Amankwah-Amoah, J. (2016). Navigating uncharted waters: A multidimensional conceptualization of exporting electronic waste. *Technological Forecasting and Social Change*, 105, 11-19.
<https://doi.org/10.1016/j.techfore.2016.01.022>

Peer reviewed version

Link to published version (if available):
[10.1016/j.techfore.2016.01.022](https://doi.org/10.1016/j.techfore.2016.01.022)

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This is the author accepted manuscript (AAM). The final published version (version of record) is available online via Elsevier at <http://www.sciencedirect.com/science/article/pii/S0040162516000238>.

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Navigating uncharted waters: A multidimensional conceptualisation of exporting electronic waste

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ABSTRACT

In spite of a growing body of scholarly works on the emerging phenomenon of exporting electronic waste (e-waste), international business, e-waste management, technological forecasting and strategy scholars have remained surprisingly silent on the subject. This paper presents an integrated conceptual framework that clarifies the boundaries and dimensions of exporting e-waste. By integrating the two types of recipient countries (i.e. developed and emerging economies) with two types of originating countries (i.e. developed and emerging economies) led to the development of an integrated 2x2 matrix. The integrated framework is then utilised to illuminate how push and pull factors specific to both the originating and recipient countries interact to determine nature and directions of exporting e-waste. The study outlines directions for future research and practical implications.

Keywords: Electronic waste; e-waste; global business; developing countries.

1 Introduction

Over the past few decades, a growing body of empirical work has documented the emergence of electronic-waste (e-waste) as not only an incipient policymaking issue but also a promising avenue for future research (Asante et al., 2012; Baldé et al., 2015a; UNEP, 2015). At the same time, there has been an incessant global growth of e-waste which is projected to surge to 50 million metric tonnes (Mt) by 2018 from 41.8 Mt in 2014 (Baldé et al., 2015b). Past studies indicate that by 2020, emerging economies such as China and South Africa will have between 200–400% more e-waste from old computers than in 2007 and India around 500% (Lundgren, 2012).

Perhaps the most puzzling is the fact that, despite the general awareness of the hazardous effects of e-waste and the need to recycle at source, exporting of e-waste from developed to developing countries has surged exponentially (Lepawsky, 2015a; Garlapati, 2016; Orlins and Guan, 2015). The emergence and growth of e-waste exporting may appear to contradict the long-held assertion by some scholars that “exports are good, and exporters are good firms; thus helping domestic firms export is good policy” (Bernard and Jensen, 2004, p. 561).

Although exporting e-waste has emerged as one of the contemporary issues in this unique area, to date, international business and strategy scholars have surprisingly remained silent about this growing phenomenon, with notable exceptions. The issue of exporting per se is not new to international business and strategy scholars (see Cavusgil, Knight and Riesenberger, 2012), nonetheless, the recent development of exporting e-waste offers the potential for cross-discipline fertilisation. Furthermore, the accumulating body of scholarly works has also brought to the fore a need for more robust explanations and conceptualisations of the subject (Cui and Zhang, 2008; Lepawsky, 2015a).

The main purpose in this paper is to propose an integrated conceptual framework which clarifies the boundaries and directions of flow of exporting e-waste. The secondary objective is to examine the precipitating factors of exporting e-waste. In attempting to synthesise the diverse streams of research on the subject and explicate our conceptual framework, illustrative cases are employed to shed additional light on the subject.

The study makes two main contributions to waste management, international business, technological forecasting and strategy research. First, although exporting e-waste has taken a pivotal role in contemporary management discourse (Baldé et al., 2015a), our understanding of the features remains limited. Nearly all of the existing bodies of literature have examined the subject from a narrow perspective of e-waste from developed to emerging economies without accounting for the reciprocal flow and/or the precipitating factors. The study departs from the current trend to examine flows from both directions. In addition, an integrated framework of pull and push factors is developed which links the dimensions. By addressing the examining the drivers of exporting e-waste, the study offers a more complete explanation of the drivers of e-waste and goes a long way to explain the growth in many developing countries (Garlapati, 2016).

The rest of this paper is organised into three sections. In the first section, a review of studies on exporting e-waste is presented. In the second section, the pillars of the integrated conceptual framework are set out. This is accompanied by an explication of the key features of the framework. The final section discusses the implications for governments and global business.

2 Background Literature

Electronic-waste or waste electrical and electronic equipment (WEEE) refers to end-of-life electrical and electronic equipment such as computers, printers, television sets and mobile phones in one market (Garlapati, 2016; Wong et al., 2007). It is associated with the disposal of old electrical and

electronic equipment which has reached an end of their lifespans. It is worth noting that such products can have their lifespan extended as second-hand goods or repair and re-use by users in the same or another country (Amoyaw-Osei et al., 2011). The waste often contains toxic or hazardous materials such as flame retardants, arsenic, cadmium and polyvinyl chloride which can cause significant harm to human life if not properly treated and disposed of (United Nations, 2014). The unprotected exposure to waste can also cause food contamination, cancer and reproductive disorders (Lepawsky, 2015a). It is worth noting that some e-wastes can be recycled, repaired and re-used, or sold in in aftermarket (Amoyaw-Osei et al., 2011).

Exporting electronic waste refers to the processes of transporting e-waste from one country to another. The process entails partners such as originating and recipient countries, multinationals, handling agents and market intermediaries. Historically, the notion that used products are exported to countries in different stages of development can be traced as far back to the emergence of colonial rule and international trade. During the colonial era, it was not uncommon for the colonial masters to export or pass on used products to their servants or “subordinates” in other countries (Amankwah-Amoah, 2015).

During the early 2000s, many countries in the developing world mainly in Africa and Asia began to experience a surge of e-waste imports. At the outset, the potential for many of the poor in Africa and elsewhere to gain access to old technologies such as computers, cassette players, mobile phones, television sets and fridges meant that there was little resistance to the inflow of e-waste. Indeed, many countries in Africa which were “hungry for information technology but with a limited capacity to manufacture it” turned to such second-hand imports (Schmidt, 2006, p. A234). There are some sectors such as the appliance repair industry and second-hand traders that have flourished on the back of the growth of such waste (see Amoyaw-Osei et al., 2011 for a detailed overview). Over time, the demands for such products coupled with a lax regulatory environment fuelled the growth of e-waste

imports, thereby making sub-Sahara Africa one of the leading destinations for obsolete electronic equipment (Schmidt, 2006; Lepawsky, 2015a, 2015b). Another factor that has contributed towards the growth of e-waste is limited governments’ ability to collect and recycle new waste.

In recent years, around 80% of the electronic waste generated in the US is exported to developing countries in Africa and Asia, often with lax health and safety regulatory regimes (The Economist, 2014). Since the turn of this century, the growing number of products becoming obsolete in the developed world has contributed to the growth of e-waste in many developing countries (Lundgren, 2012). At the same time, the number of un-useable second-hand products ending up been dumped has surged and countries began to question their previous assumptions that e-waste can be good. In recent years, e-waste has surged to become a major problem facing many countries in both the developed and developing world, exemplified by the quote below:

“Of the e-waste in developed countries that is sent for recycling, 80 per cent ends up being shipped (often illegally) to developing countries such as China, India, Ghana and Nigeria for recycling. Within the informal economy of such countries, it is recycled for its many valuable materials by recyclers using rudimentary techniques” (Lundgren, 2012, p. 9).

In recent years, governments around the globe have begun to re-enact new laws aimed at closing the gap that has allowed firms to export e-waste illegally. It must be noted that e-waste treatment in the developing world largely occurs in the informal section, where workers are often untrained to contain the harmful elements (Orlins and Guan, 2015). Consequently, many workers in this area are often exposed to toxic substances (Asante et al., 2012; Orlins and Guan, 2015). Exporting to under-developed countries where workers uses sub-standard equipment can increase this particular risk (Garlapati, 2016; Orlins and Guan, 2015).

Insert Figure 1 about here

A line of research has demonstrated that e-waste exporting is partly predicated on the existence of agents or market intermediaries who collect the waste for shipment (Puckett et al., 2002). By market intermediaries we are referring to third-party firms or “middlemen” who perform the function of facilitating the movement of goods and services (Peng and York, 2001). The unscrupulous market intermediaries known as “waste tourists” (Nordbrand, 2009) who have historically collected e-waste and illegally exported it to developing countries for profit, have also begun to see their role coming under greater scrutiny (Lundgren, 2012). Indeed, the WEE supply chain entails recyclers and brokers often operating in the highly unregulated market, lacking government certification schemes (Schmidt, 2006). As Lundgren (2012, p. 9) further observed:

“Recyclers and waste brokers are taking advantage of lower recycling costs in developing economies and at the same time avoiding disposal responsibilities at home ... up to 80 per cent of all e-waste sent for recycling in developed countries ends up in informal e-waste recycling sites.”

As can be seen from Figure 1, the market intermediaries are positioned as links between the originating and recipient countries.

3 Push and pull factors in exporting e-waste

The review of the literature uncovered two competing theoretical perspectives on exporting of e-waste i.e. the originating country hypothesis/push factors and recipient country hypothesis/pull factors.

3.1 The originating country hypothesis

The originating country hypothesis contends that it is rather the factors rooted in the source country which create conditions that allow firms and individuals to facilitate export of e-waste. Past studies have uncovered push factors such as high labour costs, high cost of recycling and stringent regulatory frameworks that compel firms to explore opportunities beyond their national borders to

recycle or discard e-waste (UNEP, 2015; Lundgren, 2012; Nnorom and Osibanjo, 2008a). Another line of argument suggests that the intense competitive pressure on developed-country firms to reduce costs has forced some firms to seek to export e-waste to low-cost locations where they can recycle more cheaply (see Slade, 2006; Nnorom and Osibanjo, 2008a). It has been suggested that unwillingness of manufacturers to treat the waste of their products and lack of will on the part of some advanced economies to force firms to recycle all their waste, have opened an avenue for market intermediaries to export e-waste to developing countries where it can be disposed of cheaply. Another recent study by UNEP (2015) identified factors such as high costs of treating and disposing hazardous, weak regulatory enforcement regime and low environmental awareness as some of the primary drivers of e-waste exports from developed countries to developing countries.

A stream of research indicates that international treaties can play an influential role in the direction of e-waste flow (see Lepawsky, 2015a, 2015b; Souza, 2013; Lundgren, 2012). One of the main treaties in this area is the 1989 Basel Convention treaty, a global treaty which controls the export of hazardous waste around the world (Lepawsky, 2015a). It seeks to ban countries from exporting useless e-waste to poor countries as well as encourage e-waste recycling (Schmidt, 2006). Unfavourable conditions and stringent regulatory frameworks in the home country can compel multinationals to export e-waste (UNEP, 2015).

3.1.1 Product take-back legislation

One of the most intriguing areas in regulating e-waste exports in recent years relates to product take-back legislation (see Navarro, 2011). Take-back legislation is anchored in the concept of extended producer responsibility (EPR) which imposes additional responsibility on manufacturers to take back used electronic and electrical products at the end of their useful life and dispose of them in a safe and secure manner (Atasu and Van Wassenhove, 2012; Souza, 2013). In recent years, EPR has emerged as the main policy tool used by governments seeking to manage e-waste flows (Gui, Atasu, Ergun

and Toktay, 2015). The key premise is that by making producers responsible for the disposal of their products, they would have the incentive to utilise recyclable and cost-efficient materials, thereby avoiding using hazardous elements (Lundgren, 2012). A large proportion of EPR implementations are carried out through large collection and recycling networks which handle multiple products (Gui et al., 2015). Such large-scale collection allows economies of scale to be accrued as well as the creation of space for market intermediaries to emerge in the chain.

To illustrate this line of argument further, we first turn to the Waste Electrical and Electronic Equipment Directive in the European Union which was one of the earliest and most prominent examples of take-back legislation (see European Commission, 2003a and 2003b, for additional details on the policy). This directive enforces manufacturer responsibility for e-waste waste for 11 product categories including cell phones and large household appliances (Atasu and Van Wassenhove, 2012; Souza, 2013).

Similarly, Japan has implemented the Specified Household Appliance Recycling Law and in the United States there are over 25 states with some form of take-back legislation for e-waste geared towards encouraging e-waste recycling (Electronics TakeBack Coalition, 2014). Product take-back legislation has been found to minimise the environmental impact associated with disposal of e-waste and incentivised manufacturers to design greener products (Atasu, Ozdemir and Van Wassenhove, 2012). It is contended that mandatory take-back is more likely to have a visible impact than voluntary or negotiated take-back programmes (see also Nnorom and Osibanjo, 2008a; Atasu and Van Wassenhove, 2010).

Nevertheless, these actions often do not guarantee that the waste will not be exported to the developing world. The mere existence of product take-back regulation is unlikely to deter exporting of e-waste, rather it is the compliance and enforcement that would help to deter or stem the flows

from developed to emerging economies. The unwillingness of many manufacturers to treat the waste of their products and lack of will on the part of advanced economies to force firms to recycle all their waste, have opened an avenue for market intermediaries to export e-waste to developing countries where it can be disposed of cheaply.

Although many countries have some form of take-back legislation with the aim of reducing e-waste and encouraging recycling, enforcement tends to differ (Atasu and Van Wassenhove 2009). Some have attributed the degree of enforcement and effective implementation of such “rules of the game” to power and pressure of stakeholders such as green organisations, environmental pressure groups (such as Greenpeace) and the NGOs (Atasu and Boyaci, 2010).

3.2 The recipient country hypothesis

The recipient country hypothesis contends that destination countries possess some features or conditions that make them an attractive destination for e-waste. In other words, pull factors pertain to political, economic and legal factor conditions in recipient countries that encourage the inflow of e-waste (see Baldé et al., 2015b; UNEP, 2015). These include weak law enforcement mechanisms and lack of effective laws to deal with e-waste. Past studies have identified factors such as the nature of domestic laws and regulations, and environmental pressure groups which play a pivotal role in influencing the flow of e-waste (see Lundgren, 2012).

Scholars have long established that stakeholders can exert pressure to influence the adoption of new practices by firms (Freeman, 1984). Many firms conform or respond to the pressures exerted by powerful stakeholders who often demand an adoption of a particular course of action or deviation from causing harm to others (see also Laplume, Sonpar and Litz, 2008). In countries with weak environmental groups, there is likely to be little pressure on politicians and policymakers to initiate, develop and enforce strict environmental standards or take-back regulations. Countries with powerful

environmental groups are more likely to deter dumping and encourage strict environmental standards. Consequently, weak environmental standards in many developing countries have created conditions for e-waste inflow and informal recycling leading exposure to toxic elements (de Oliveira, Bernardes and Gerbase, 2012; Atasu and Boyaci, 2010). Table 1 provides a summary of a host of factors identified by past studies on e-waste.

Insert Table 1 about here

Taken together, there is a host of factors in both the originating and destination countries which are institutional in nature, conceptualised to influence the evolution. These are “rules of the game” which include formal factors such as regulations and laws, and informal factors including culture, traditions and norms (Peng et al., 2008). As illustrated in Figure 2, both push and pull factors interact to precipitate the exporting of e-waste. The push factors include the incentives, forces and cues the persuade firms to export their waste to developing countries. These factors which relate to market conditions broadly determine whether a firm decides to export waste to another country.

Insert Figure 2 about here

4 A multidimensional framework for analysing exporting electronic waste

Having set out the literature on exporting e-waste, we now turn to the conceptual framework. To develop a multidimensional framework, it is contended that there are two types of countries, i.e. originating/source countries and recipient/destination countries. Historically, the source countries for e-waste have been developed countries and the destination countries have often been developing countries. Over the past few years, many developing countries have opened up their economies more widely to welcome foreign direct investment and imports (see Cui, Meyer and Hu, 2014; Amankwah-Amoah, 2016b). This has also been accompanied by the inflow of e-waste often with varying

consequences for their economies (Asante et al., 2012). Given that the flow of e-waste extends beyond a simple flow from developed to developing countries (Lundgren, 2012; Lepawsky and McNabb, 2010), the conceptualisation is extended to reflect these complexities inherent in examining the subject.

Based on this, there are broadly two types of originating countries, i.e. developed and emerging countries and two main types of destination countries, i.e. developed and emerging countries. Emerging market economies refers to “a subset of former developing economies that have achieved substantial industrialization, modernization, improved living standards and remarkable economic growth” (Cavusgil et al., 2012, p. 254; Amankwah-Amoah, 2016a). Examples of emerging economies extend beyond the so-called BRIC countries (Brazil, Russia, India and China) to include other classifications such as MIKT (Mexico, Indonesia, South Korea and Turkey) and PINE (Philippines, Indonesia, Nigeria and Ethiopia).

Insert Table 2 about here

Table 2 provides a summary of the various acronyms used to classify emerging economies. On the other hand, developed economies refer to “post-industrial countries characterized by high per capita income, well-developed education system, highly competitive industries and well-developed commercial infrastructure” (Cavusgil et al., 2012, p. 254). Examples of developed countries include the United States, Canada, Australia and Western European countries. Using these insights, we developed a 2X2 matrix to articulate the features and directions of e-waste flows, as demonstrated in Figure 3. Four quadrants are deduced in the model that differentiates the various dimensions and flows of e-waste activities. Below, we explicate the key features of the four quadrants.

Insert Figure 3 about here

4.1 Quadrant I: From emerging to emerging economies

Quadrant I characterises where there is an international flow of e-waste from one emerging economy to another. It may be driven by country-specific factors such as government policies and well-developed manufacturing centres. An important driver within this quadrant is a “race to the bottom” as many multinationals seek countries with low tax rates, low or non-existing environmental regulations and restricted workers’ rights where e-waste can be disposed of more cheaply. In this regard, Puckett et al. (2002, p. 11) stressed that:

“E-waste exports to developing countries are motivated entirely by brute global economics. Market forces, if left unregulated, dictate that toxic waste will always run ‘downhill’ on an economic path of least resistance. If left unchecked, the toxic effluent of the affluent will flood towards the world’s poorest countries where labor is cheap, and occupational and environmental protections are inadequate.”

One emerging body of work posits that the failure of manufacturers to take back used products has created conditions for used products to be dumped in the developing world. Unlike many advanced economies with product take-back legislation, developing countries often lack such regulations (Nnorom and Osibanjo 2008b). This has created an environment where firms seek locations where e-waste can be recycled cheaply. Rising recycling costs and wages in some emerging markets such as China have also prompted firms to seek alternative low-cost destinations. As Puckett et al. (2002, p. 11) observed:

“Hazardous waste trade allows waste generators to externalize their costs ... As long as one can cheaply dump their waste problems on poorer economies, there will never be incentives to minimize hazardous waste at the source. This forestalls the necessary innovation to solve environmental problems through design.”

Research in this area could proceed by examining additional forces towards this quadrant beyond cost.

4.2 Quadrant II: From developed to emerging economies

Quadrant II represents a situation where e-waste is exported from an advanced economy to an emerging economy. Two important factors are advanced to influence this shift: regulatory environment and cost drivers. A line of research indicates that, faced with high costs of recycling waste at home and intense competitive rivalry, many Western multinationals and firms often opt to export e-waste to developing countries with low-cost locations (see Kuper and Hojsik, 2008). Exporting waste to developing countries has traditionally been viewed as a convenient mechanism for industrialised nations and multinational enterprises to avoid the high cost associated with disposal and the intense public scrutiny (Puckett et al., 2002).

One of the benefits of such e-waste exporting is that it enables firms in advanced economies with stringent regulatory frameworks and high recycling costs to bypass the constraints by taking advantage of lax or non-existing regulatory environments and low labour cost in developing countries (Nnorom and Osibanjo, 2008a). By taking advantage of such conditions, the focal firms would be able to recycle or dispose of waste more cheaply than rivals and accrue higher profits. Strict enforcement of the Basel treaty by signatory nations should in theory help to mitigate the growth of exporting electronic waste, yet many countries lack the capacity to do so. For instance, in 2005, inspections of 18 European seaports uncovered that around 50% of the e-waste intended for export to developing countries was actually illegal (The Economist, 2014). More importantly, the Basel treaty is yet to be signed by the United States. The US remains the only developed country yet to ratify fully the treaty (The Economist, 2014). Consequently, Moran (2006, p. nd) noted that:

“While a combination of United States laws and regulations ban dumping electronic waste in domestic landfills, many recyclers and brokers export e-waste to mostly unregulated markets overseas. About 80 percent of computers and other electronics collected for recycling are dumped in landfills in developing countries.”

Schmidt (2006, p. A235) added:

“As long as the export goal is ‘recycling’ U.S. shippers can legally send e-wastes wherever they wish.”

The case of Nigeria also helps to illustrate the arguments well. It has been recognised that the cost of recycling e-waste is relative low in countries such as Nigeria compared with the United States. This often means that companies are more reluctant to attempt to recycle in developed countries, thereby precipitating the surge to dispose of waste in the developing world for recycling. It was commonly held that it costs around US\$5,000 to ship a 40-foot container of e-waste from the US to Africa (Schmidt, 2006).

However, in many African countries “only 40 good Pentium III computers pays for an entire container, leaving a comfortable margin for profit even if the container is loaded with mostly unusable waste” (Schmidt, 2006, p. A234). Smuggling of e-waste to developing countries has been identified as outcome of weak enforcement and inadequate inspections within both the originating and recipient countries (UNEP, 2015). Indeed, around three-quarters of PCs sent from the US to Nigeria for reuse were eventually dumped in the country (Vaughan, 2009). Although the United States has made a concerted effort to recycle domestic e-waste, it has not been accompanied by similar progress when it comes to exporting e-waste to the Third World (Moran, 2006).

Another important feature of this quadrant pertains to political, economic and legal conditions in recipient countries that encourage the inflow of e-waste. These include weak law enforcement mechanisms and lack of effective laws to deal with e-waste. It has been suggested that weak regulatory environments have encouraged the extensive flow of e-waste to developing countries and created a situation where the poor are shouldering a disproportionate burden of recycling waste generated in advanced economies using rudimentary techniques and obsolete technologies (Lundgren, 2012).

To gauge the magnitude of this effect, a case in point is Ghana in Western Africa which until recently did not have any effective regulatory framework for dealing with e-waste. Consequently, by 2011 the country's Agbogbloshie Market came to be regarded as the "the world's largest e-waste dump site" (The Guardian, 2011) and "Africa's computer graveyard" (Asante et al., 2012; Vidal, 2014). Indeed, countries with high legal restrictions on imports are more likely to encourage only waste that is recyclable or useable, thereby mitigating or reducing the arrival of un-useable e-waste. Many of the observations in the last decades suggest that the flow of e-waste to developing countries, such as Ghana and Nigeria, are largely driven by MNEs and firms' desire to bypass strict regulatory restrictions and controls of such activities.

Ghana, like most developing countries, is yet to develop a formal government-driven or private-industry-driven EPR programme for electrical and electronic equipment management (Nnorom and Osibanjo, 2008a). Based on the above arguments, future research could explore the issue of whether MNEs are more likely to be motivated by strict regulatory restrictions than firm-specific factors in selecting locations for e-waste export.

4.3 Quadrant III: From emerging to developed economies

Quadrant III is where e-waste flows from an emerging economy to a developed economy. One important driver stems from firms' decision to recycle in one location to accrue economies of scale or take advantage of subsidies offered. Other enticing forces for this quadrant include the existence of superior infrastructural assets, and reducing transportation and shipping costs by moving waste processing closer to factories, etc. Indeed, many highly technical firms are situated in advanced economies with expertise to handle highly contagious and toxic waste securely. It is worth noting that in 2001, a large proportion of the e-waste generated in Africa was subsequently exported to developed countries such as Korea and Spain (Lundgren, 2012). This quadrant remains largely unexplored by past studies. Thus, future research could explore the whether the flow of e-waste from

emerging economies to developed economies is more likely to be influenced by firm-specific factors rather than regulatory environment.

4.4 Quadrant IV: From developed to developed economies

Quadrants I, II and III correspond more broadly with the current evolution of e-waste. Quadrant IV is where e-waste is exported from a developed economy to another. One explanation for this is that it may stem from mandated recycling requirements laid down by law and firms attempt to take advantage of advanced technologies or a “state-of-the-art hazardous waste recycling facility” (Puckett et al., 2002). The existence of recycling facilities in a country mandated by law would encourage or force firms to use facilities, thereby fostering the flow. Another driver in this quadrant is attempts by firms to take advantage of government incentives and subsidies to promote recycling in a particular country on a large scale. It can be argued that these are driven heavily by location-specific advantages (Dunning, 1988) attributed to the specialised expertise required to treat and process such waste situated in an area.

A well-developed theoretical explanation for exporting is that firms engage in such activities to maximise profit and firms that export are more productive than non-exporting firms (Bernard and Jensen, 2004). Multinationals seeking to achieve economies of scale are more likely to move e-waste to a single location (e.g. from one developed nation to another) that allows economies of scale to be accrued. Stemming from the above arguments, future studies could explore whether the most likely motivation for the export of e-waste to developed countries is the pursuit of efficiency.

5 Integrating the conceptualisation with existing theories

The conceptualisation has some key linkages with the existing stream of research and represents potential for further cross-fertilisation. Across the four quadrants, one plausible explanation rooted in the transaction cost perspective (Williamson, 1979) suggests that opportunistic behaviour drives the

decision by firms to export e-waste from one country to another. It has been suggested that the tightening of regulations in one region is more likely to divert e-waste to other regions unless a more effective global governance arrangement emerges (Lundgren, 2012). This partly stems from opportunistic behaviour by individuals and market intermediaries. The arguments thus far suggest that theories such as the transaction cost perspective (Williamson, 1979), stakeholder theory (Freeman, 1984) and the natural-resource-based view (Hart, 1995) are rooted in the conceptualisation of the issue. Table 3 summarises some of the existing theories and potential avenues for cross-fertilisation.

Insert Table 3 about here

6 Discussion and implications

Although we have seen tremendous growth of e-waste and the emergence of distinct streams of research, these have not translated into improved understanding of exporting e-waste. This paper attempted to fill the void in our understanding by developing an integrated multidimensional framework which clarifies the boundaries and dimensions of exporting e-waste. The conceptualisation led to the identification of two types of originating countries, i.e. developed and emerging countries and two main types of destination countries, i.e. developed and emerging countries. Taken together, the conceptualisation led to the development of a 2X2 matrix which demonstrates that the direction of flow of e-waste is multidimensional and extends beyond mere developed to developing countries’ flows.

Traditionally, the exporting e-waste issue has been construed as dumping of waste by advanced economies on poor developing nations (Lepawsky, 2015a). However, the analysis demonstrates multiple dimensions to international flow of e-waste including from one emerging to another. The study identified push and pull factors specific to originating and recipient country-specific features

which interact to precipitate the direction of flows. The analysis lends support to the contention that a better understanding of the evolution of exporting e-waste is rooted in the integration of the features of both originating and recipient countries. The analysis also lends some support to the contention that exporting of ethically contentious substances has potential to generate deleterious effects.

6.1 Contributions to theory and future research

The study makes further key contributions to strategy and international business literature. First, although past studies have examined e-waste (e.g. Atasu and Van Wassenhove, 2012; Lepawsky, 2015a), the contributions thus far have been largely disjointed. Consequently, the accumulated knowledge has remained largely disjointed and has not been translated into improved understanding. The work takes a leap forward by weaving these diverse bodies of research into a unified framework. In so doing, the study provides a useful starting point to illuminate our understanding of the key features of the subject.

Second, given the burgeoning stream of research on market entry modes (e.g. Morschett, Schramm-Klein and Swoboda, 2010), it is surprising that exporting electronic waste remains an underexplored issue. The study identified some pull and push factors in exporting electronic waste. This study deviates from much of the existing stream of scholarly works to develop a multidimensional framework to account for the underlying factors in exporting e-waste. In so doing, the study fleshes out the importance of product stewardship and sustainable development which are key pillars of the natural-resource-based view of the firm (Hart, 1995).

One possible limitation of the conceptualisation is that the originating-recipient countries' matrix provides incomplete explanations of the complexities and processes inherent in exporting e-waste and roles of multiple partners. Therefore, there is a need for future research to assess the robustness of our conceptual framework and the underlying drivers. Future research could also explore the

ethical issues inherent in exporting e-waste in a more comprehensive manner. Another key starting point for future research could be to examine questions identified above.

From a practical standpoint, although the exporting of e-waste remains an evolving phenomenon, the ability to identify the key players and pull and push factors can equip policymakers in devising effective policies to curb the negative effects. In addition, effective regulatory enforcement mechanisms are also needed to stem the illegal flow of e-waste mainly from developed to developing countries. It is hoped that this study helps to foster wider discourse around e-waste.

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Figure 1: Networks in exporting e-waste

Figure 2: Dimensions of e-waste

Figure 3: A multidimensional framework of exporting electronic waste

Table1: Exemplary studies on the pull and push factors

Studies	Focus	Key findings
Nnorom and Osibanjo, 2008b.	Developed and developing countries	<ul style="list-style-type: none">• Technological obsolescence and lax regulatory regimes in developing countries have created conditions for importation of e-waste.• E-waste in developing countries stems partly from the activities of illegal imports.
Chi et al., 2011	China	<ul style="list-style-type: none">• The growth of e-waste in the country partly stems from gaps in environmental management and demand for second-hand appliances.• The growth of informal recycling businesses has created demand for e-waste.
Orlins and Guan, 2015	China	<ul style="list-style-type: none">• Weak regulatory environments, low labour costs and manufacturing prowess and capabilities have enticed firms to export waste for “recycling”.
Nnorom and Osibanjo, 2008a, 2008b.	Nigeria	<ul style="list-style-type: none">• High demands for second-hand electronic equipment, weak regulatory frameworks and enforcement, and desire by governments in the developing world, in general, and Nigeria, in particular, are primary drivers of e-waste export.
Oteng-Ababio, 2010; Lundgren, 2012; Nnorom and Osibanjo, 2008b; Puckett et al., 2002.	Developed and developing countries	<ul style="list-style-type: none">• Lack of effective legislation and enforcement create favourable conditions for importing e-waste.• Failure to develop effective policies has opened an avenue for firms and agents to import greater quantities of e-waste.
Nnorom and Osibanjo, 2008b; Kibert, 2004; Puckett et al., 2002; Puckett, 2004.	Developed and developing countries	<ul style="list-style-type: none">• Opportunistic behaviours by developed countries’ multinationals and firms to take advantage of the absence or lax enforcement of environmental laws in many developing countries.

Table 3: Integrating the conceptualisation with some established theories

Key theories	Key premise - adapted to context	Links between the established theories and the framework
Transaction cost perspective (Williamson, 1979)	<ul style="list-style-type: none"> Transaction cost explanation of e-waste would suggest that firms engage in opportunistic behaviour to take advantage of weak institutional environment elsewhere. 	Quadrants I and II.
Efficiency-seeking motive (Dunning, 1998).	<ul style="list-style-type: none"> Firms are driven by desire to achieve economies of scale on recycling. 	Quadrants III and IV.
Institution-based view (Peng et al., 2008).	<ul style="list-style-type: none"> Formal and informal institutional factors such as law and regulations drive the decision to export e-waste to developing counties. Domestic regulatory environment; government policy; take-back policy. 	Quadrants I, II, III and IV.
Stakeholder theory	<ul style="list-style-type: none"> Stakeholders can exert intense pressure on firms to change behaviour and encourage the adoption of sustainable waste disposal. Pressures from environmental pressure groups with both the originating and recipient countries. 	Quadrants I, II, III and IV.
The natural-resource-based view (Hart, 1995)	<ul style="list-style-type: none"> Identified three important strategic capabilities, i.e. pollution prevention, product stewardship and sustainable development. Firm-level behaviour and strategy can emerge as either a pull or push factor. 	Largely unexplored and not fully captured by the quadrants and therefore represents fruitful avenues for future research.
Resource-based perspective (Barney, 1991)	<ul style="list-style-type: none"> Firm-specific resources drive the decision to export electronic waste to other countries. Firm-specific decisions and competencies are main drivers in the decisions to export. 	

Table 2: Emerging market acronyms

Acronym	Countries
BRICs	Brazil, Russia, India, China and South Africa.
MINT	Mexico, Indonesia, Nigeria and Turkey.
Fragile Five/BIITS	Brazil, Indonesia, India, Turkey and South Africa.
EAGLEs	Brazil, China, Egypt, India, Indonesia, South Korea, Mexico, Russia, Taiwan and Turkey.
PIIGS	Portugal, Italy, Ireland, Greece and Spain.
CIVETS	Colombia, Indonesia, Vietnam, Egypt, Turkey and South Africa.
SANE	South Africa, Algeria, Nigeria and Egypt.
TIMPs	Turkey, Indonesia, Mexico and Philippines.
MIKT	Mexico, Indonesia, South Korea and Turkey
PINE	Philippines, Indonesia, Nigeria and Ethiopia.
KETU	Kenya, Ethiopia, Tanzania and Uganda.
GAM	Ghana, Algeria, Mexico and Argentina.

Data sources: Amankwah-Amoah and Sarpong, 2016; Amankwah-Amoah et al., 2016; Northam, 2014; Spence, Palmer and Oliver, 2014; BBC, 2014; Espinoza, 2014; Cavusgil et al., 2012.