostveer, 2009; Geels, 2015).

Further, the Constitution commits state organs, non-state actors and citizens to play significant roles in the prevention of risks to human health and the environment. Besides, EMCA provides for subsidiary regulations and decision-making structures for public engagement, such as EIA/EA Regulations (2003); the Waste Management Regulations (2006); the Water Regulations (2006); and Public Complaints Committee. This provision and regulatory space are laudable in sustainable environmental management (Furedy, 1992; Arora, 2008; GoK, 2015a; Sikor et al., 2014).

Environmental Governance and Computer E-Waste Disposal Management

If sustainability initiatives are to succeed, the top management of an institution must believe that it is the right thing to do and that businesses should do the right thing (Adams, 2013). The study observed that robust internal leadership strategies were found to influence computer e-waste disposal management, especially with private companies. The Kenya Revenue Authority (KRA) had developed an environmental sustainability policy and formed an environmental management committee to implement the policy. However,

many institutions explicitly expressed that human health and the environment were the major drivers towards computer e-waste disposal management but establishing enabling governance structures for their disposal management remained a mirage (Florida et al., 2001; Henriques et al., 1999).

The study noted that many institutions had included computer e-waste disposal management in their MQA statements. However, adherence to the same was compelled mainly by County directives and performance contracting targets' requirements which featured prominently as opposed to compliance with human health and environmental factors. The study, however, established that the respondents were optimistic about prospects of including the same in their service charters.

Voluntary ISO certifications (14001:2008 Environmental Management System-EMS) and Quality Management System (9001:2004-QMS)) were found to be additional organisational innovations taking place in the public institutions and private companies. Although voluntary certification is one way of showing commitment to going beyond compliance in environmental practices, there was no compelling evidence that public institutions with ISO 14001:2008 EMS had triggered a culture and superior environmental performance especially on computer e-waste disposal management as was evidenced by lack of an e-waste management policy in several institutions and private companies. The findings of this study on ISO 14001:2008 EMS certification supports the position advanced in the literature that many certified firms/institutions often fail to comply with national regulations and legislation (Prakash et al., 2014). This could explain the case of many businesses that did not ascribe to a certified EMS, but the commitment by the top leadership to environmental excellence provided for CEDM reality. Establishment of environmental units within the institutional structure and financial commitment to environmental sustainability was assessed as one of the indicators of its commitment to integrating environmentally responsive practices. However, weak financial position, particularly for public institutions, contributed to the inability to embrace the computer e-waste disposal management (Key informant, NEMA, 2016). This finding reflects the charge often

labeled to institutions/businesses that they do not automatically embrace good environmental governance activities that would reduce risks to human health and environment if they are not convinced of the immediate potential of increasing their profit margins (York et al., 2003). However, EMCA provides for regulatory tools (e.g. EIA/EA) in the monitoring of the environmental performance of sustainable waste disposal management system. This policy-practice trade-off raises the possibility that the NCC has not put in place strategies to operationalise the provisions in the Constitution to support environmental sustainability agenda.

CONCLUSION

The study concludes that the County Government has not adhered to the socio-economic and environmental aspects of computer e-waste disposal management as required of sustainability. This is an indication that the polluter-pays-principle is yet to be applied in the prevention of pollution of water sources, air and soil by computer e-waste in the County. Further, the existing environmental governance tools such as management plans, including the institutional capability of the County to sustainably facilitate CEDM is very weak and some exhibit overlaps on their mandates, especially the sector-specific regulations (e.g. Water Management Authority and NEMA). The study also concludes that the policy-making process has been hindered by an uncoordinated approach due to the formulation at different timelines and funding by external partners with different interests. There was also lack of evidence on impacts, strengths, weaknesses, opportunities of the existing environmental governance tools to inform the development of new ones. Besides, exceptions to the trans-boundary movement of hazardous wastes generated within Africa and of lead by the RoHs directive and lack of domestication of the Basel Convention is a major challenge and setback towards sustainability. Lack of implementation of the EPR has hampered the shift of responsibility from the County to the manufacturers and, therefore, waste from computers continue to pose potential negative effects on human health and the environment. Likewise, lack of a national e-waste policy has hampered the operationalization of the e-waste guidelines; lack of harmonisation of environmental legislation as stipulated in the

Vision 2030 has also been a significant challenge.

Although voluntary, ISO certification is a commitment towards environmental sustainability. The study concludes that there was, no compelling evidence that this had triggered a culture and superior environmental performance especially on computer e-waste disposal management. Lack of environmental management systems (EMS) in most of the institutions and private companies was also a clear indication that issues of human health and environment were not a major concern as far as potential effect on human health and environment were concerned. Environmental governance tools related to the effect of human health and environment by computer e-waste disposal management. These include international conventions and treaties (e.g. Basel Convention); policies (both national and sectoral related to water, human health and environment); regulatory and administrative instruments (e.g. environmental standards); market-based instrument (e.g. the cost of disposing of end-of-life of computers, environmental degradation due to emissions; and cost of human health and environmental risks caused by toxic components of computer e-waste); environmental impact assessment (EIA); institutional framework for planning and EMS; and monitoring and control to ensure compliance were found to be some of the enabling factors for sustainable computer disposal management in the County. Also, the study concludes that there is need for efficient and effective relevant regulations, which are compliant with international standards to avoid negative impacts on human health and the environment from open computer e-waste disposal management approaches.

RECOMMENDATIONS

The study recommends the establishment of a computer e-waste disposal management system. This provide for the formulation of a zero e-waste policy which provides for the creation of a County E-waste Management Authority (CEMA) or a department at the Communication Authority of Kenya or City County Office. The system will include: i) County Computer E-Waste Recycling Centre (CEREC) whose responsibility will be to ensure that computer e-waste from all public institutions and businesses (including domestic e-wastes) is processed in an environmentally

sound manner; and ii) strategic residential/commercial/neighbourhood computer e-waste drop off points (CEDOPs); and iii) Ward Computer Literacy Centres (WCLCs) that can absorb some of the spinoffs from CEREC for community capacity building. CEREC and the WCLCs will be manned through private-public-partnerships. Besides, there is need for the NCC to embrace a comprehensive, effective, and sustainable computer e-waste disposal management system which engages public-private-partnerships and includes all stakeholders in the entire CEDM decision-making process. Any non-recyclable computer e-waste will be exported to high-income countries where it can be processed using best available technologies and the best environmental practices.

CITED REFERENCES

Adams, C.A. (2013). The role of leadership and governance in transformational change towards sustainability. *Global Responsibility*. Issue 9.

Arora, R. (2008). Best practices for e-waste management in developing nations. *GTZ-ASEM*.

Bell, A. (1993). Some experiments in diagnostic teaching. *Educational Studies in Mathematics*. 24 (1), 115-137.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative*. London: Sage.

Creswell, J.W. (2005). Planning, conducting, and evaluating quantitative and qualitative research. *Educational Research* (Vol. Pearson Education): Upper Saddle River.

European Union (EU). (2003). Directive (2002/96/EC of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE). *Official Journal*. 24-39.

Florida, R. & Davison, D. (2001). Why Do Firms Adopt Advanced Environmental Practices (and do they make a difference?). Regulating from the inside: Can environmental management systems achieve policy goals? C. Coglianese & J. Nash.

Washington DC. *Resources for the Future*. 82-104.

Furedy, C. (1992). Garbage: Exploring non-conventional options in Asian cities. *Environment and Urbanization*. 4 (2), 42-54.

Geels, F.M. (2015). A critical appraisal of sustainable consumption and production research: The reformist, revolutionary and reconfiguration positions. *Global Environmental change*. 34, 1-12.

Government of Kenya. (2016a). *Environmental Management Coordination (E-waste) Regulation* (Unpublished). Nairobi: Government Printers.

Government of Kenya. (2016b). *Water Act*. Nairobi: Government Printers.

Government of Kenya. (2015a). *Environment Management Coordination Act*. Nairobi: Government Printers.

Government of Kenya. (2015b). *Public Procurement and Asset Disposal Act*. Nairobi: Government Printers.

Government of Kenya. (2014). *National Environment Policy*. Nairobi: Government Printers.

Government of Kenya. (2014-2030). *Kenya Health Policy*. Nairobi: Government Printers.

Government of Kenya. (2012a). *Public Health Act*. Nairobi: Government Printers.

Government of Kenya. (2012b). *Water Policy*. Nairobi: Government Printers.

Government of Kenya. (2010). *Constitution of Kenya*. Nairobi: Government Printers.

Government of Kenya. (2007). *Vision 2030*. Nairobi: Government Printers.

Government of Kenya. (2003). *Environmental Management Coordination (Impact assessment and*

Audit) Regulations. Nairobi: Government Printers.

Grimes, D.A. (2002). Bias and causal associations in observational research. *The Lancet.* 359, 248–252.

Hammal, F., Mock, J., Ward, K., Fouad, M., Beech, B. and Maziak, M. (2005). Settling with danger: Conditions and health problems in peri-urban neighbourhoods in Aleppo, Syria. *Environment and Urbanization.* 17(2), 113-125.

Haregu, T.N., Ziraba, A.K. and Mberu, B. (2016). Integration of solid waste management policies in Kenya: Analysis of coherence, gaps and overlaps. *African Population Studies.* 30 (2), 2876-2885.

Henriques, I. and Sadorsky, P. (1999). The relationship between environmental commitment and managerial perceptions of stakeholder importance. *Academy of Management Journal.* 42 (1), 87-99.

Lindhqvist, T. (2000). *Extended Producer Responsibility in Cleaner Production: Policy Principle to Promote Environmental Improvements of Product Systems* (IIIEE dissertation). Lund University, Lund.

Kerlinger, F.N. (1993). *Behavioral research: A conceptual approach.* New York: Holt Reinhert and Winston Inc.

Kerlinger, F.N. (1983). *Foundations of Behavioral Research* (2nd Edition). New Delhi: Surject Publications.

Maimba M.W., Ngau P.W. and Mugo F.W. (2019). Level of public awareness on effects of computer e-waste disposal management approaches on human health and the environment in Nairobi City County, Kenya. *African Journal of Environmental and Waste Management.* 6(1), 001-011.

Moore, J.W. (2015). Putting Nature to Work. In C. Wee, J. Schönenbach, & Arndt O. (Eds.), *Supramarkt: A micro-toolkit for disobedient consumers, or how to frank the fatal forces of the Capitalism.* Gothenburg: Irene Books.

Mugenda, O.M. and Mugenda, A.G. (2003). *Research Methods: Quantitative and Qualitative Approaches.* Nairobi: African Centre for Technology Studies.

Njeru, J. (2006). The urban political ecology of plastic bad waste problem in Nairobi, Kenya. *Geoforum.* 37, 1046-1058.

Oosteveer, P. (2009). Urban environmental services and the state in East Africa: Between neo-developmental and network governance approaches. *Geoforum.* 40, 1061-1068.

Porter, R.C. (2002). *The Economics of Waste, Resources for the Future.* Washington D.C.

Prakash, A.P. and Potoski, M. (2014). Global private regimes, domestic public law: ISO 14001 and pollution reduction. *Comparative Political Studies.* 14 (3).

Schluep, M., Hagelucken, C., Kuehr, R., Magalini, F., Maurer, C., Meskers C., et al. (2009). *Sustainable Innovation and Technology Transfer Industrial Sector Studies: Recycling-From E-Waste to Resources.* United Nations Environment Programme and United Nations University/StEP Initiative.

Sikor, T. and Newell, P. (2014). Globalising environmental justice. *Geoforum.* 54, 151-157.

Thyberg, K.L. and Tonjes, D.J. (2015). A Management Framework for Municipal Solid Waste Systems and its Application to Food Waste Prevention. *Systems.* 3, 133-151.

United Nations. (2011). Human Development Report. *Sustainability and Equity: A Better Future for All.*

York, R. and Eugene A.R. (2003). Key challenges to ecological modernization theory: Institutional efficacy, Case study evidence, Units of analysis, and the Pace of eco-efficiency. *Organization & Environment.* 16(3), 273-88.