

The e-waste conundrum: Balancing evidence from the North and on-the-ground developing countries' realities for improved management

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Abstract

E-waste is currently the fastest-growing waste stream, posing major global management challenges. One of the unintended outcomes of this growth in the developing world is the increasing presence of informal e-waste recyclers, providing livelihood opportunities, albeit under elevated health-threatening risks and limited protection. Based on a detailed assessment of the context in Ghana, the authors propose a disposal model involving all stakeholders in the development of new state policies for e-waste recycling. Based on the principle of participatory development, the authors posit that the informal sector concentrates on the collection, disassembly and segregation, while the formal sector manages the upstream state-of-the-art processing requiring more capital and technology investment, and expertise. Tackling e-waste management at the two extremes will build a broader consensus for a greener agenda and mitigate the potential environmental pollution embedded in current practices. Although the authors' model is proposed with reference to the Ghanaian context, it stands a better chance of success and applicability to other developing countries than models that are developed based on developed world experiences.

Keywords: E-waste recycling, formal-informal interface, livelihood, waste management, Accra

1 Introduction

The increasing revolutionary application of electronic and electrical equipment (EEE) generally classified as hazardous (BAN, 2005; Toxics Link, 2007) has become a powerful socio-economic driver, creating jobs and reducing poverty levels (Zandi and Singh, 2010). The situation has prompted global concerns, with developed nations adopting appropriate management policies and legislations. However, in most developing countries, a lack of formal management options has compelled the informal sector to respond positively (but probably selfishly) to tap into the profit potential of the waste electrical and electronic equipment (WEEE), popularly called electronic waste or e-waste. Various studies in Ghana have recounted the rudimentary methods through which WEEE is handled (Amoyaw-Osei *et al.*, 2011; Grant and Oteng-Ababio, 2012). These studies have all shown that there is neither

the infrastructure nor specific legislation for e-waste disposal. Currently, 40 to 60 per cent of domestically generated e-waste is recycled, out of which 95 per cent is done informally (Oteng-Ababio, 2010b). The rest is stored for some uncertain and perceived value (Osibanjo and Nnorom, 2007).

Environmental and safety concerns have necessitated the need for a more robust but sustainable recycling approach based on the current socio-economic and technological development and circumstances, as well as using the 'best available technologies'. Environmental Non-Governmental Organisations (ENGOS), such as Greenpeace and BAN, propose the complete replacement of the informal sector with a formal one. Chatterjee and Kumar (2009), on the other hand, propose an 'outsourcing model' based on the assumption that the major motivation for informal sector involvement is to extract precious metals (gold, silver) from the printed circuit boards (PCBs).

We argue that to ensure public ownership and support of any investment in a new e-waste recycling model, city authorities and planners need to involve the key stakeholders concerned with all aspects of the process. We further maintain that replacing the informal sector with a formal one is impractical. For example, according to Chatterjee and Kumar (2009), the informal sector's motivation for participating in e-waste recycling is the desire for chemically extracted gold, but in Ghana, studies have shown that harvesting copper through open burning drives the sector (Brigden *et al.*, 2008; Prakash *et al.*, 2010; Amoyaw-Osei *et al.*, 2011). We believe that any e-waste recycling model for a country should be informed by the country's level of economic development, information and communication technology (ICT) penetration and poverty levels, as well as the level of sophistication of the informal sector. Systematic reform should incorporate the interests of all stakeholders, including the collectors, environmentalists, policy makers, and beneficiaries.

This article has two main aims: first, it highlights how the authorities can respond appropriately to e-waste challenges on a local and a national scale (beyond the call to ban informal operations). Second, it reiterates the economic logic for a management model involving all key stakeholders in the planning, implementation and monitoring processes. We contend that informality is part of the formal business model and elucidate how the two sectors operate as a closely interlinked chain of activities, and how such a realisation is essential to policy-making. The article is organised as follows: the next section provides an overview of the formal–informal-sector debates and concurs that the recent rise in informal employment is partly due to the informalisation of once formal employment relationships, thus necessitating inclusive practices. This is followed by an overview of e-waste management practices globally, highlighting the inter- and intra-country differences in terms of characteristics such as practices and incentives in the developed and developing countries. A general discussion of the proposed model is presented, grounded in the belief that as a new model for e-waste recycling is being designed, stakeholders will need to provide feedback on the availability, accessibility and usage of the

service, as well as its impact on the distribution and marketing of recycled goods. Equally important is feedback on possible financial arrangements. The concluding section offers recommendations for policy considerations on how to make the model applicable to, and possibly useful for, other developing countries.

2 Revisiting the formal–informal sector discourse

The informal sector, since its ‘discovery’ in development studies (Hart, 1973), has been the subject of different interpretations and academic debates regarding its structure, linkages and sustainability. Over the years, the debate has crystallised into three main schools of thought: dualism, structuralism and legalism. Dualists see the sector as comprising marginal activities, distinct from the formal economy and characterised by the ease of entry, reliance on indigenous resources, family ownership and small-scale of operations, and providing a safety net in times of crisis (Sethuraman, 1976; Tokman, 1978). Structuralists focus on production relationships and see the two economies as universal, heterogeneous, and increasingly systematic and intrinsically linked (Moser, 1978; Portes *et al.*, 1989). Legalists argue that informality is generated by hostile legal systems emanating from a collusion between capitalist interests and government facilitation, and providing ‘plucky’ micro-entrepreneurs who choose to operate informally in order to avoid the cost, time and effort of formal registration (De Soto, 1989; Biles, 2008).

In the discussion that follows, we draw attention to the paucity of empirical tests of these causal theories to exclusively and comprehensively explain each segment of informal employment. The nature of the current informality can only be understood within the macro-political and social contexts, as well as overall global trends. For example, what are the drivers of informality, particularly with reference to individual countries’ socio-political and economic circumstances? As rightly noted by Chen (2012), to the extent that the informal economy is quite heterogeneous, there is merit in each of these perspectives, as each reflects one ‘slice of the pie’, although the sector is more heterogeneous and complex than the sum of these perspectives would suggest (Vanek *et al.*, 2012).

Without denying that some self-employed choose to work informally in order to avoid registration and taxation, others also do so out of necessity, social conditioning, or tradition. Recent studies (Bernstein, 2004; Chen, 2012) revealed that formal and informal institutions, local customs, patterns of social organisation, inter-group relations, social institutions (i.e., family, kinship groups, tribal or ethnic affiliations), formal and customary laws and regulations, property rights, subsidy arrangements, central and local government agencies, and information and communications systems can create systematic structural blockages to formal employment. Chen (2012, p. 6) further argues that much of the recent rise in informal wage employment is due to the informalisation of once formal employment relationships, adding that, ‘it is the employers, not their employees, who are avoiding regulation and taxation’.

In the specific case of municipal solid waste management (MSWM), Schubeler (1996, p. 24) observes that ‘the marginalised and unstable social and economic circumstances of informal waste workers make it quite difficult to integrate their contribution into the MSWM system’. We concur with this position, and emphasise that conscious effort is needed to strengthen local-level and community institutions, to enhance self-help capacity, and to remove institutional constraints to inclusive practices. Any alternative will only exacerbate the exclusion of certain groups, particularly women, and will damage too many livelihoods. Minter (2013) highlights that ‘junkyard work’ is the second-largest employment category in the world after agricultural employment, so properly managing informal waste work can no longer be neglected.

On that score, local government must seek to enhance public awareness of MSWM problems and priorities, while national governments must assist in cross-jurisdictional challenges. In practice, however, the state concurrently attacks and compels the informal sector, forcing it to be ‘on the run’ (Asiedu and Agyei-Mensah, 2008) and regularly razes dwellings for being ‘unauthorised and without permits’ (Obeng-Odoom, 2011). Underlying this debacle is the fact that informal work is not documented so it is hard to officially claim it as a driver of the urban economy, but with four out of five residents engaged in some capacity, the make-up and contribution of that economy is immense, vital and hard to deny (UN-Habitat, 2011). The overriding political argument has been that the city is achieving economic growth (NDPC, 2010) – a feat which can be attributed to the people toiling in this unrecognised sector. Yet, most empirical literature frame informality negatively (Grant, 2009, p. 255). We submit that the sector must be appreciated within the Ghanaian development context, in respect of its contributions to the overall economy.

2.1 Current e-waste management practices

In the e-waste recycling industry, various studies portray informality as a growing entity, indicative of a more permanent condition (Gregory and Kirchain, 2008; Rousis *et al.*, 2008; Grant and Oteng-Ababio, 2012). Researchers depict e-waste collection and treatment as a highly intricate system, in which the flow of materials includes a great variety of inter-connected stakeholders. Case studies in Asia reveal that about two per cent of the urban population survives on waste picking alone (Medina, 2000). Waste picking has come to be realised as a foundational component of the urban economy, rather than a peripheral activity. This logic informs our position that informality is part of a closely interlinked chain of economic relations – of production, distribution and employment – with enterprises and workers falling at some point on this continuum, between pure ‘formal’ (i.e., regulated and protected) and pure ‘informal’ (i.e., unregulated and unprotected), and that the ‘formal and informal ends of the continuum are dynamically linked’ (Chen, 2007, p. 2). In particular, the collection of e-waste, which is the crucial stage to aggregate and divert waste streams to the desired treatment facilities, is difficult and expensive.

In the developed world, three main approaches are practised. First, the European Union (EU) has adopted the Extended Producer Responsibility (EPR), which makes producers and importers responsible for their products. This is intended to ‘preserve, protect and improve the quality of the environment, protect human health and utilise natural resources prudently and rationally’ (EU–WEEE Directive, 2003). Second, Japan has adopted the ‘Consumer Pays’ model, which ‘obligates retailers to take back home appliances from consumers while the consumers take the responsibility for the payment of costs of collection and recycling’ (Widmer *et al.*, 2005, p. 437). Third, the USA employs a ‘Mixed Model’, involving a patchwork of state regulations, based on limited or full EPR. The State of California, for example, charges consumers a fee (between US\$ 6 and US\$ 10) in ‘Advanced Recycling Fees’ (ARFs) at the time product is purchased (Kahhat *et al.*, 2008), while Washington State’s Electronic Product Recycling Law requires manufacturers to provide recycling services throughout the state, at no cost to consumers (Gregory and Kirchain, 2007).

In terms of up-stream processing of e-waste, there are only four integrated smelters and refineries worldwide. Three of these are in Europe: Umicore in Hoboken (Belgium), Norddeutsche Affinerie in Hamburg (Germany) and Boliden in Rönnskär (Sweden), while Nippon Mining and Metal Groups is in Tokyo (Japan). The obvious questions then are: What are the institutional arrangements for handling WEEE in developing countries? How sustainable are these options? Clearly, emerging economies face several socio-economic challenges, making the wholesale adoption of the models used in developed countries, problematic. Specifically, there is a big disparity between the rural and urban economy in terms of income, living standard and household occupation of EEE (Chi *et al.*, 2011). Accordingly, used EEE through imports and from the city still find faithful users in rural areas, stimulating urban to rural collection and encouraging complete loss of control over the original producers. Many are recipients of ‘donations’ from governments and benevolent NGOs who are helping to bridge the digital divide, and encouraging other dumping practices where components are repurposed for affordable devices purchased by ruralites. Furthermore, waste collection and disposal services constitute a higher proportion of the average household income (Cointreau, 2006), while formal processing refineries, which are highly capital-intensive and expert-driven are non-existent in most developing countries.

Under the circumstances, most countries are in the process of domesticating the models used in the developed world. In 2010, India started experimenting with a draft law with the intent of introducing EPR, banning the import of used EEE for charity and formalising the large informal sector. So far, the system’s credibility has been undermined mainly by poorly defined collection schemes and limited financial incentives (Research Unit, 2011). In 2011, China promulgated the ‘Regulation on the Administration of the Recovery and Disposal of WEEE’ law, which sets up a special fund for subsidising formal e-waste collection and treatment. Under this regulation, producers and importers are expected to take responsibility for their

products. Although the regulation applies EPR in principle and outlines a financing mechanism, how the funding programme will work remains to be seen, considering the fact that crucial issues such as product coverage, financing mechanisms and ministerial responsibilities are yet to be specified and tested (Zhang, 2011).

Within the African region, in 2008 South Africa established the e-Waste Association of South Africa, eWASA (Finlay, 2005). The National Waste Act, 59 of 2008, which established the association, enjoins manufacturers and importers of EEE to define an Industrial Waste Management Plan (IWMP) before they can sell their e-products. Furthermore, the accompanying *Consumer Protection Act*, 68 of 2008, obligates retailers to accept 'take-backs' from consumers buying a new product. However, operationalisation and years of experimentation with this new framework have brought to the fore some of its inherent deficiencies. For example, the policy fails to identify stakeholders' individual responsibilities, and, more importantly, does not cover imported used electronics, thus making companies' legal 'e-waste management readiness' mixed, rather than certain (African Institute, 2012, p. 22). The situation in Ghana is even worse as, to date, there is neither a regulation nor formal infrastructure covering the recycling of e-waste. The national environmental and sanitation policy remains silent on the question of recycling.

Clearly, there are a plethora of models for e-waste recycling worldwide, but the models have little transferability to developing world contexts, where basic solid waste removal and engineered, sanitary landfills remain a major challenge (Ecroignard, 2005). For example, Accra, the capital city of Ghana, does not even have an engineered landfill. In addition, the economic value of e-waste is not always recognised by policymakers in the developing world (see Amoyaw-Osei *et al.*, 2011; Grant and Oteng-Ababio, 2012). Also, in developed countries, regulations have been the main catalyst for organised e-waste recycling models, but the regulatory environment is much weaker in the developing world.

In essence, the current situation reflects a continuum where some countries focus on downstream collection, segregation, crushing and disassembling, while others concentrate on upstream complex end-processing. The article does not endorse, encourage or condone the unethical exportation of hazardous materials and unwaged labour-intensive activities to developing countries, since that is morally unacceptable and practically unsustainable – particularly so when developed-world consumers, as already noted, pay for formal recycling. As a different tact, we propose a recycling model that incorporates all institutional concerns, creates a set of converging policies and strategies that are pertinent and reconcile the need for access to livelihood strategies, and mitigates adverse impacts in the long run.

3 Overview of e-waste recycling in Ghana

This study benefited from our previous research which systematically documented and analysed baseline conditions of WEEE in Agbogbloshie, Accra, the e-waste recycling hub of Ghana (Oteng-Ababio, 2010a and 2012b; Agyei-Mensah and Oteng-

Ababio, 2012; Grant and Oteng-Ababio, 2012; Amankwaa, 2013). The underpinning objective was to interrogate current e-waste challenges in terms of flows (circuitry) recycling and, to some extent, the health implications of the practises. During our studies, the team became conscious of the vulnerable state of the e-waste workers, especially those involved in the incineration of wires to harvest copper.

We organised five focus group discussions (FGDs) with different segments along the recycling chain. Participants of the FGDs were male-dominated, as the enterprise itself is gender biased. The results were supplemented by 25 key policymaker interviews with the Assemblyman; opinion leaders; officials of Accra Metropolitan Assembly (AMA) and Environmental Protection Agency, among others. The initial fieldwork took place in March 2010, after which several surveys were also conducted. Since then, we have returned at various stages to conduct additional interviews between December 2011 and March 2012. We also report on 22 interviews with key informal informants.

3.1 Exploring WEEE participants

Our studies demonstrate that the Ghanaian e-waste economy emanates from three main sources (consumption, importation and production), and is operated mainly by informal self-employed entrepreneurs producing legitimate goods and services, which are sold in the regulated sector. We identified different operators along the formal–informal continuum, with each assuming peculiar local titles. Table 1 lists the different local names along the continuum.

Table 1: Local names of waste professions and their informal/formal status

Local Name	Status	Type of Activity
‘Bolaman’*	<i>Informal</i>	Waste collector at the dump or skip site (transfer station)
Condemned	<i>Intermediary</i>	Itinerant waste buyer who operates purely for economic gain (targeting waste like bottles, plastics)
Kaya bola	<i>Informal</i>	Private waste pickers who collect from homes, stores, and offices for disposal at a fee. They simultaneously engage in waste separation for re-use or sale
Recycler	<i>Informal</i>	Waste worker who is involved in segregating functional parts for sale and the burning of wires to harvest copper
Middleman	<i>Informal</i>	An intermediary between the collector and the scrap dealer who builds bulk before selling to a scrap dealer
Scrap dealer	<i>Intermediary</i>	An intermediary (link) between the middleman and the recycling company
Repairer (refurbisher)	<i>Informal</i>	Private electrical technician who uses separated functional materials from old electronics to repair others
Municipal waste collector	<i>Formal</i>	Public/private sector employee who engages in waste collection in households, markets and other public places

Source: Authors’ construct, 2012

* Bolaman literally means ‘waste man’

Participants in waste management in Accra are not a homogenous group. For ease of analysis, the predominant type of waste collected has been used to categorise them into groups. The ‘condemned’ are a male-dominated group who move from house to house buying used bottles and plastics for resale to formal industries. Typically, they are pensioners with a long history of involvement in the ‘waste’ business and knowledge of market dynamics. Hence, the more resourceful among them have taken up warehousing in anticipation of better profit margins in future. The Kaya bola operates like a just-in-time worker who collects mixed waste from houses, stores and offices, to deliver to the dump site for a fee (which depends on the volume of the waste). Although both men and women engage in this venture, it is dominated by men in their 20s, from northern Ghana, who normally use this activity as an entry point into the urban economy.

The e-waste recycler is among the beginners in the waste economy who specialises in picking recyclable elements to sell to intermediaries directly or after processing. They do not, however, have the luxury of warehousing to attract a better price, since the practice is their main livelihood. This is a male-dominated survivalist hand-to-mouth business, and has witnessed the involvement of children – some as young as ten – who engage in waste picking as part-time collectors in after-school activities or as truants. The middlemen serve as intermediaries between the recyclers and the scrap dealers, purchasing recovered materials (scraps) in bits from the recyclers and subsequently selling same in bulk to the dealers who, in turn, sell to refinery industries and exporters. The refurbishers, on the other hand, repair obsolete (broken-down) WEEE for reuse and/or they build up (install) new ones for the second-hand market. Generally, these shops have extensive inventories of accumulated parts to service the reuse cluster, and city refurbishers travel to the area to service or source spruce-up parts. Municipal waste collectors are employees of the private waste collection companies engaged officially by the local authorities. Most are academically challenged, since private entrepreneurs are loath to employ workers with good qualifications, probably for fear of increased wage costs. Generally, waste picking in the city seems to be the preserve of a particular ethnic group, and is often conducted by youth who have dropped out of school.

3.2 *E-waste estimates*

Participating in the ‘waste economy’ is neither incidental nor isolated, but is a reflection of the increasing engagement of most cities with EEE (Osibanjo and Nnorom, 2007). Although there is dearth of official data on the amount of EEE imports to Ghana, an estimated 215 000 tons were imported in 2009, comprising 30 per cent (64 000 tons) new products and 70 per cent (147 000 tons) second-hand (Amoyaw-Osei *et al.*, 2011). Figure 1 shows the trend of used computer imports from Organisation for Economic Co-operation and Development (OECD) and non-OECD countries to Ghana, from 2004 to 2010 with both clearly depicting a rising trend. In terms of material flow, studies (see Oteng-Ababio, 2010a, 2012a) have shown that

a failure to check for functionality has created a situation where 30 per cent (44 000 tons) of used imports remain unsellable (i.e., malfunctioning, broken down or outdated), while 20 per cent have to be refurbished to be functional.

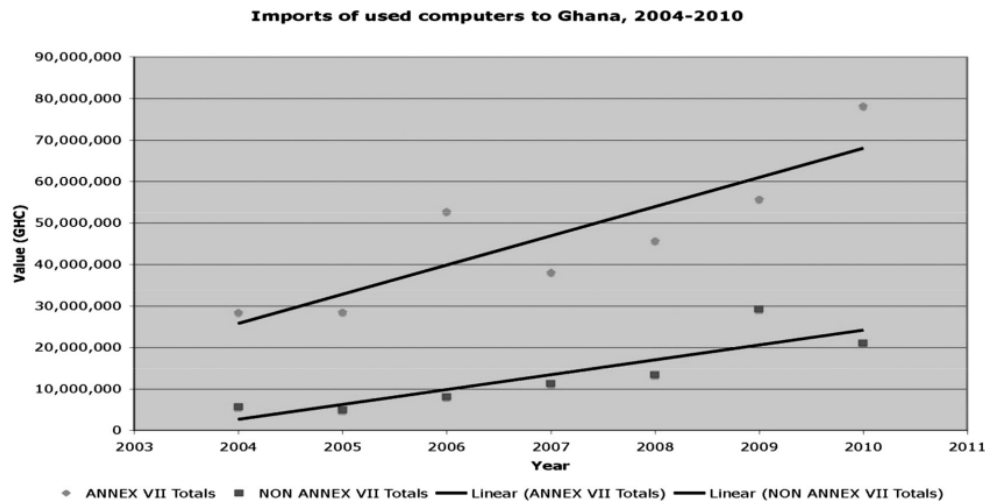


Figure 1: Used computer imports from OECD and non-OECD countries to Ghana, 2004–2010

Source: Authors' construct (2011); data from Customs Exercise and Preventive Service (CEPS) records (2011)

Recent studies have shown that the EEE sector achieved a 37 and 23 per cent growth rate in 2007 and 2008 respectively (Oteng-Ababio, 2010a). The current penetration rate of computers in the economy stands at 7.6 per cent (1.9 million units in 2009), against the 0.6 per cent reported by International Telecommunication Union (ITU 2008) and 1.1 per cent by the World Bank (WDI, 2008). Not only has the influx of WEEE imports increased the rate of e-waste generation, lack of proper infrastructure for its end-of-life recycling has invariably legitimised the embryonic informal recycling activity in the country.

3.3 Policy and legal framework

The sheer magnitude of the rate of e-waste obsolescence, increasing technological innovations, the lack of local infrastructural and the linked environmental challenges in the face of growing public environmental consciousness, create a 'new world, new waste, and new challenge' (Oteng-Ababio, 2010a). Legislative gaps and lax customs control provide opportunities for the illegal entry of e-waste into the country. As previously noted, there is currently no regulation dealing specifically with WEEE disposal, except some environmental legislation that incorporates sections on 'hazardous waste management and handling' (see *EPA Act, 1994*; *Pesticides Control and Management Act, 1996*; *Environmental Sanitation Policy of Ghana, 1999*).

Given the fact that most of these laws were passed long before the so-called 'e-waste menace' emerged within the entire Ghanaian geographical space, their key principles, which could impact on sustainable e-waste management, are vaguely defined. This effectively compromises their legal enforceability, especially in situations where the informal sector is not captured under any of the regulatory frameworks. Internationally, Ghana is a signatory of the Basel Convention, which prohibits trade between Annex VII countries (OECD, EU and Liechtenstein) and non-Annex VII countries. It is also concerned with waste minimisation and environmentally sound management. However, the Ghanaian government is yet to ratify (domesticate) the convention, which compromises its applicability.

Constrained by national laws and regulations as well as local government codes of ethics that outline right and wrong behaviour, or actions to conform to set standards and values, the floodgates have opened for the unrestricted importation of WEEE, which has led to a thriving e-waste economy. Admittedly, depending on social norms (which reflect how people respond to rules), managing a diverse and complex issue such as e-waste recycling with so many interested parties will be administratively unwise and ineffectual. At the same time, employing stringent conventional laws may also drive a defensive response (reifying the status quo). We believe any policy response should aim to strengthen local-level and community institutions and capacity, and strive to remove institutional constraints to inclusive practices. In order not to overwhelm or block their points of view, the involvement of all key stakeholders in the planning, implementation and monitoring processes is paramount.

4 The state of informality in the e-waste economy

Recent scholarship on e-waste recycling has either focused on explorative (value chain) analysis (Grant and Oteng-Ababio, 2012), social impacts (Prakash *et al.*, 2010), incentive systems (Amoyaw-Osei *et al.*, 2011), or health consequences (Asante *et al.*, 2012; Amankwaa, 2013). Areas that have received less attention include the structure and organisation of the formal–informal relationship, production processes and product outflows, market relations, and marketing networks. Yet, to appreciate the role of the informal sector in the WEEE economy, the chain of activities within the continuum must be comprehensively understood. Existing studies (Prakash *et al.*, 2010) reveal that Agbogbloshie treats over 171 000 tons of e-waste annually, with its recycling output amounting to US\$ 200,000 in 2009 (Amoyaw-Osei *et al.*, 2011).

Figure 2 presents the chain of activity in e-waste recycling in Agbogbloshie. From collection, dismantling and refurbishing, value is added at each stage of the chain, creating employment at different levels (Grant and Oteng-Ababio, 2012). During the recycling processes, reusable parts are retrieved and directly reapplied, creating revenue from both component reuse and material recycling. The modus operandi is very 'cost-efficient' due to the use of non-skilled manual labour and blatant disregard for any hazards to the environment (Chi *et al.*, 2011). It does, however, contribute to

the release of toxic metals (such as lead) and persistent organic pollutants into the environment (Brigden *et al.*, 2008), and into the air (Caravanos *et al.*, 2011), with negative health impacts (Asante *et al.*, 2012).

The chain of activities shows a vertical integration that encompasses a broader space-economy and some degree of specialisation and differentiation in terms of financial realisation. For example, the average daily earnings of collectors who are at the base of the 'e-waste financial ladder' is US\$3.50 per day (see Grant and Oteng-Ababio, 2012), which is about two and half times the average income of informal workers in Ghana (GSS, 2008). Indeed, collectors involved in dismantling and metal recovery earn an average of US\$8.00 a day. At the top of the income ladder are the scrap dealers who earn US\$50 per day. Just below them are the middlemen, who earn up to US\$35 a day. Studies show that refurbishment provides a steadier income stream than collection, earning such workers an average of US\$7 a day. The findings generally show that the upper end of the informal work hierarchy incorporates more regular working hours, and social ties as well as networking. In addition, it shows a steadier increase in the earnings of informal workers over the years. For example, Asiedu and Agyei-Mensah (2008) reported the average earnings of informal workers to be about US\$2.00, while more recently, Amankwaa (2013) recorded a figure of about US\$6.00.

5 Formal e-waste recycling

Though the informal e-waste activity is highly visible in the economy, insufficient collection efforts and resources, inappropriate recycling technologies, and illegal 'import' streams have brought their operations under public scrutiny. The government is being urged, mostly by ENGOs, to institute a formal recycling system as a way of addressing the challenges embedded in informal operations. Insights gleaned from the proposed e-waste management bill currently under cabinet consideration downplay the role of the informal sector. Should the bill become an act, there is the risk that the act may sooner rather than later join the many ill-fated MSWM policies (see Oteng-Ababio *et al.*, 2013) not only because the majority of Ghanaians engage with used EEE, but more importantly, the authorities lack the financial capacity to either acquire the needed capital-intensive recycling technologies and expertise, or to provide engineered landfills (see Obirih-Opareh and Post, 2002; Post *et al.*, 2003).

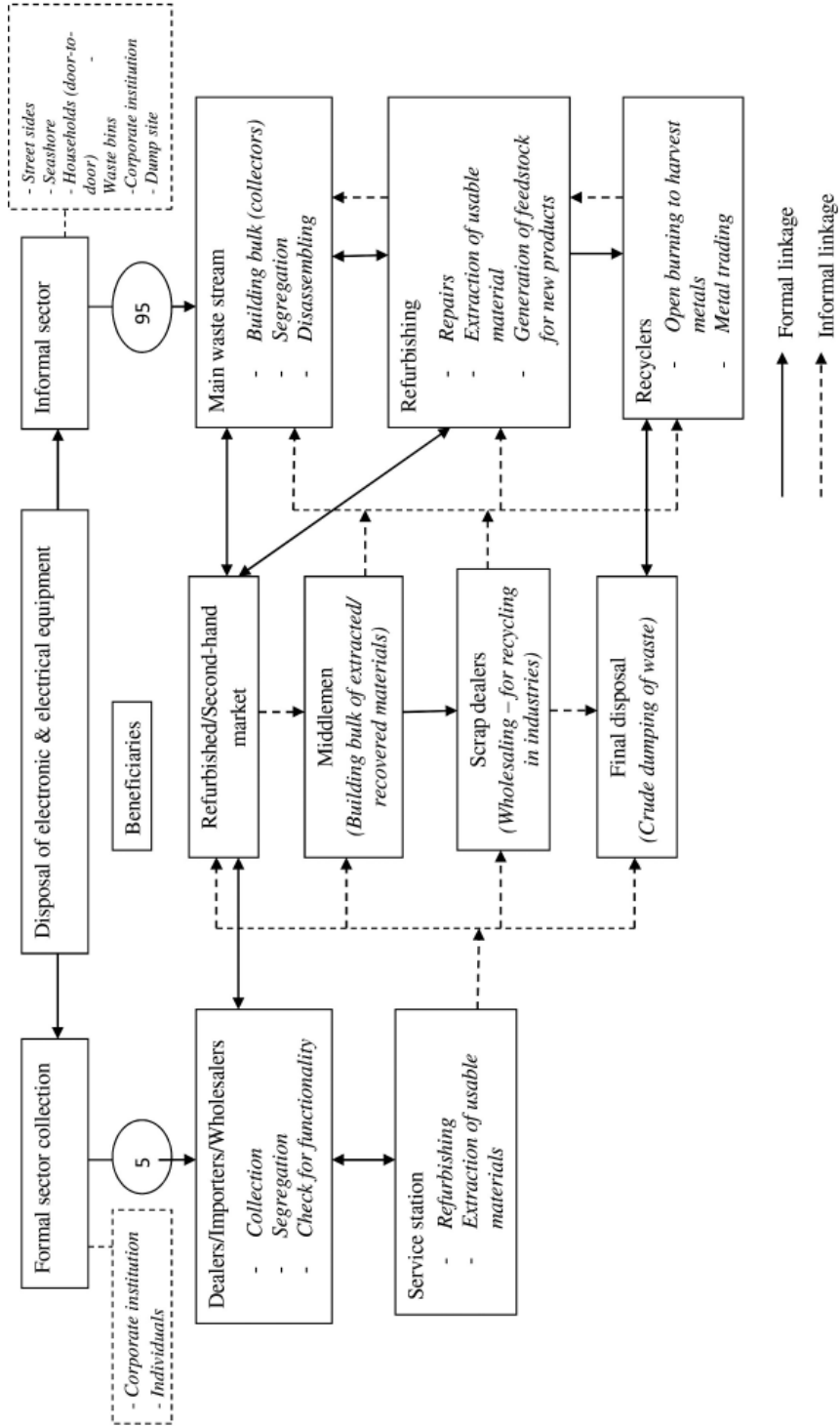


Figure 2: The current recycling and disposal practices in the study area

Source: Oteng-Ababio (2012b)

Additionally, in Ghana none of the EEE companies or their representatives operate any EPR which guarantees the institution of take-back¹ (or payback) facilities. At best, they maintain a limited presence only in Accra and Kumasi. The only EEE companies operating a semblance of EPR systems are two Ghanaian private companies – RLG Communications Limited and Kasapa (Expresso) Limited. RLG assembles mobile phones and laptops for markets in Ghana, the Gambia, Senegal, Nigeria and China. The company occasionally advertises for its customers to bring their old (not necessarily broken) phones and laptops for upgrading. However, our current findings reveal a disappointing response to the scheme, as the company does not even upgrade systems that were not obtained directly from its official outlet, or in instances where a customer misplaced the warranty card.

The other company, Kasapa (Expresso), is one of six mobile telephony companies in the country. The company initiated a recycling initiative by collecting consumers' obsolete cell phones and accessories, and has embarked on a vigorous campaign of television and radio adverts urging customers to return their obsolete equipment to any of its regional offices for placement or repairs at a discounted fee. However, the company, with a subscriber base of 186 000 in 2011, retrieved only 200 discarded phones after two years of rigorous campaigning on both radio and television. Apart from people engaging in an extensive reuse culture and thereby overstretching the geographies of users, many perceive used EEE as retaining a certain amount of value, and thus store it for a very long time. In parallel with these initiatives, Blancomet Recycling Company is the only formal private recycling firm to successfully consolidate its new e-waste recycling investment (in 2009). The company performs elementary dismantling, relying heavily on hand-sorting and dismantling. The plastic and metal components are recycled locally, while extracted motherboards are exported in raw form (a 40-foot container every two months), with Asia and Europe being the prime destinations.

5.1 Can the informal sector be excluded from e-waste recycling?

Determining the fate of the informal sector in any formal recycling system presents a challenge, as their marginalised and unstable social and economic circumstances make it quite difficult to integrate their contribution into the MSWM system (Schubeler, 1996). In particular, adopting the universal employment notion that 'links a person, called the employee (or a worker) with another person called the employer to whom she or he provides labour or services under conditions in return for remuneration' (ILO, 2003, p. 12) excludes those who engage in the sale of either collectors' tools (e.g., hammers, chisels, wrenches) or refurbished and spruced-up electronics. Yet they all play indispensable roles along the continuum, and their steady growth illuminates the sector's economic and environmental benefits and

¹ – a system that enjoins manufacturers/retailers to accept used WEEE at the end of the product's life.

potentials, which most studies have highlighted (Medina, 2000; Hayami *et al.*, 2006; Prakash *et al.*, 2010).

In the current global dispensation, attempts to change the working conditions of informal collectors may well be detrimental to their ability to make a living, thereby potentially excluding the very people the policy was intended to protect, while simultaneously creating inefficiencies in waste collection and sorting. The semblance of producers' buy-back interventions that are being experimented with in some developing countries (including South Africa) have not been successful. For example, the results of our study revealed that RLG, which operated ten regional offices, eight sales and 16 service centers nationwide, and retails 15 000 mobile phones and about 10 000 laptops a month, has only been able to collect and export 1 300 discarded mobile phones and 100 laptops annually to China for recycling. Indeed, another company, Kasapa (Expresso) only recovered 200 used phones between 2009 and 2011,² thus compromising the project's financial viability and sustainability.

All indications are that the formal sector not only lacks its own house-to-house collection networks, it also operates under a regulated environment which demands huge overhead costs that impact on its financial competitiveness. Altruism is not enough to guarantee recycling. Participants in the informal sector, on the other hand, are motivated economically and therefore are unable to overlook any potential opportunity for income. They have a penchant for seeking opportunities from that which is within their reach, albeit that their unregulated operations release toxics into the air (Caravanos *et al.*, 2011), contaminate water and soil (Brigden *et al.*, 2008), create serious health concerns (Agyei-Mensah and Oteng-Ababio, 2012; Asante *et al.*, 2012) and lead to low recovery of materials due to the use of rudimentary processes (De Soto, 1989).

Yet, advocating for the disbandment of the informal sector negates the fact that, currently, the sector recycles 95 per cent of WEEE in Ghana, and thus should form part of any formal business model (Oteng-Ababio, 2012b). By implication, any sustainable recycling project will need to appreciate and 'exploit' the advantages of this continuum (see Table 2), taking cognisance of macro-institutional issues and implementation challenges. In all probability, certain local-level and informal rules (including norms, values, and belief systems) that shape the behaviour and attitudes of social groups may impact negatively on implementation arrangements. A situation has arisen where the intended beneficiaries believe it is the government's responsibility to provide such public services for free, therefore they exhibit a reluctance to contribute either in cash or kind. This should be anticipated and addressed. Identifying such structural bottlenecks is imperative for any modifications to existing arrangements, and this is best achieved when all stakeholders are involved in the initial institutional planning, implementation and project analysis.

2 Personal communication with the Head Recycling Unit of the Company, November, 2012.

Table 2: The formal-informal interface – a comparative analysis

FORMAL	ATTRIBUTE	INFORMAL
– Higher cost	<i>economic</i>	– Lower cost
– Lower revenue		– Higher revenue
– Comprehensive	<i>technical</i>	– Manual dismantling
– Skilled technology specialised		– Rudimentary
– Sound	<i>environmental</i>	– Polluting
– Internalised		– Externalised
– Decreased livelihood	<i>social</i>	– Livelihood for the masses
– Authorised/legal	<i>legislature</i>	– Banned/illegal
– Low involvement	<i>market</i>	– Matured network
– High technology	<i>cultural</i>	– Historical (local knowledge)
– Rigid law		– Spontaneous (hereditary)

Source: Authors' construct (2012)

6 The proposed model

One way to improve conditions in the informal sector is to combine it with the formal sector more directly, in such a way that it will be accepted and supported in what can be called a 'federated model'. Within the Ghanaian e-waste economy, recognising the role of both the formal and the informal sectors is desirable but daunting: desirable because the informal sector continues to play an important role within the value chain due to its employment-generating potentials, experience and work ethics; daunting due to its modus operandi and fragmented nature. The challenge is to find a way to mobilise and involve various individual groups with diverse networking agendas and interests in a cooperative body, and to dovetail their experiences professionally into the formal system. Its multi-stakeholder nature requires a multi-level approach for their inclusion into the formal sector. Currently, one of the biggest challenges facing the informal e-waste recycling industry is constant harassment from city authorities due to workers' perceived illegal status, occasioning alleged extortion from the city police (Oteng-Ababio, 2012b).

The formal e-waste sector is in its formative stage and is beset by teething problems. Based on current knowledge, we propose a model that draws on the ingenuity gleaned from both sectors, with the aim of strengthening local-level and community institutions, enhancing self-help capacity, and removing institutional constraints to inclusive practises (see Figure 3). This will not only serve as a springboard for further management research but, more importantly, will identify the various strengths located within the chain of activities relevant for achieving social development, and will highlight potentially adverse impacts. This is particularly the case in situations where most local authorities remain cash-strapped in the face of chronic infrastructural deficiencies.

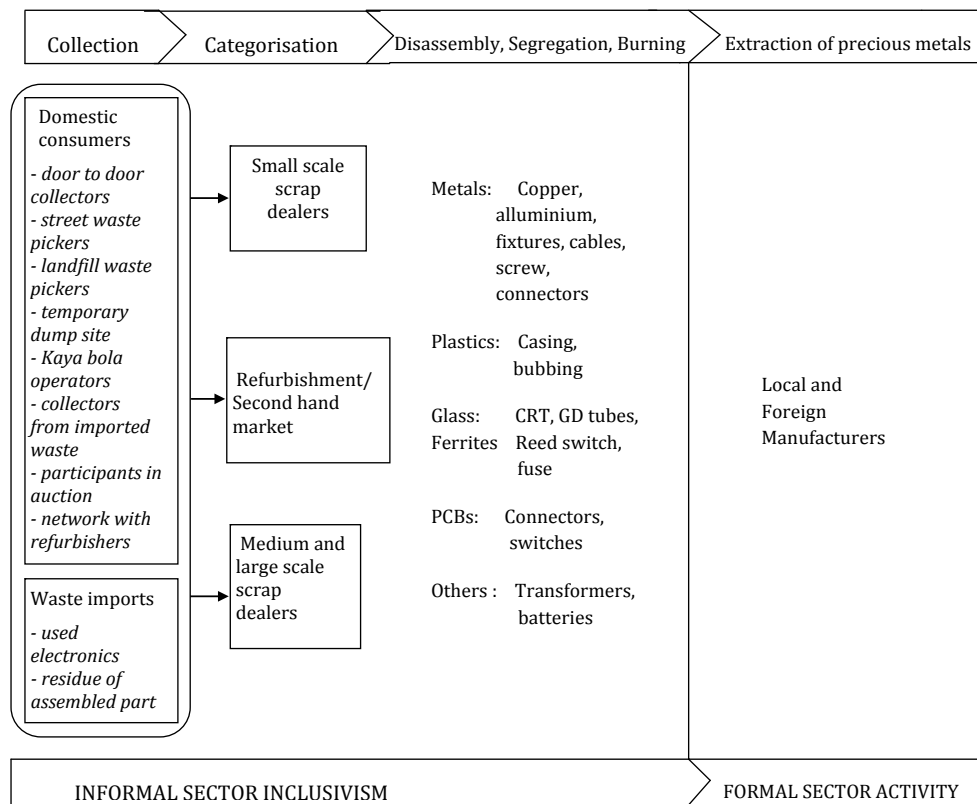


Figure 3: The federated model for e-waste recycling

Source: Authors' construct, 2012

A study by Amoyaw-Osei *et al.* (2011) revealed e-waste recycling output in Agbogbloshie in 2009 to be US\$ 200,000 – a potential socio-economic development indicator which must be mobilised and regulated. However, any success will necessitate the creation of a superintending body to coordinate the activities of the fragmented entities and to develop internal decision-making structures, mechanisms for conflict resolution and the mobilization of financial resources. We are convinced that the way forward in tackling this new waste (e-waste), which is creating a new challenge (providing livelihood in environmentally challenging conditions) in a new (globalizing) world, is to officially tap into and properly recognise the formal–informal continuum through mobilising, regulating and ‘professionalising’ the activities of the various interest groups.

In linking such a formal and informal relationship which is characterised by complex forms of domination, subordination and exploitation (Obeng-Odoom, 2013), we need to move beyond the normal quantitative economic ‘growth’ indicators (Grant, 2009) to reconceptualise the essence of development to include social emancipation (see also Anyidoho, 2010). The successful implementation of

our proposed model will define the specific responsibilities and contributions of each stakeholder group, and will make social transformation central not only to the methodology of development, but also to its end result, for the full and equal participation of formerly excluded groups in the initiation, design, implementation and outcome of projects. As noted by Connell (1997, p. 254), if such a relationship is to be self-sustaining, participation must translate into dynamic self-organisation and be consciously 'integrated into all project efforts, not only to facilitate the direct, immediate participation of the poor, but also to ensure that these efforts support long-term engagement, education, and action'. Bernstein (2004, p. 22) emphasises that comprehensive stakeholder involvement and 'dialogue help determine implementation options including institutional changes, capacity building, targeting, sequencing, subsidies and incentives'. The local authority's role in this direction is paramount, including, for example, familiarising community members with similar efforts elsewhere, and linking various community-based initiatives, so as to facilitate the growth of regional, national, and even international networks (Connell, 1997).

Generally, inadequate human capital and financial resources, and to some extent legal obligations, will most certainly restrict the informal sector to those activities that take place at the beginning (local level) of the e-waste recycling chain – collection, dismantling, disassembling for re-use, preparation for recycling (e.g., shredding) – while the formal sector engages in the capital-intensive, expert-driven upstream recycling which covers benefits, as well as risks, conflicts and costs. The danger is whether we will, with our proposed model, be promoting and endorsing informality while forsaking job creation. We are conscious of the fact that the formal sector is [or is supposed to be] regulated by formal laws and regulations, and that if policies are not properly planned, promulgated and implemented, such interventions can propagate informal workers' marginality and vulnerability (see Sternberg, 2013). Sternberg highlights this observation when examining the interconnections between neoliberal urban policy ascendancy and waste pickers (*cartoneros*) in Buenos Aires. She notes that 'regulating the activities of the *cartoneros* did not entail giving them an opportunity to play central roles in the city's waste management system but was compatible with the logic of the local neoliberal intention to discipline the city's physical and social landscape as new opportunities for growth and development emerge' (Sternberg, 2013, p. 187).

We are convinced that with proper stakeholder participation in the planning and implementation processes, our model will yield successful outcomes. Our thinking is bolstered by experiences from Cairo (Egypt) and Ciudad Juarez (Mexico), where the informal sector has been properly involved in the initial decision-making process of crafting such policies, so that the sector has been successfully organised into recycling cooperatives and granted concessions for collecting and recycling solid waste (see Pfammater and Schertenlied, 1996). In Pakistan, too, there is the well-known Orangi Project (see Hasan, 2006), established to assist the 'katchi abadis' (unauthorised settlements on government land) in developing their own 'internal'

sewerage and sanitation facilities. Hasan opines that the results have abundantly demonstrated that communities can effectively and efficiently finance, manage and build on internal development, as long as they are organised and are provided with technical assistance and managerial guidance.

While all these examples are different both geographically and contextually, they share the principle of participatory and inclusive development (see Connell, 1997; Feeney, 1998; Dipholo, 2002; Anyidoho, 2010). These researchers have highlighted the core principles inherent in this approach to development: an emphasis on inclusivity, empowerment, local control, human rights and flexibility. Consequently, development is seen as a multifaceted process not only *for* the local people, but also *by* the local people, to build capacity and control their future (Dipholo, 2002). Feeney (1998, p. 10) explains that participatory development is an opportunity for citizens, the public and private organisations to express their opinions, and to have their priorities and needs integrated into government policies or programmes.

It is not enough to consult beneficiaries and then to act on their behalf. Nor is it usually enough to engage people in a development process if the conceptual orientation and the language of that process do not relate to their experience, and if they lack the tools to assess their needs effectively and to know what options are available to them to bring about constructive change. (Connell, 1997, p. 250)

These studies have demonstrated that to achieve effective inclusivity, all the available knowledge (within and outside the community as well as within and beyond the reach of participants, local members, development agents, sponsoring agencies) must be accessible to all stakeholders. This reinforces Connell's (1997, p. 251) assertion that inclusive development is both a methodology and a strategic goal, but not something to be added onto or inserted into a development model. Rather, it provides an alternative pathway to improving people's standards of living, starting with the identification and description of problems, needs and opportunities – a process that requires specific tools, the equitable distribution of power (empowerment) and a grasp of the context, if it is to be carried out effectively (Connell, 1997; Martinussen, 1997; Dipholo, 2002). This is particularly true for improving conditions in the e-waste formal and informal recycling sectors.

Of course, our model needs to be accompanied by policy commitment and ample financial incentives. Involving all the stakeholders in planning and instituting appropriate tax and subsidy policies for the formal sector can change the nature of products and reduce social costs, while simultaneously advancing pro-poor economic policies and promoting the use of recycled materials. We submit that while regulations are important, appropriate incentives are even more effective in modifying public behaviour and reducing waste diversion.

7 Conclusion: The federated model – fact or fantasy?

Earlier studies have amply demonstrated that statistical information on the informal economy is relatively underdeveloped (see Obeng-Odoom, 2011, p. 358). Accra's

economy, estimated to be about US\$ 3billion (or 10% of national GDP) is based on the services sector, which accounted for 48 per cent of the country's GDP in 2011 (ISSER, 2013). Thus, the sector's contribution, mainly driven by the informal economy, is immense, vital and hard to objectively deny, but government policies and regulations either overlook this fact, or work against it. The local government from time to time attempts to outlaw the city's most visible (and perhaps most important) economic activity through the passage of by-laws prohibiting street-level sales, market trading without permits, and, in respect of MSWM, through using force and harassment against informal waste collectors (Agyei-Mensah and Oteng-Ababio, 2012).

This development is happening at a time when e-waste recycling appears to have assumed a geographic and socio-economic division of labour: enforceable legislation, identifiable separate collection channels and capital-intensive sophisticated treatments are only operational in developed countries, while lax regulation, unregulated repairs and reuse with sub-standard informal recycling predominate in less developed countries. This dualism needs to end if we are serious about environmentally sustainable WEEE management. The national authority is financially, legally and socio-culturally too challenged to adopt, on a wholesale scale, developed-world models. Instead, it seems more practical and sensible to involve, recognise, mobilise and regulate the informal sector and to find ways to encourage its growth through effective stakeholder participation. Hence, we call for a federated model to incorporate and include various stakeholders.

Apart from economic reasons (70% of EEE imports are second-hand), there is currently no incentive to attract WEEE at the household level in the country. At the local level, there is always a higher propensity for communities to focus on their immediate interests and to neglect more strategic issues. This reality must be appreciated to warrant a review of the laws governing waste management at the local level (Medina, 2005; Dhuy, 2008; Liu, 2008). It is from this perspective that we hope our model can create a field of opportunity for stakeholders (formal and informal) to address local concerns which may cascade into regional and (possibly) the national agenda. This will serve to increase social legitimacy and decrease stigmatisation. Key research informants articulated a number of potential material benefits related to formalisation, including access to sorting and storage areas, and the possibility of up-scaling the volume of their operations.

However, the benefits of formalisation would not be without costs and would be limited to those workers who affiliate with the process. Geographical and/or interpersonal barriers to a new affiliation will arise. Those operating informally may not be interested in working under a collective working structure, due to relatively low levels of trust and camaraderie among them. Those relying on informal work as a temporary or occasional work strategy may not be interested in becoming involved in a work organisation that requires a long-term and possibly time-intensive commitment.

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We accordingly propose that further measures be taken to address the possible social and economic marginality of certain workers who worked informally pre-formalisation. For example, the intervention of the government as a possible guaranteed buyer of recyclable materials at subsidised prices that favour the informal sellers may be a welcome idea. However, such a proposition would be more expensive for the already cash-strapped municipality, and so is an unlikely intervention, although in reality it is not unusual for municipal recycling programmes in the global North to occasionally run at a financial loss, due to the unstable nature of recycling markets.

In the long run, we are hopeful this could be a springboard for the government to enact a legal framework that will compel large waste generators (corporate entities) to play an active role in the management process, once local situations have been sanitised and properly established. Presently, none of the bigger players in the industry have waste disposal policies: waste is disposed of in an unregulated manner, to those who can pay the highest price – little consideration is given to the environmental, or health and safety standards. With efficient local structures, community participation and capacity building, restructuring and regulating key stakeholders presents a less significant challenge. The big electronic companies can then be motivated to apply minimum standards in their e-waste disposal. Government will be expected to take the lead in creating the necessary space, awareness and regulatory framework to enhance community participation in the planning, implementation and monitoring of any policy interventions.

We risk misunderstanding the dynamics of the new world, new waste and the new challenges of contemporary economic geography, if we defy local knowledge and import completely foreign-based models. In practice, most formal private firms have opted for an informal relationship that obliterates formal obligations to their employees, and as rightly noted by Chen (2007, p. 9) it is the formal firm, not the informal worker, who decides to operate informally and enjoys the benefits of informality. Thus, involving informality in WEEE recycling policies needs rethinking and reincorporation into a more democratic government-managed stewardship of the economies and the environments. Our proposed system will not be without implementation difficulties, but it is more democratic and inclusive and is a viable way forward.

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