

Alternatives for Financing Waste Management: Implications for Ghana's Growing Electronic and Electrical Equipment Waste

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/AJEBA/2017/31409

Editor(s):

(1) Gerasimos T. Soldatos, American University of Athens, Athens, Greece.

Reviewers:

(1) Matheus Poletto, Universidade de Caxias do Sul, Brazil.

(2) Dal Singh Kharat, Central Pollution Control Board, India.

(3) Mohd Hilmi Izwan Abd Rahim, Universiti Tun Hussein Onn, Malaysia.

Complete Peer review History: <http://www.sciencedomain.org/review-history/17649>

Policy Article

Received 4th January 2017
Accepted 17th January 2017
Published 28th January 2017

ABSTRACT

The waste of electrical and electronic equipment pose an environmental and human health challenge for some developing countries, including Ghana. Despite such challenges, it contributes to job creation and income generation if properly collected and processed. This type of waste may contain precious minerals including gold and mercury. However, the processing of such waste is dominated by the informal sector. Due to the availability of finance, they resort to unhealthy such as burning and crushing as a means of processing this waste, thereby, exposing themselves and the environment to poisonous metals and substances. To curtail the problems created by this waste, the government proposed the establishment of a fund to enable the country secure the needed capital to deal with this waste problem. The paper uses documentary review to assess the proposed government approach to funding of this waste. It proposes an alternative model of financing of this waste. It recommends, among other things, the need to promote the sector as a business venture and encourage the participation of private, public, foreign and domestic investment. The said investment is expected to promote the acquisition of the needed technology to manage e-waste.

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Keywords: Financing; electrical; electronic waste; Ghana.

1. INTRODUCTION

Ghana launched the National Information Communication Technology (ICT) Policy in 2003 with the goal of engineering an ICT-led socio-economic development process with the potential to transform Ghana into a middle income, information-rich, knowledge-based and technology-driven economy and society [1]. The focus of the policy was to promote the deployment of ICT in all areas and sectors of the economy, including the production and distribution of goods and services as well as the modernization of agriculture, health and governance. Among the critical areas targeted for the deployment of ICT also included education and health care delivery. As a key success factor, taxes on ICT equipment for health and education purposes were reduced or removed. These included mobile phones [2,3]. All these culminated into an influx of ICT gadgets and equipment being imported into the country, especially computers for educational or health purposes. A large volume of these came through donation to schools and charity homes. Apart from computers, other electrical equipment that come in as gift is hospital equipment, including used X-ray machines, diagnostic machines and ICT scanners among others.

A 2011 report on Ghana Electronic Waste (e-waste) Country Assessment, showed Ghana imported 215,000 tons of electrical electronic equipment (EEE) with 64,500 (30%) being new. As [4] and [5] submit, about 70% of this electrical and electronic equipment imported into the country are used products. Furthermore, 97,825 (65%) of the used ones come into the country in good working condition. Another 37,625 (25%) can only function after repairing or refurbishing them. An estimated 15,050 (10%) come into the country broken and unsalvageable. Whether these EEE come into the country used or brand new, what matters is how their end-of-life is managed. This is because, waste of electronic and electrical equipment (WEEE) if improperly handled have negative health and environmental implications for the society. WEEE is found to be a valuable resource if properly managed. However, the current situation of WEEE in Ghana is more of a menace than a blessing. Several studies have documented the negative health, environmental, social and economic impact of electronic waste, especially in the cities where landfills are located.

These studies had originated from known areas of EEE problems including Ghana [6] and India [7]. Furthermore, [8] and [9] conducted research on the same subject in China. Findings from such studies indicate significant display of toxic elements in the blood stream, serum, scalp hair, human milk and urine of people working or living in places of massive e-waste. Waste management is a major issue in major cities in developing countries, especially in Sub-Saharan African countries including Ghana.

Meanwhile, there are few companies and limited technologies available for the collection, sorting and processing of e-waste in the country. This comes against the backdrop of limited investment into e-waste management, despite the increased in the generation of such waste. According to [10], about 30% of the EEE imported in 2009 did not function and therefore were waste. The resultant effect is about forty thousand (40,000) tonnes of waste. This view is supported by [11], who put the total EEE in the during the same period at 215,000 tons, with 70% being used products. With the coming in of the ICT Policy and the penetration of ICT in Ghana, the volume of e-waste continues to increase in the country. However, there are few formal e-waste management companies in the country to handle the huge e-waste generated. For the few companies that operate in the sector, their main activity is the collection and dumping of the waste at designated landfill sites. The sector is highly dominated by informal sector, mainly small and medium enterprises (SMEs). These businesses are involved in the collection and processing of e-waste in the cities and towns. However, their methods of processing have been crude. For instance, they burn e-waste to extract copper wires contained in this equipment. Appendix Figs. 1, 2, 3 and 4 provide images of informal e-waste processing activity at Agbogloshie in Ghana as contained in the e-waste country assessment report on Ghana, published in 2011 under SBC e-Waste Africa Project. The images provide the plausible of the informal e-waste processing on human and environmental life.

Such approach to dismantling WEEE leads to loss of important and valuable elements (especially gold and mercury) contained in this equipment. If properly managed, WEEE has the potential to create jobs, generate income and improve the livelihood of those engaged in such

businesses. A paper published in the Seattle Journal of Environmental Law, in 2015, revealed that 10 to 13,000 metric tons of WEEE is processed per year in Accra. This contributes between US\$105 million and US\$268 million into Ghana's economy. Furthermore, the processing of WEEE using these crude methods sustains between 121,800 and 201,600 people in Ghana. What this means is that with the right investment and efficient recycling facilities, the country could earn more, create more jobs and improve the standard of living for those engaged in the business. The paper analysis the suggested mode of financing WEEE as contained in the E-Waste Act of Ghana and proposes other alternative modes of financing e-waste in Ghana. The rest of the paper is divided into five parts. Part two looks at the theoretical framework and the existing financing models. The third part looks at the research method the paper adopts. The framework for financing WEEE is in Part four and part five looks at conclusion and recommendation.

2. THEORETICAL FRAMEWORK

It is established in previous studies [12] that e-waste is a major problem because it causes environmental damage and a severe human health concerns if not properly handled. This is because it often contains high amounts of toxic and environmentally sensitive materials and thus, hazardous to humans and the environment, if improperly disposed or recycled [12]. This, notwithstanding, e-waste is found to provide huge business opportunity due to the rich minerals it often contains. This view is expressed in the *waste-to-resource* (WTR) ideology. The WTR is supported by the wealth creation and profit maximisation theories of the firm. High profit margins may lead to growth and survival of the firm. Firms create wealth through innovation and invention of new products. The WTR to creating value occurs through refurbishment, recycling, reclaiming or re-use.

Furthermore, production theory suggests production is complete when it reaches the final consumer. The WTR philosophy extends the production ideology, making producers the final consumers through extended responsibilities towards the environment. By extended producer responsibility (EPR), producers are made accountable for complete life cycle of the product from the source of raw material, processing, distribution and disposal after product's useful life. These include strategies such as take-back

reuse, reduce, recycling and recovering approaches [13,14]. [15], emphasised on post-consumption phase of the product's life cycle as they talk about EPR. Previous studies have emphasised on the competitive advantage gained by firms due to better design impact of EPR [16]. From purely corporate social responsibility (CSR) perspective, [17] opined that EPR is an indication of corporate stewardship and good citizenship.

However, despite the major concerns, e-waste is a potential source of income if the valuable materials contained in them are properly recovered.

Due to the complicated nature of e-waste and the harm it may cause to those involved in the e-waste business, it is necessary to use the right technologies in its processing. However, this comes with the relevant cost. According to [12], in some instances, the benefits for collection and recycling of e-waste might be less than the revenues generated from the recovered materials if the right technology is not used. This calls for adequate investment into the sector.

From the stakeholder theory perspective, financing the sector should be the responsibility of all the actors within the value chain; i.e. producers, distributors and consumers, with the government and international community acting as the interveners. The theory is of the view that there are various groups in society that have interest in the activities of business, and hence has the ability to influence how a firm conducts its activities. It opines that the power and influence of the actors significantly influence corporate practices. Analysing the critical role of these groups in society, [18] based on this theory identifies several interest groups in a firm's activities including suppliers, shareholders, civil society organisations, the media, consumers, competitors as well as state and its agencies.

Similar to other industries, interest groups in the electronic and electrical equipment industry has the power to influence how corporate bodies in sector conduct business. It has therefore been argued that any finance initiative should revolve around the actors in the sector [19]. Therefore, the understanding of the financing of electronic waste must be looked at within the context of these interest groups. In the view of [12], there are three main stakeholders including producers, waste-holders and the wider society who could bear financial responsibility for end-of-life

management of any kind of waste. Fig. 1 provides some identified stakeholders in the e-waste sector. The ensuing sections discuss some traditional finance models that have been suggested for Ghana.

2.1 Existing Financing Models

Existing studies [20,12] on e-waste financing has concentrated on manufacturers through extended producer responsibility (EPR) mechanism. What is missing is whether suppliers of electronic inputs for the manufacturers of EEE fall within the category of producers. [12] outlines three proposed and existing financing schemes for some countries. The first model is *consumer e-waste financing* (CEF) approach. This is the model in California and Japan. In California, consumers pay for the management of e-waste upon purchase of new electronic and electrical appliance. In the case of Japan, consumers pay for disposing electronic equipment. This strategy as [21] suggests, provides an up-front finance for the management of e-waste. However, it may lead to illegal dumping by consumers who want to avoid the payment of fees.

The second is the *producer e-waste financing* (PEF). The countries using this approach (also known as extended producer responsibility) include South Africa, Kenya, India and Europe. In South Africa, the plan is to get producers pay into a fund to be disbursed to producer responsibility organization. Kenya proposes a model where, producers pay for the net treatment costs directly to recyclers.

The European model deviates slightly from other practices of EPR. The European model as deduced from the work by [21], focuses on getting producers to invest more in product design and re-manufacturing as well as financing the establishment of new industry in the collection, dismantling and processing of e-waste. The next approach is the *shared e-waste financing* (SEF) model. The SEF as proposed for Ethiopia is a combination of EPR with electricity bill (or municipal solid waste fee) increase. Meanwhile, the method is described as a fair allocation of financial responsibilities among two different stakeholders – manufacturers and society. Table 1 provides a summary of some of the existing e-waste management practices.

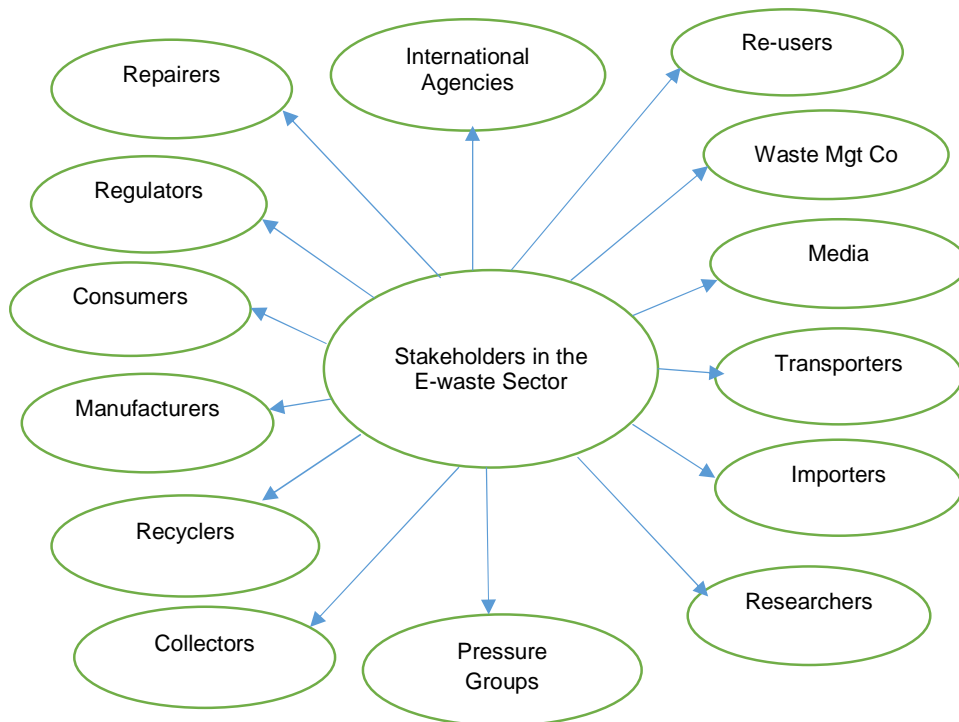


Fig. 1. Stakeholders in the E-waste in Ghana
 Source: Author's construct

Table 1. Existing E-Waste management practice

| Approach | Financing practice | Practicing country | Merits | Demerits |
|-----------------------------|---|--|--|---|
| Consumer E-Waste financing. | 1. Consumers pay extra for EEE. 2. Consumers pay for disposing off e-waste. | 1. California 2. Japan | There would be an upfront funding for managing WEEE. | It would create additional cost to consumers and may lead to illegal dumping. |
| Producer E-Waste financing. | 1. Producers pay money into a fund to be disbursed to those in e-waste management. 2. They pay for the cost of treating e-waste 3. Producers are mandated to invest into product design to reduce e-waste | 1. South Africa 2. Kenya 3. Europe | 1. Ready funding for managing e-waste. 2. New product design reduces e-waste generated. | This could lead to increase in the prices of electrical equipment. |
| Shared E-Waste financing. | This is made up of EPR and consumers being made to pay for waste levies. | Ethiopia | Funding for managing e-waste would be readily available | The practice is unfair to those without electronic and electrical equipment. |
| E-Waste fund. | Importers and those in the business of e-waste are made to pay levies into the fund. | Proposed model for Ghana. | Ready funding for managing e-waste | Importers and businesses would shift the levies unto consumers. |

Source: Author compiled, 2016

The issue with the existing models is that they appear to be mitigating measures than to raise funding to take advantage of the opportunity the sector presents. E-waste is touted a valuable income stream [22]. A report by the [23] estimated Americans dump phones containing over US\$60 million in gold/silver every year. According to the report, for every 1 million cell phones that are recycled, 35,274 lbs of copper, 772 lbs of silver, 75lbs of gold and 33lbs of palladium can be recovered. Although there is no consensus on the annual total value of global e-waste trade, findings from various empirical studies show the sector is profitable if properly exploit. For instance, [24] estimated the intrinsic material value of global e-waste to be 48 billion euros in 2014. According [25], in 2009, the e-waste trade (primarily the black market) was estimated to be US\$11 billion. The study concludes the industry remains profitable based on its current exploitation of developing nations. Furthermore, [26] submits that individual European companies involved in the e-waste black market make more than €2 million per year. As indicated earlier, WEEE contributes to between US\$105 million to US\$268 million into Ghana's economy despite the crude technology used in its processing.

Furthermore, it estimates that 600 forty feet super containers of WEEE are shipped to Accra, Ghana on a monthly basis [27,28]. In less than two years, majority of this WEEE finds, their way into landfill sites, rivers and gutters since the people and the small businesses involved in the e-waste trade has not the expertise, finance to acquire the needed technology to process the waste into resource. Given the volume of WEEE that is generated annually in Ghana, the question is if the above options for financing is adequate. It has been suggested that with the right technology and investment, it could contribute significantly to the economy. The paper provides some financing options for the processing of e-waste into resource or other useful products.

2.2 Ghana's Proposed E-Waste Financing Model

Ghana's E-Waste Law passed in 2016 largely makes producers responsible for the management of e-waste in the country. This is similar to legislations in countries such as South Africa and Kenya, where there is EPR in the payment for the cost of managing e-waste. Under the new E-Waste Law of Ghana, it required of manufacturers and importers of electronics, excluding state agencies, to register

with the Environmental Protection Agency and to pay levies that would go into a fund for the collection, treatment, recovery and environmentally-sound disposal of e-waste [29]. Similar to existing models like the Educational Trust Fund, Ghana Road Fund, National Health Insurance Scheme, the question is how such a fund must be managed. Should an institution from the public or the private sector be responsible for managing such a fund or the private sector?

In this model, financial responsibility is allocated to producers but the organizing role remains with the government. However, whether this works depends on the location of the EEE manufacturer. The sector is largely dominated by the informal sector, operating unregistered businesses. According to [30] 40% to 60% of domestically generated e-waste is recycled, out of which 95% is done informally. Meanwhile, [31] maintains that replacing the informal sector with a formal one is impractical. Therefore, any legislation and financial strategy should aim at the informal sector. This is another challenge for the proposed financing model for the sector.

The next point is how to tackle the issue of donation of EEE, especially computers that are given as gift to institutions and schools. The question is who pays for the taxes to be imposed on such EEE as being proposed by the new law on e-waste. How can these donating institutions ensure the functionality of these equipment before giving them out? Ghana, like any other developing nation, depends on donations. There is evidence that e-waste is sent to Africa and Ghana in the name of donation [29,32]. The volumes of e-waste in Ghana continues to increase. Two reasons account for this. First is the rapid growth in global volumes of e-waste generated. In 2014, 41 million tonnes of e-waste estimated at GB£34 million were discarded world-wide [33,34]. However, only 6million tonnes out of the huge volumes of e-waste was recycled. The greater percentage of the unprocessed e-waste eventually find their way to Africa and Ghana. [29] reports that 20 to 50 million tons of e-waste are generated in the world annually and a great amount of that ends up in developing countries including Ghana and Nigeria. Second reason accounting for the increase in e-waste is the positive impact of the National ICT introduced in Ghana in 2012. The aim of the programme was to increase the use and penetration of ICT in both social and economic activities in the country. This had led to

increase usage of ICT in education and governance. Ghana now generates a substantial e-waste domestically. So the question is how the proposed financing model sustains the management of the ever-increasing e-waste in the country.

Furthermore, it is difficult to control or manage the situation where importers pass on the additional cost (by way of levies or taxes on EEE imports) to consumers. The idea of levying dealers of EEE as a way to raise funding for the proposed e-waste fund is the possible price pressure on consumers. Economic theory argues that producers would shift the effect of tax on prices to consumers, especially where the product is a necessity product [35,36]. This could discourage the patronage and use of EEE. This would negatively impact on the 'Information Communication Technology for Accelerated Development (ICT4AD) programme of the country.

Further question that needs to be answered is whether revenues generated from levying dealers of EEE is adequate for dealing with the e-waste menace now and for the future. A recent survey by the United Nations Office for Project Services (UNOPS) showed that between 2010 and 2014, 15,481,721 metric tons of new EEE were imported into the country. A total of 595,328 tons of old EEE were imported during the same period [37].

The current approach to funding e-waste suggests it is still considered as just waste and not resources. However, as discussed earlier, WEEE has the potential of generating wealth and jobs for a country if given the necessary attention and investment. It is on this note that we proposed more sustainable models for financing e-waste in Ghana.

3. RESEARCH APPROACH

The paper adopts documentary content analysis [38] approach to research. This is found to be rigorous for the exploration of important but difficult-to-study issues of interest [39]. The approach of the paper is to make replicable and valid inferences by interpreting textual material. Primary data was used and was sourced from printed publications including books, magazines, newspapers, websites, public records, media reports, private papers, strategies, and policies, action plans by public bodies or organisations.

The research approach involved analytic reading and review of relevant written materials. Then, the relevant portions that were in line with the study objective were then extracted. There were three stages in the approach to this analysis. First is *preparation*. This is the stage where the materials required for the analysis was identified and collected. This involved identifying the possible source of the necessary data. This is followed by *material review and sorting*. In this stage, the documents collected were studied in details and categorised with reference to the study objectives. The final stage was the deductions and thematic write-up stage. In this stage, deductions were made from a detailed study of the documents collected, making inferences and drawing conclusions based on the views, opinions and findings from previous studies. Results from the analysis were presented thematically; proposing a financing an alternative for the management of e-waste in Ghana.

4. THE PROPOSED FINANCING MODELS

There is evidence to support the view that the state cannot solely provide the fund to support waste management in the country [40]. Private Sector Participation (PPP) can help mobilize resources, reduce risks, contribute to economies of scale and enhance service delivery [41,42]. However, a PPP model would operate better if there is national framework for e-waste would incorporate a business sense or describe returns on investment for private investors in the sector. The paper, therefore, proposes the following models for financing e-waste in Ghana including the state or the national fund:

4.1 Domestic/FDI in Waste Processing

The sector requires the inflow of investment like any other sectors of the economy. Investments can come from both domestic and foreign direct investment. There are currently no statistics on the total investment required for the management of the current electronic waste in Ghana. But the statistics on the import of EEE into the country [37] suggest more funding is required in dealing with the end-of-life of these EEE. Furthermore, WEEE provides business opportunity with good returns. A 2015 United Nations report, cited in [21] projected the global WEEE production to 50 million metric tons by 2018, from the approximated 41.8 million metric tons in 2014. Global e-waste recovery market holds enormous revenue potential and is expected to reach \$21 billion by 2020, growing from \$6.9 billion in 2009.

[43,24] found the revenue generated from the e-waste management market is expected to grow from \$9.15 billion in 2011 to \$20.25 billion in 2016 at a compound annual growth rate of 17.22% from 2011 to 2016. The implication is that the sector provides business opportunity for investors.

4.2 Public Private Partnership

Public private partnership has been used to finance numerous and similar projects in Ghana. According to [44], PPP introduce private sector resources and/or expertise in order to help provide and deliver public sector assets and services. These include the Ghana Community Services Network Ltd (GCNet), solid and urban waste management [45,46], urban and small-town water provision [47]. Public private partnership would help pool funds and skills from the two sectors for the funding of the e-waste activities.

4.3 Private Private Partnership

This takes the form of joint ventures, mergers and strategic alliance. Due to the huge investment required to finance e-waste business, it requires the pooling of resources. Private-

private partnership and strategic alliance is not common practice in Ghana and Africa. However, if properly explored, it would raise the needed capital for the establishment of e-waste business. In Ghana, mergers as a mode of raising capital has been found in the banking sector, especially from the period between 2009 and 2014, when the Bank of Ghana increased the minimum capital requirement from GHS60 million to GHS120 million. There is the need for the small and medium sized waste management firms currently operating in the sector to go into strategic alliance and joint ventures to enable them raise the needed capital for the taking advantage of the opportunities in the sector. Beside two private local companies going into alliance, domestic waste management companies can also go into alliance with foreign private companies with the technology to process WEEE in the country.

4.4 Public Public Partnership

Public-public partnership mode of financing could be in the form of grants and donation (i.e. technology or capital) to deal with WEEE in the country. The state receives numerous grants and donations for undertaking numerous projects including poverty reduction, malaria

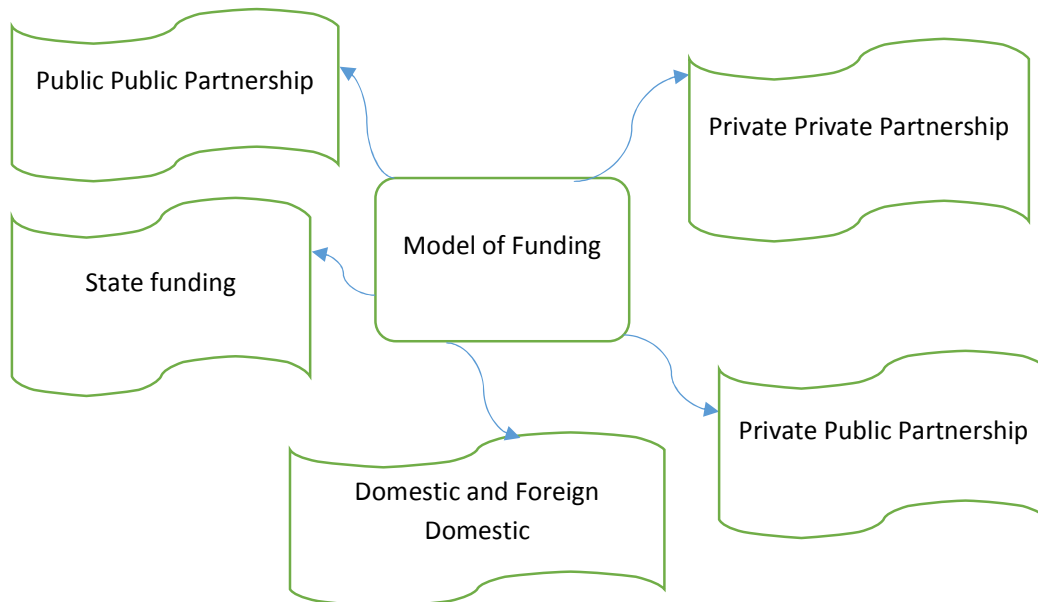


Fig. 2. Alternative source of funding E-waste in Ghana

Source: Author's construct

prevention and reducing HIV/AIDS prevalence. Such grants could be extended to e-waste sector to enable the state raise the needed funding for the management of such harmful waste. For instance, the German Federal Ministry for Economic Cooperation and Development (BMZ), has partnered and sponsored similar projects in Ghana including Sustainable Economic Development in Ghana as well as projects such as sustainable access to modern energy services. There is even multiple project funding for Ghana by GIZ and the Netherlands Directorate General for International Cooperation (DGIS) and the Danish International Development Agency (DANIDA).

4.5 State Funding of E-waste Projects

The business of electronic waste is largely dominated by the informal sector. As indicated earlier, government funded e-waste project would help create jobs and at the same time reduce the negative environmental impact of e-waste. As a means of funding, government can raise the needed capital by taxing second-hand EEE imported into the country. The state can issue bonds to finance e-waste. Funds from taxes on EEE and from issuing securities can be used to set up a waste management fund. This fund should be made accessible for MSMEs to enable them acquire the needed capital required for operating a business in the sector. This deviates from some existing models from other countries that use strategies such as consumer levying for buying EEE or dumping it. The aim of public or state funding has been purely on non-profit making motive.

Fig. 2 provide a summary of the summary of the sources of funding of electronic waste in Ghana. These alternative strategies as explained in the write-up includes private-private, private-public, public-public, domestic-foreign, state funding and private –public financing initiatives.

5. CONCLUSIONS AND POLICY RECOMMENDATION

The waste from electronic and electrical equipment creates both problems and opportunities for individuals (investors), corporate bodies and the state. The problem of e-waste is not only created by the influx of WEEE from the developed countries, but e-waste is also generated domestically. This is contrary to the existing view that the WEEE problem is created by waste from developed countries.

Electronic waste is a resource than just a waste. However, the current approach to managing e-waste is short of business sense that enables the sector to attract the needed investment.

The sector is the source of job creation and income generation for most people in the informal sector. However, there is little by way of technological adoption due to limited investment in the sector.

The current WEEE funding strategy is more of raising money to mitigate the environmental and health hazards that comes with WEEE.

The current and the proposed approach to funding e-waste have the tendency to impact negatively on the national ICT4AD policy. The policy aims at improving the adoption and usage of ICT in the country.

5.1 Policy Recommendation

Develop a national framework for supporting the establishment of eco-innovative MSMEs in the e-waste sector. Such framework should identify the sources of financing such businesses, and these financing sources should include private, public or both sources. Both domestic and foreign sources of funding would be critical in financing e-waste activities in the country.

The strategy of imposing taxes on EEE to raise funds for e-waste activities would have a negative impact on the ICT4AD policy of the country. The alternative source of funding other than taxation would help in the attachment of the national ICT programme goals. Meanwhile, in imposing taxes on the e-waste business, policymakers should be conscious of the attitude of the informal sector towards the payment of taxes. There is the tendency for the operators of these small businesses to go ‘undercover’ if they feel threatened by the effect of taxes on their businesses.

There is the need to promote e-waste as a business venture and encourage the participation of larger businesses. Such larger businesses are likely to put more investment into such activities and acquire more or higher technology.

E-waste business operators can mobilize more resources and introduce superior technology to managing WEEE to help them expand their businesses to enable them employ more people.

One of the key success factors for improved e-waste business, is the willingness of consumers and their associations to patronise and pay more for environmentally friendly products. Furthermore, middlemen/distributors and companies must through their CSR activities extend their responsibility to distribution, consumption and disposal.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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APPENDIX



Appendix Fig. 1. Manual processing of electronic waste in the informal sector



Appendix Fig. 2. Manual processing of electronic waste in Agbogloshie



Appendix Fig. 3. Informal E-waste processing and health implications



Appendix Fig. 4. Polluted nature of electronic waste processing in the informal sector

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Peer-review history:
The peer review history for this paper can be accessed here:
<http://sciencedomain.org/review-history/17649>