Ctrl-Alt-Recycle: E-waste and the intersections between culture and technology

A Major Paper submitted to the Faculty of Environmental Studies in partial fulfillment of the requirements for the degree of Master in Environmental Studies

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Abstract

The information and telecommunication revolution has led to a very real change in the behavior of people in developed nations, specifically their increasing dependency on technological tools. We not only use these electronics for work and communication, but they have also become an essential part of our culture and a source of daily entertainment for many people all over the world. But what are the results on the environment of people constantly upgrading and replacing their computers and cell phones? For example, where do discarded electronics end up? Further how has over-consumption in our society—at both the personal and industry level—contributed to the multiplying of electronic waste? In addition, especially in North America, are consumers' attitudes influencing the burgeoning of this waste? Are most people aware of what happens to their rejected phones and computers or are they detached from and indifferent to the increasingly critical problems surrounding the disposal of their end-of-life tools?

In this paper I explore what electronic waste is and its dimensions. As well as going deeper into the intersections between culture and technology and how these connections in turn contribute to the quandary of electronic waste. Using research from scholarly journals, statistics, and analysis, I cover the avenues in which culture and electronic waste overlap. Further, I explore the issue of electronic waste and how it is inherently affected by our culture, our attitudes and our lifestyle.

Foreword

This Major Paper satisfies the requirements of the Master in Environmental Studies degree through in-depth research relating to my Area of Concentration within my Plan of Study pertaining to improving business efficiency in order to make electronic companies act in a way that makes the broader social and environmental systems more sustainable.

In my research paper I examine how the concept of "shared value"—people, planet, and profit—can be used to help reduce a company's environmental impact while also remaining profitable.

Furthermore, I have scrutinized the components in my Plan of Study through this research paper, addressing the issues of "waste culture" as well as "corporate social responsibility." While exploring electronic waste, I was able to examine a major producer of consumer waste and how it ties into our culture as well as analyzing ways in which this waste can be both limited and more properly recycled and reused efficiently. I was able to gauge the "cradle-to-grave" impacts of electronic waste and how increasing both durability and efficiency within the lifecycle of electronic products can help improve this situation. One of my learning objectives stated in my Plan of Study is to examine how corporations can lessen their environmental impact while strengthening their brand. Here I explore how the current recycling of electronic waste produced by discarding electronics is

largely unregulated, leading to the growth of polluting, and dangerous sweatshop-like sub-industries in North America and in the developing world.

Introduction

The purpose of this Major Paper is to scrutinize the relationships between electronic waste (e-waste) and culture. In particular, the paper addresses the following research questions:

1. What is e-waste?
2. How is e-waste affected by our culture? More specifically, what are the cultural drivers that lead to the design, manufacture and purchase of disposable e-products that, as e-waste, have deleterious impacts on people and the environment in Canada and abroad?
3. What are the cultural norms and practices that lead people to overlook or discount the hazards of e-waste?
4. What is the role of advertising and marketing in general in creating and reinforcing the cultural attitudes and behaviors that lead to e-waste?
5. Do Corporate Social Responsibility (CSR) and Extended Producer Responsibility (EPR) practices represent positive forces for cultural change in industry to reduce e-waste? (CSR is broadly defined as when a company analyzes their environmental impact and makes a sensible effort to be more economically, socially, and/or environmentally sustainable within their supply chain. EPR is a model in which both importers and manufacturers of goods should include a substantial amount of responsibility for their product's environmental impact throughout its entire life-cycle—including materials used, production, and disposal of the products as well (OECD, 2006)).

Chapter 1: What is e-waste and why is it a problem?

In this chapter I discuss what e-waste is and why it is a growing environmental concern. As technology continues to play a greater role in society and our culture, technology-related consequences are significantly impacting the quality of life and nature (Slack and Wise, 2005, pg. 1). Computer and cell phone technology is very rapidly advancing, and has improved the efficiency of global communications tremendously. Although electronic waste is created by various technological tools being produced, I will focus mainly on digital gadgets that become obsolete quickly—particularly cell phones and computers. These new technologies have become critical to our way of life and continue to expand our growing economy. The prevalence of the industries that produce them has created new jobs worldwide and at the same time has led to the elimination of others. However, with these technological advancements come great environmental impacts that must be considered as well.

Each year approximately 300 million computers and 1 billion cell phones are produced; meanwhile these amounts are expected to continuously climb (Causes International, 2014). In the United States, nearly 75% of obsolete electronics are stockpiled (Gabrys, 2001, pg. 90). When computers or cell phones are no longer deemed useful by a consumer, or they replace these gadgets with newer ones, too often they are just stored in their basement or closet and serve no further use. Instead, they could be collected and recycled for the precious resources that were

put into making these products—in order to make new products from them and technology somewhat more sustainable.

1.1 Defining E-waste

E-waste is defined as electronics (electronic hardware, monitors, computers, DVD players, mobile phones, televisions, gaming devices, etc.) that have become obsolete and are ready for disposal (Gabrys, 2011, pg. 2). Worldwide, e-waste is also commonly referred to as Waste Electrical and Electronic Equipment (WEEE) (UNEP, 2005). Statistics show that not only is the generation of e-waste immense, but it is also growing at unprecedented rates. In 2012, 48,894 metric kilotonnes of e-waste was generated worldwide (StEp, 2012). Meanwhile, the amount of used and unwanted electronics is predicted to be 33% higher in 2017 than it was in 2012 (Causes International, 2014).

I focus mainly on the environmental impacts of computers/laptops, and I will also touch on cell phones and televisions. However, e-waste can also include a vast amount of electronics further defined by Waste Diversion Ontario (WDO). According to Waste Diversion Ontario (WDO), "waste electrical and electronic equipment" (WEEE) refers to any gadget or machine that is waste and involves an electrical current in order to function (Dombrowsky, 2004). The various WEEE categories are broken down into the following: (1) information technology equipment, (2) household appliances, (3) audio/visual equipment, (4) telecommunications equipment, (5) medical or navigational controlling instruments, (6) sporting or leisure equipment, and lastly (7) electronic or electrical tools

(Dombrowsky, 2004). (For a complete list of detailed devices please refer to the Appendix).

As the amount of e-waste has been growing rapidly for the past two decades, I discuss several statistics and figures in order to better gauge the dilemma. In this paper I present information at the national and global levels, using the United States as a benchmark as it is the highest national contributor of e-waste in the world.

1.2 United States e-waste statistics

In American culture, the concept of progress is often associated with technological advancement; in order to keep progressing technology should keep improving and developing further (Slack and Wise, 2005, pg. 9). While in developed countries technological progress is often considered a fundamentally positive aspect of development, its environmental (and social) impacts are increasingly becoming a concern (Slack and Wise, 2005, pg. 14). Technological advancements and progress can help us to be more efficient and productive in some aspects. However, if we are consistently generating critically large amounts of waste in the meantime—we are not taking advantage of all the resources used in these technological tools and the benefits gained by innovation are nullified or outweighed by the failure to deal with the waste it generates. A portrait of the gravity of the situation is offered by the U.S.'s Environmental Protection Agency (EPA). The EPA estimated that in 2010, 51,900,000 computers, 35,800,000 monitors, and 152,000,000 mobile devices were "disposed" of in the United States alone (Figure 1).

Figure 1: Estimates of E-waste By Product in 2010

(Source: EPA)

How Much E-waste Do We Generate?

Whether trashed or recycled, what are we getting rid of each year in the U.S.? (See next section for what we stockpile.)

E-Waste by the Ton in 2010 – Was it Trashed or Recycled (According to the EPA)

Products	Total disposed**	Trashed	Recycled	Recycling Rate
	tons	tons	tons	%
Computers	423,000	255,000	168,000	40%
Monitors	595,000	401,000	194,000	33%
Hard copy devices	290,000	193,000	97,000	33%
Keyboards and Mice	67,800	61,400	6,460	10%
Televisions	1,040	864,000	181,000	17%
Mobile devices	19,500	17,200	2,240	11%
TV peripherals*	Not included	Not included	Not included	Not included
Total (in tons)	2,440,000	1,790,000	649,000	27%

E-Waste by the UNIT in 2010 – Was it Trashed or Recycled

(Same report as above, but reported in UNITs, not by TONS)

Products	Total disposed**	Trashed	Recycled	Recycling Rate
	Units	Units	Units	%
Computers	51,900,000	31,300,000	20,600,000	40%
Monitors	35,800,000	24,100,000	11,700,000	33%
Hard copy devices	33,600,000	22,400,000	11,200,000	33%
Keyboards and Mice	82,200,000	74,400,000	7,830,000	10%
Televisions	28,500,000	23,600,000	4,940,000	17%
Mobile devices	152,000,000	135,000,000	17,400,000	11%
TV peripherals*	Not included	Not included	Not included	Not included
Total (in units_	384,000,000	310,000,000	73,700,000	19%

What's included here?
Computer products include CPUs, desktops and portables.
Hard copy devices are printers, digital copiers, scanners, multi-functions and faxes.
Mobile devices are cell phones, personal digital assistants (PDAs), smartphones, and pagers
*Study did not include a large category of e-waste: TV peripherals, such as VCRs, DVD players, DVRs, cable/satellite receivers, converter boxes, game consoles.

**"Disposed" means going into trash or recycling. These totals don't include products that are no longer used, but which are still stored in homes and offices.

Source: EPA [1]

The numbers in Figure 1 include the electronics that were relegated to the trash or recycled in some manner. It is hard to fully measure the amount of e-waste as an unknown amount is unaccounted for, quite possibly still stored away in people's homes and offices. In the United States approximately 40% of the computers, 33% of the monitors, and only 11% of the mobile devices were reportedly recycled in 2010 (Figure 2). In 2012, the United States generated a massive amount of e-waste, approximately 9,359 metric kilotonnes of e-waste nationwide, roughly 30 kg per inhabitant. This is more than any other country measured (StEp, 2013).

The United States Government of Accountability Office (GAO) explains that, "Exporting used electronics from the United States brings important benefits. For example, export leads to viable and productive secondhand use of electronic devices in developing countries—a practice known as 'bridging the digital divide'—where they can be purchased for 1/10th the price of a new unit and contribute significantly to the operations of schools, small businesses, and government agencies" (GAO, 2008, pg. 10). There are various ways in which old electronics can become useful and have their lives extended further than most people think. This is only benefitting the developing nations if the electronics are still actually functional or easily recyclable for its resources.

Figure 2: Total U.S. E-waste in 2012
(Source: StEp, 2013)

United States of America

Overview of e-waste related information

Subject	Unit	Year	Amount	Source
Population	(total inhabitants in million)	2012	314.31	IMF WEO
Purchasing Power*	(USD per Inhabitant)	2012	49,802.15	IMF WEO
EEE Put on Market*	(kg per inhabitant)	2012	31.71	UNU (Jaco Huisman)*
	(total in metric kilotonnes)	2012	9,965.66	UNU (Jaco Huisman)*
E-waste Generated*	(kg per inhabitant)	2012	29.78	UNU (Jaco Huisman)*
	(total in metric kilotonnes)	2012	9,359.78	UNU (Jaco Huisman)*

1.3 Canadian e-waste statistics

The generation of e-waste is not as considerable in Canada as it is in the United States, but it is still an issue of concern. (CBC, 2010). What is also concerning is the disposal of the waste. In Canada exporting e-waste to developing nations is illegal, but it still happens as enforcement of the law is weak (CBC, 2010). Because it is cheaper for electronics recyclers to ship their e-waste to developing countries where labor is cheap and environmental restrictions are not highly regulated, it is more prone to happening.

Some eco fees are applied to electronics at the time of purchase, to go towards the safe recycling of the product at its end of life. However, Ontario's electronic waste recycling program still seems to be dumping the majority of the e-

waste. Approximately 80% of e-waste recyclers here still export, by putting the waste in containers they can easily disguise it and ship it overseas (CBC, 2010).

In 2012, Canada generated approximately 860 metric kiltonnes nationwide, or roughly 24 kg per person (Figure 3). According to a survey done in March 2014, those in the "millennial" generation—aged 18-29—the top obstacles to recycling electronics include inconvenience (40%), lack of information (28%), and security and privacy concerns about personal information/date not being destroyed in the disposal process (OES, 2014). Unless these issues are addressed and overcome, electronics recycling will continue to be a struggle to success as evidenced by the fact that half of millennial Ontarians feel that their end-of-life electronics should be recycled, but only one in five actually do so (OES, 2014).

Figure 3: Total Canadian E-waste in 2012
(Source: StEp, 2013)

Canada

Overview of e-waste related information

Subject	Unit	Year	Amount	Source
Population	(total inhabitants in million)	2012	34.83	IMF WEO
Purchasing Power*	(USD per Inhabitant)	2012	41,506.88	IMF WEO
EEE Put on Market*	(kg per inhabitant)	2012	28.59	UNU (Jaco Huisman)*
	(total in metric kilotonnes)	2012	995.83	UNU (Jaco Huisman)*
E-waste Generated*	(kg per inhabitant)	2012	24.72	UNU (Jaco Huisman)*
	(total in metric kilotonnes)	2012	860.74	UNU (Jaco Huisman)*

1.4 The larger scope of the issue

In regards to WEEE, the Restriction of the Use of Certain Hazardous Substances (RoHS) as well as packaging waste, the obligation to eliminate or reduce these is upon the manufacturers and retailers (Mckinnon, Browne, and Whiteing, 2012, pg. 253). Since there is little regulation of RoHS and e-waste, much of the drive to decrease waste production and limit hazardous substances, as well as more accurately control relevant logistics operations, comes through taking part in certain waste take-back systems (Mckinnon, Growne, and Whiteing, 2012, pg. 253). In worldwide sales in 2012, 238.5 million televisions, 444.4 million computers and tablets, and 1.75 billion mobile phones were sold (E-Stewards, 2014). Often electronics such as these become undesirable or obsolete in one to three years (E-Stewards, 2014). Each year, globally we produce 50 million metric tonnes of e-waste (BAN, 2012). If we can't figure out efficient ways to reuse and recycle these electronics, it will likely catch up to us very quickly with increasing effects on the environment.

1.5 Hazards of E-waste

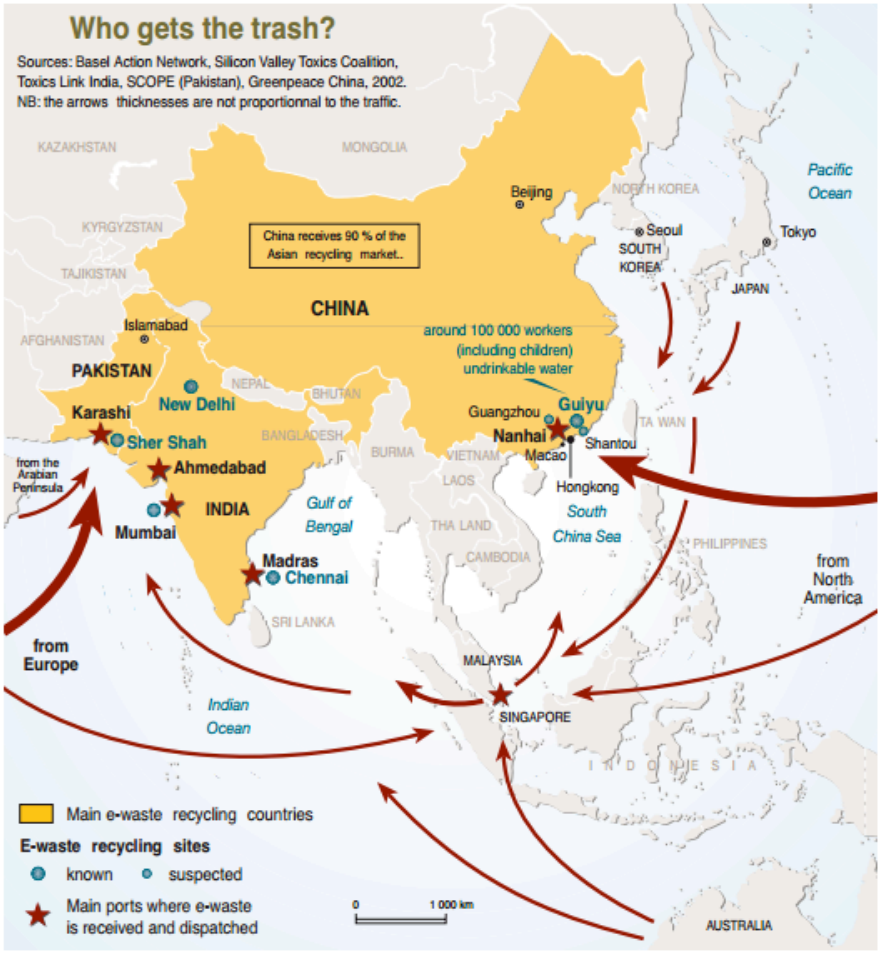
E-waste is a significant problem because it represents the fastest increasing waste flow in developed countries; meanwhile the volume of e-waste is also concerning (Gabrys, 2011, pg. 95). But e-waste creates environmental problems in other ways too. The recycling of e-waste is hazardous because the separating, sorting, and the deterioration of its elements can cause harm to the people doing it (Gabrys, 2011, pg. 95). As well, e-waste materials recovery systems highly pollute the areas that they are located in (Alexander and Reno, 2012, pg. 113).

Additionally, the transport of e-waste leads to air and water pollution. So e-waste presents serious issues when it is left in landfills and little is done with it after it accumulates, and also when action is taken and it is broken down into component parts. This is when e-waste becomes more severe and concerning than just average consumer waste accumulation.

The Electronics Takeback Coalition (ETBC) reports that approximately 50-80% of e-waste that recyclers collect, ends up in developing countries (2009). Often when consumers bring their old electronics to recyclers, then they don't tend to "recycle" them as we would think. Despite several certifications or treaties that ban illegal overseas shipping of electronics, approximately 80% of private recyclers continue to ship this waste to developing countries (ETBC, 2009).

Material handling procedures and freight transport can be considered large contributing factors to environmental degradation (McKinnon, Browne, and Whiteing, 2012, pg. 31). Often when electronics reach their end of life, unfortunately they are being transported and dumped in Far Eastern and Third World countries (Hester and Harrison, 2009, pg.2). This is not only adding to the greenhouse gas (GHG) emissions through the transportation to the landfills, but this current system is also heavily polluting the surrounding communities near the landfills (Hester and Harrison, 2009, pg. 2).

Figure 4: Map of where e-waste typically ends up
(Source: UNEP, 2005)



As is evident from Figure 4, most of the e-waste is taken to China and India to be "recycled." A continual flow of e-waste has been making its way to a small rural town in China called Guiyu since 1995—making this town one of the biggest electronic waste dumpsites in the world (Moskvitch, 2012). In Guiyu, the soil is extremely saturated with heavy metals and the groundwater is no longer drinkable (Moskvitch, 2012). Guiyu is said to have the highest amount of cancer-causing dioxins globally—while many local children are known to have very high amounts of lead poisoning (Moskvitch, 2012). Electronics are being consumed largely by

developed nations, and then the e-waste is dumped in developing nations to deal with the toxic aftermath (Gabrys, 2011).

Recycling electronics is a complex process since there are many different components in the gadgets as well as various sizes and formats and, "as electronics become even more pervasive, the dilemma of how to contend with chemicals and wasted materials that enable their production becomes even more pressing" (Gabrys, 2011, pg. 29). While electronics might not necessarily have a very long lifespan, once they no longer function, approximately 95% of electronic equipment can be recycled into valuable materials including: copper, aluminum, and other rare metals that can be used to construct new products (Weber, 2012). However pressing the need to recycle, e-waste industries find it hard to justify the process—the energy and work put into separating these materials—and fail to take on the recycling themselves as the last part of the production itself. They seem to be content to let the recycling take place in countries far from where the electronics were produced or used.

It is in China, India and Kenya where the growing e-waste recycling industry is booming (UNEP, 2004). Recycling dumps employ workers who endure sweatshop conditions and meagre wages to break down electronics (UNEP, 2004). This unregulated industry can cause major health issues for workers and their families. There is also critical concern for "waste scavengers" (UNEP, 2004). Often the poorest of the poor, these are people not formally employed by recyclers who pick

through the landfills for e-waste they can use or sell, this relying on trashed technology waste for survival (UNEP, 2004).

Whether scavenging the dumps or working as recyclers, e-waste is detrimental to workers' health. It is much more hazardous than general consumer waste as it is composed of many toxic chemicals including: lead, cadmium, polyvinyl chloride (PVC), mercury, beryllium, arsenic, and brominated flame retardants (BFRs) (Causes International, 2011). Cadmium can be dangerously toxic to people as it bio-accumulates in the environment, having detrimental effects on bones and kidneys (StEp Initiative, 2014). PVCs also have harmful effects on the environment when landfilled or burned, including negative impacts on immune systems as well as human reproductive systems (StEp Initiative, 2014). BFRs are a group of chemicals often used in electronics in order to help make them less flammable. However these toxins are also known to contribute to cognitive problems (Leonard, 2010). Meanwhile mercury is known to cause harm to the brain, kidneys, and the nervous system—unfortunately these effects can be transmitted to infants through breast milk (StEp Initiative, 2014).

Many recyclers take the e-waste home to break down to its parts. Their homes and families are exposed to the heavy metals and chemicals causing huge health risks. In addition, most e-waste is dumped in landfills in rural areas (Causes International, 2011). Disadvantaged poor communities are often left dealing with these health risks (StEp, 2014). However if there is employment to be

gained from e-waste, people with few resources have to rely on this way of life to survive (UNEP, 2004).

Not only are humans adversely affected by toxins from e-waste, but the whole environment is subject to harm. Animals, birds, marine life can all be harmed from the dumping of e-waste (Causes International, 2011). The toxins from these electronics can leach into the ground and have negative consequences on crops and groundwater alike (Causes International, 2011).

The OECD defines their Environmentally Sound Management (ESM) of waste to be, "taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner that will protect human health and the environment against the adverse effects which may result from such wastes" (OECD, 2004, pg. 4). However they do recognize that regulations vary significantly from country to country. Even though they promote ESM, it is not closely regulated enough to fully eliminate the dumping of e-waste.

Typically electronics consumers are very detached from and not aware of the detrimental consequences that ultimately result from their purchase and use of digital gadgets. Because e-waste consists of numerous sorts of minerals (up to 60 elements for multifaceted electronics), and there are not widely common procedures to maximize resource separation, they are more commonly than not left to pollute the environment instead of being reused (StEp Initiative, 2014). Meanwhile, there are so many toxic chemicals in e-waste, recycling or assembling these electronics is

not a safe or easy process. Unfortunately all the gains from electronic advancements come with a downside, "the digital revolution as it turns out, is littered with rubbish" (Gabrys, 2011, pg. 2)

1.6 Conclusion

After analyzing the dimensions and hazards of electronic waste, it is clear that our accumulating toxic garbage represents a global crisis. What is also concerning is the fact that the general public is not aware of e-waste and what the consequences are of this escalating issue. Various toxic chemicals go into making the digital gadgets that we enjoy, and recycling them safely, economically and efficiently is not a simple process. More often than not, e-waste is exported at its end-of-life. At the next stage, in developing countries, it is either put in a landfill or incinerator—both very hazardous to surrounding communities and the environment. It is easier for developed countries to export or "recycle" e-waste because overseas there are fewer environmental restrictions and minor or nonexistent labor laws and protections. There, ten thousand kilometers from us, our electronic garbage lies, invisible even as its hazards threaten the rest of the world. Meanwhile, our culture plays into the very behaviors that made this mess, and lead us to buy more and more electronics.

Chapter 2: Cultural drivers behind e-waste?

In this chapter I cover some of the cultural drivers that influence our use and disposal of e-waste. Here, I will also explore what our constant cycles of obsolescence in electronics define our material culture.

Gabrys writes about the link between waste and our buying behavior in a theory called garbology which he says, "examines cultural phenomena by linking discarded artifacts with consumption patterns" (Gabrys, 2011, pg. 16). In other words, the waste that we generate shows us how much we are buying, how we are going through products we buy so quickly and then dumping them in a short span of time, contributes to our consumer-driven culture.

In our consumer-laden culture, when we're done with something, we throw it away; it then gets hauled off so our discards are basically out of sight and out of mind. We only care about our consumer goods as long as they serve a purpose to us. In the same way, electronics industries only care about their products up until the point that they are sold. But this reckless detachment from products after we're through with them is an attitude that in our society today, can't continue. Waste can no longer be deemed completely in isolation from civilization (UNEP, 2004, pg.1). The United Nations Environment Program (UNEP) explains that we need to be responsible for what we produce even after we discard it, urging that manufacturing processes and products be, "designed taking into account resource conservation goals, even if this seems to conflict with economic benefits" (2004). However, although this "cradle to cradle" approach is ideal, it is not a priority when

industry is profit driven. The electronics industry should be held accountable for the harmful pollution they are creating at the end of their products' life cycle. Otherwise corporations ultimately have a license to harm.

2.1 What is culture?

Culture encompasses the language, symbols, tools, and characteristics of a group of people. A culture is created by one's surroundings, including the time and place in which one lives. In culture, our traditions and what we learn or practice are reflected through our everyday lives (Slack and Wise, 2005, pg. 4).

According to Sahlins, culture is not only connecting human association to the environment by a social rationale of relativity, but establishing by that theory the significant objective and subjective indications of this correlation (Sahlins, 2013, pg. x). So culture is depicted in our daily rituals, the tools we utilize, and the way we use them in our lives. When we become dependent on digital gadgets to function on a daily basis, this behavior then becomes a part of our culture and who we are. Postman has a term for cultures which are extremely reliant on and motivated to invent more technological tools. He calls them "technocracies." Technocracies benefit the corporations who are able to inexpensively create these goods that people crave and rely on (Postman, 1993, pg. 41). They often exclude those who are incapable of manipulating technology. In these cultures, people who embrace and are consumed by handy and convenient digital gadgets, can easily ignore those who are left out, and lose sight of the impact that this technological reliance has on our surrounding environment.

2.2 Culture in relation to technology

Technology can often define and reflect the nature of human existence; we develop a culture based on technology and its tools that we utilize and incorporate into our lives (Slack and Wise, 2005, pg. 3). In North American culture today, technology is ingrained in our culture because it allows us to communicate with people across the world at an instant, and to often know the news as it is happening.. Due to our obsession for keeping up with the latest technology, we are concurrently generating large amounts of electronic waste that is not being properly managed.

Meanwhile, news can be collected in many forms, only some of which give us accurate and objective data in today's digital age. News can be word of mouth from a colleague or coworker who may or may not have witnessed what they are reporting. It can be gathered from others who are witnessed, and/or experts and written in reports as secondary data. Or it can be primary data from a study or event or experience you have done or seen firsthand. It is hard to determine which news is actually fact as most is swayed or biased in some way or another.

Technology significantly changed our culture when the 24-hour news cycle was introduced. Media conglomerates anticipated that people would develop the urgency to stay connected to events and trends, through electronic gadgets anywhere and anytime. Businesses, institutions, and government agencies also rely on the immediacy of news events often to get their messages out to stakeholders. Corporate culture has changed enormously with technology, relying on computers

for data management and organization, advertising, even money transfers (Gere, 2014, pg. 14). Our technological advancements have turned many societies into digital cultures in which it is the main outlet for communication and transactions (Gere, 2014, pg. 14). Many transactions that were once more personal and tangible are now conveniently done online or on screens or telephone.

The intersection of technology and culture is very obvious in people's personal lives. Face to face encounters are increasingly replaced in today's digital culture with people connecting to each other on the internet or cell phones, sometimes even if they are already in another social setting. According to Canadian Internet Registration Authority (CIRA), nearly 8 in 10 Canadians are online, and they are almost all daily users (CIRA, 2013). On average, Canadians spend 45 hours a month on the internet—nearly doubling the worldwide average (CIRA, 2013). People are on the internet for longer amounts of time than in the past, and are keeping up to speed with the newest and fastest electronics—consistent with the theory of technocracy in that, we have a constant desire for more gadgets with increasing functions and performance benefits.

Technology is especially essential to the cultural lives of younger generations. .According to a survey conducted in March of 2014, one in ten millennials (aged 18-29) living in Ontario would choose to give up food for a day over their phone (OES, 2014). This shows that this generation is very much a part of Postman's technocracy.

An example of change brought about by technology is that of Hilton hotels which is currently working on a 550 million dollar plan to make their hotel room keys obsolete through having guests use their smartphones instead (Karmin, 2014). The project is planned to be effective through Hilton hotels worldwide by the end of 2016; meanwhile this new technology will allow guests to use their smartphone to check-in to the hotel (eliminating having to wait in line at the concierge), choose their room, and even unlock their hotel room door (Karmin, 2014). In this situation although we are harnessing technology to enhance performance and efficiency, it is making our reliance on digital gadgets even stronger. With technology surrounding us every day, our culture has become very intertwined with how we live our lives and communicate and function on a daily basis. Since the EOL of these digital gadgets we use are not managed to their full potential, the hazards of techno-trash are becoming problematic.

2.3 Why e-waste is growing so fast

Americans replace their cell phones on average every 22 months—dumping about 150 million phones solely in 2010 (New York Times, 2013). It is estimated that by 2015, four out of five households in the United States will possess a smartphone (CEA, 2013). When we consume more quickly, we discard our goods more quickly. Electronic waste is the fastest growing source of waste in North America (Causes International, 2014). Cell phones were originally designed to make calls to people and communicate on the go. Now "smartphones" are mini-computers that let users purchase goods in global marketplaces, seal legal

contracts, play games, email, research across the world, download music, remotely switch on heating and cooling units before going home. There are apps that so everything under the sun and are all powered by palm sized devices—a far cry from the original functions of these tools.

With the appeal of apps that often do make life easier, consumers are eager to update cell phones to power the increasingly sophisticated software being produced. Sometimes they have to buy new phones simply because newer software might not work on the older models (even if the electronics themselves still work). Newer digital gadgets often get smaller, sleeker, more aesthetically pleasing, efficient, and more functional than the models they replace.

Sometimes people upgrade their phones for reasons other than the practical. Postman points out that our culture and surroundings have convinced people to want newer technology because they crave the latest trends (Postman, 1993). Why else do consumers want to upgrade their current devices constantly? Sometimes simply because they can. A throwaway consumer culture has been perpetuated by the fact that, "technological advancements in automation led to lower production costs, which led, in turn, to a flood of cheap goods on the market, the rise of disposability, and the decline of repair" (Gabrys, 2011, pg. 82). When consumers have easy access to new goods and forms of disposal as well, it makes our culture more prone to generating e-waste while not having to worry about the harm that is being done to the environment as a result. Gabrys goes on to say that the constant rapid production of electronics means that they can be quite

effortlessly swapped for new ones, giving off the notion that electronics are less enduring and more interchangeable (Gabrys, 2011, pg. 83). E-devices can often be more costly and feasible to replace them instead of fixing them when they are broken. It is the increased rates of production of electronics paired with their increasingly shorter life cycle that perpetuates the accrual of e-waste (Gabrys, 2011, pg. 84).

When people share values in a culture they are often influenced by those around them. In consumer-driver cultures that influence can be around the material goods, and in our digital world, people seem to think they want and need the latest in electronics. The rapid turnover of tech tools—for whatever reason—is at the core of the generation of e-waste and other polluting behaviors. If manufacturers were more efficiently recycling their electronics, this industry would not have as big an impact on the environment. Considering that 81% of a computer's energy use is from manufacturing it, and not using it, the environment would largely benefit from more consistently recycling these products instead of dumping them (Williams, 2004). Although technological advancements are showing progress in the developed nations that create and use them, it is doing the opposite to the developing nations that receive all the toxic e-waste being dumped (Alexander and Reno, 2012). There is a large disconnect between the consumers and the products they use—or where they end up.

2.4 Conclusion

As consumers, we are used to buying products and being able to "dispose" of them when we are finished with them, so that we can then purchase new goods. By 2015, there will be over a billion smart phones in the world and 700 million computers by 2017 (ETBC, 2013) It is clear that electronics are major drivers in our shortsighted material economy.

In addition, people are constantly purchasing newer electronics and stockpiling outdated ones (assuming they can just dispose of them), which in turn supports the notion that we live in a throwaway consumer culture. This has formed a cultural shift of perception, that we can just keep buying new electronics and tossing out the old ones while being detached from the critical accumulation of e-waste and how it is harming society.

Chapter 3: Cultural norms that allow us to neglect the negative impacts of e-waste

3.1 Consumption

It is especially true in Western culture that many people feel that the more material goods they accumulate the happier they will be. Michael and Joyce Huesemann discuss the theory of hedonic adaptation "with people being most satisfied when they have attained their expected level of material affluence." (Huesemann and Huesemann, 2011, pg. 217). But the chase to acquire more continues because according to the theory of the "hedonic treadmill" people become accustomed to their new material possessions—and want more. They can never actually be satisfied with what they have. Similarly, Herman Daly describes this culture of material goods as, "Humanity, craving for the infinite, has been corrupted by the temptation to satisfy an insatiable hunger in the material realm" (Huesemann and Huesemann, 2011, pg. 219). This material-driven culture he explains will never be fulfilled, we will always want more and the latest digital gadgets.

Our society is more and more consumed with consuming and this is really evident in our desire to own technology. Upgrading cell phones (as stated earlier, Americans replace their phones every 22 months), buying new apps for them, getting thinner screened TVs and tablets all become part of the drive to be happy. That urge could be so strong it lets people give themselves permission to over-consume with no thought for what comes of all the "outdated" gadgets they discard and which end up in overseas landfill dumps.

Another cultural norm in our society is the need for social status and the search for that validation often drives people to high levels of consumption. Standing out from the crowd is a desire most people share. One of the ways to show you're better than your neighbors or your peers is to own more than they do. According to the Huesemanns, "in industrialized nations, a large fraction of household income, 50 percent or more is spent on competitive consumption, or conspicuous consumption." (Huesemann and Huesemann, 2011, pg. 218)

While our culture and mass consumerism have both highly contributed to the dimensions of e-waste, there is also a theory that every industry can turn its consumers into "prosumers" (Tapscott, 2009, pg. 208). Tapscott explains that "prosumerism" goes beyond the expansion of customer orientation, mass customization, or any other aspects that go into corporations making standard goods and having consumers alter the specifics (Tapscott, 2009, pg. 208). In this theory, "prosumerism" helps perpetuate this idea of needing goods and wanting the latest trends constantly into our culture.

Our culture's drive for status could also be a reason we are consuming electronic equipment at such a rapid rate, with hardly any regard for where our rejects end up and the hazards they create in other peoples' and other countries' trash bins.

3.2 Convenience

One of the modern values of our time is convenience (Slack and Wise, 2005, pg. 29). Convenience is anything that makes our lives easier and more comfortable.

What has become central to our convenience, especially in Western society is the idea that "we increasingly need to do everything faster" (Slack and Wise, 2005, pg. 34). When computers and printers first became part of the work landscape, they replaced the clunky old technology of the typewriter with ribbons made of ink, and white ribbons that only manually corrected typing mistakes. The new technology with autocorrect and spell check saved immeasurable time for office workers and data processors. Old fashioned telephones kept in the home didn't even have voicemail, so people had to physically speak to someone to convey a message. Like computers, today's smartphones have brought us incredible savings in time and ease both in our personal and professional lives. Technology has brought us too much convenience, and has allowed us to solve problems in our jobs and thrive in our social lives almost instantaneously.

The promise of even greater speed (convenience) is very appealing and many of us readily download new apps and upgrade our technology just for that reason. It could also ne one cultural norm we care so much we ignore what happens to our "slow" gadgets as we leave them behind for the new speedy ones. But technology isn't so convenient now that we are realizing that the cost of its disposal is so high.

3.3 Advertising: Feeding the Hunger

"It's so hard to resist the life that the social-media machine has created for us, one in which we are both consumer and producer, sharing generously of our own creative energy and expending our attention in a self-nourishing loop, from which someone else – Google, Facebook, Apple – plucks the profit" (Anderssen, 2014).

According to the New York Times, in 2009 adults in the US spent on average 8.5 hours watching a digital screen—more than a whole work day (Stelter, 2009). This is a fact advertisers understand. They are using the Internet and mobile phones as places to sell their products—with a cut of the revenue going to Google, Facebook and Apple. While we are bombarded by ads on TV, it is easy to change the channel when ads come on. This is not as easy with computers and cell phones. Just turning on the computer to collect your email will subject you to ads. Reading the papers online, you are hit by banners running horizontally across the page and vertically up your screen. And while TV limits advertising to eight minutes per half hour, the internet has no rules. And every time you change sites—and in eight hours imagine how many sites you visit—you are exposed to a whole new set of banner and side ads.

In traditional media, most of the time people are aware of when they are watching an ad, when someone is trying to sell them. However, advertising on our countless screens blurs that distinction as content and ad graphics can run simultaneously. What this means for consumers is that they are being pitched products over and over again throughout their day, even while they are working on their devices or relaxing on social media.

The prevalence of ads feeds into our desire to consume and our screens become the place where devices—with screens—are hyped and sold. So just using a computer or cell phone all day long can make us want more and better computers and cell phones and other technology. And we're a captive audience for app

developers, software companies, bloggers, web designers, and media sources [who] are all competing to grab our attention in order to seduce and divert us (Anderssen, 2014).

But it's not just producers of electronics who are selling to us. They have discovered a way to use ordinary people to pitch their products without even knowing it. The act of seeing colleagues or coworkers with products digital gadgets that they use, often has a high impact on swaying people to want to buy the same items if they seem admirable or satisfied with them. This concept relates to our culture in that the people we surround ourselves with often impacts our values and wants.

Designers take special care to fashion the covers/shells of their mobile gadgets so as our colleagues and peers carry them, they are literally walking advertisements. As William Leiss and Stephen Kline point out, advertisers ensure that products are "'aestheticized' both in their material design and representation for maximum cultural acceptance and minimum rejection" (Leiss, 2005, pg. 49).

Their targets are often the younger generations whose phones are never far from their hands and who are especially eager to have the latest and "coolest" gadgets. Advertising's purpose is "to convince, to persuade, to motivate, and most importantly, to get people to act, to do something" (Berger, 2004, pg.5) And that something the ads on our devices get us to do is especially to upgrade our gadgets whether we need to or not.

This is one of the roles that advertising has in creating and reinforcing cultural norms that generate to e-waste. When consumer cultures value electronics for satisfaction, status, entertainment, and communication, perceiving their devices as necessities, they can more readily ignore the harsh environmental impact they are having by keeping up with technology.

3.4 Net Generation and Technology

The fast turnover in electronics ownership goes beyond the need to want. Young people are especially prone to craving new technology and the desire to have it is deepening. Children used to want things like the latest dolls, board games, or action figures; however now in developed nations, children are increasingly getting hooked on electronic devices (Tapscott, 2009). Instead of writing notes on paper to your classmates as I remember doing as a child, texting, emailing and social media sites are used to communicate between people more prominently. In 2007 a research project titled, "The Net Generation: a Strategic Investigation" sought to investigate some of the new trends that technology has developed within people and culture. In May of 2007 the researchers in this project interviewed 7,685 Net Geners who ranged in age from 16 to 29 years old, and lived in 12 different countries (the United States, Canada, the United Kingdom, Germany, France, Spain, Mexico, Brazil, Russia, China, Japan, and India) (Tapscott, 2009, pg. xi). The study indicated that when "Net Geners" watch television, they prefer downloading their shows and movies off the internet and watching them on a computer or prerecording them on TiVo in order to enable them to watch these

shows whenever and wherever they want (Tapscott, 2009, pg. 43). Since the invention of film and cinemas, and broadcast television, and before the invention of recording technologies, audiences watched the same programs together at the same time. Movie and TV viewing was a shared, communal experience that brought together neighborhoods, families and even complete strangers. There was the feeling that viewers had witnessed history together. The advent of the digital age has brought about a significant culture shift as watching TV has moved from a family and community activity to a more individual pursuit.

As an individual activity the new way to watch entertainment has consequences beyond the cultural shift. Kids, teenagers, and young adults are increasingly becoming hooked to their digital screens and the internet (Tapscott, 2009, pg. 3). Instead of being active outside, often children and young adults are inside staring at a screen watching videos, playing games, or connecting with their friends – remotely rather than face-to-face — via the internet.

There are many social and psychological consequences to this shift in entertainment viewing and personal interaction as children of the digital age grow up. The one that relates to the accumulation of e-waste is especially the consumers' desire to listen to any song or music video or movie at the touch of the button any time and any place. Since multiple members in households now have these digital gadgets to consume entertainment, people are becoming more reliant on the latest, fastest, lightest forms of technology on more advanced high-resolution screens. The growth in the purchase of electronics reflects this. In 1983, merely 7% of households

possessed personal computers; by 2004 this number increased to 44% (Tapscott, 2009, pg. 17). Our desire to watch entertainment and form relationships on newer and newer technology is a leading cause of the accumulation of e-waste. Our culture today often acts as if everything is easily disposable and easily replenishable as well. Notes passed at school were also put in the garbage but most paper was bio-degradable. The e-refuse we are now creating with our technological consumerism has far more serious environmental consequences.

3.5 Second-Screen Phenomenon

With so many digital gadgets available, many people own several computers and it's not uncommon for them to be using more than one screen at a time. For example, you may be watching television while simultaneously being online on your laptop, tablet or smartphone connecting or communicating with other friends as well (Shapiro, 2013). This behavior is referred to as the *second-screen phenomenon* (Shapiro, 2013)

In the digital age, various new technologies are seen not just as tools or even accessories but as cultural essentials. Unlike their parents, children have never known a life without digital devices. They can't imagine a life "unwired". It's common today for even primary school students to be equipped by their parents with cell phones because they think the devices, worth hundreds of dollars, are essential. "Wants and luxuries become necessities. They become habits deeply entrenched in the way that culture is organized" (Slack and Wise, 2005, pg. 33).

The habitual use of technology is behind young peoples' use of multiple screens at once. "Limiting screen time" is the goal of many parents as they try to ease their kids away from their obsessive use of one and two and even three screens at the same time. For most parents, it is too late to try to take away their children's technology. The reaction would be too fierce. So they end up continually buying the electronics to feed their young "addicts."

Second screen habits are also particularly hardened with Net Geners leading them to always try to get the latest and most advanced electronics available, whether it's a new computer, smartphone, gaming device, or iPod (Tapscott, 2009, pg.192). Like with adults, keeping up with these newer trends and owning the latest devices elevates many young peoples' social status and can even make peers envious (Tapscott, 2009, pg. 192). The electronics industry plays into the social status their products can deliver. Marketing campaigns frequently promote new digital gadgets that will give you a "better life," concealing the price the disposable devices takes on our environment while playing up the privileges they deliver (Slack and Wise, 2006, pg. 19).

3.6 Accepting Obsolescence

It seems that the minute you get your new computer or new cell phone home, an even newer model appears, with more speed, better features and a more aesthetically pleasing cover. You realize that your purchase is already obsolete. If this isn't actually the case, manufacturers want you to believe this. It is the improvements of new models that draw our eye, because as discussed, convenience

is a motivator for our consumption. But are the improvements surrounding the launch of a new product there for the consumer? Ernest Braun has written about the failures of the promises of technology. He believes that consumers' desires for improvements are not what drives new products, it's the desires of "the engineers and scientists, ambitious to achieve ever more elegant solutions to self-imposed problems. The desires are also those of the entrepreneurs, eager to carve out a niche for themselves and make a good profit. The desires are those of manufacturers, eager to stimulate new waves of purchases for new products when markets are saturated." (as quoted in Huesemann and Huesemann, 2011, pg. 210)

So some believe that it is the electronics industry that is driving our consumption patterns. But many people when they buy electronics are aware of the marketing manipulation that suggests a product is better than its previous model. It is a cultural norm that they accept marketing is not to be taken at face value and that they may well be being duped about a gadget's real improvements. We also accept the notion of "planned obsolescence"-- that goods are created and designed to be useless and reach their end of life very quickly so that you are forced to go buy a new one (Leonard, 2001). While individuals might resent the manipulations of manufacturers, most consumers don't rebel against the deliberate shortened duration of their technologies. They cast off their gadgets and "upgrade" to a better model because their urge to consume is strong and it at least temporarily gives them validation and happiness.

There is a darker side to manufacturer's planned obsolescence and our acceptance of it and that is that cosmetic innovations can be promoted while real innovation—especially into the durability of products—is being ignored. Because as electronics manufacturers have profit in mind, they are not necessarily looking to extend the life of the products they've already sold. Chemist and electrical engineer, Tim and Nick Sherstyuk—have recently come up with technology to make a standard lithium-ion battery last significantly longer than before (Divon, 2014). The new battery has an enhanced capacity by 30%, while also increasing the amount of recharging cycles from 300 cycles to 2,500 cycles (Divon, 2014). Despite the discovery of this amazing electronic life-extending technology, corporations have not been too excited. Of the major electronics manufactures that the Sherstyuks have met with, the companies have only been interested in the amplified capacity of the battery and prefer to restrain the extended life—they fear that longer-lasting batteries will equate to consumers holding on to their gadgets for quite longer as well as less products being sold (Divon, 2014).

The rejection of the durable battery re-enforces the fact that most of these electronics are "designed for the dump" (Leonard, 2010). Manufacturers know that if their products last longer it will decrease their sales and revenue.

3.7 Positive Progress

Our digitally driven culture has had a significant impact on our values and one of them is that progress is beneficial. Postman writes that, "in cultures that have a democratic ethos, relatively weak traditions, and a high receptivity to new

technologies, everyone is inclined to be enthusiastic about technological change, believing that its benefits will eventually spread evenly among the entire population. Especially in the United States, where the lust for what is new has no bounds, do we find this childlike conviction most widely held" (Postman, 1996, pg. 11).

This belief in the goodness of what is new, is a reason why we more easily accept manufacturers' deliberate plan to make technologies wear out before they need to and accept "planned obsolescence." While technology is changing rapidly we don't make demands on the electronics industry to use innovations that bring about better quality standards. What if instead of accepting the short life of our computers, we were able to take our old machines back to the manufacturer and demand they reuse parts for a new computer, at a reasonable price? A global consumer rebellion could well lead to a revolution in the manufacturing industry, as they would be forced to extend the lifecycle of the goods they produce. That in turn would do much to fix the e-waste crisis the world is facing.

But most people resist recognizing the e-waste they create. They have embraced the belief that technology is good and they have turned a blind eye to its dark side.

3.8 Conclusion

Advanced performance in electronics have revolutionized the way we live and work. Increased technological innovation has also been contributing to our material affluence and culture. Our electronics hold meaning beyond their use as machines.

To many they are symbols of happiness and social status. Advertising contributes to our cultural dependency on and craving for digital gadgets, so much so that we are constantly upgrading and discarding our electronics, often when they are still fully functional, just maybe not as "trendy" as ones our friends have.

Advertising plays a significant role in creating and reinforcing cultural norms that contribute to over-consumption and in turn the accumulation of e-waste. When consumer cultures value the hoarding of the latest electronics it makes it easy for consumers to justify owning multiple gadgets and watching multiple screens at once. As they chase happiness, and proof of their success, the farthest thing from consumers' minds is what happens to all their electronics when they are bored with them, or convinced they no longer work.

Chapter 4: CSR and EPR methods to reduce e-waste

In this chapter I explain how Corporate Social Responsibility (CSR) and Extended Producer Responsibility (EPR) practices embody positive forces for cultural change in industry to reduce e-waste.

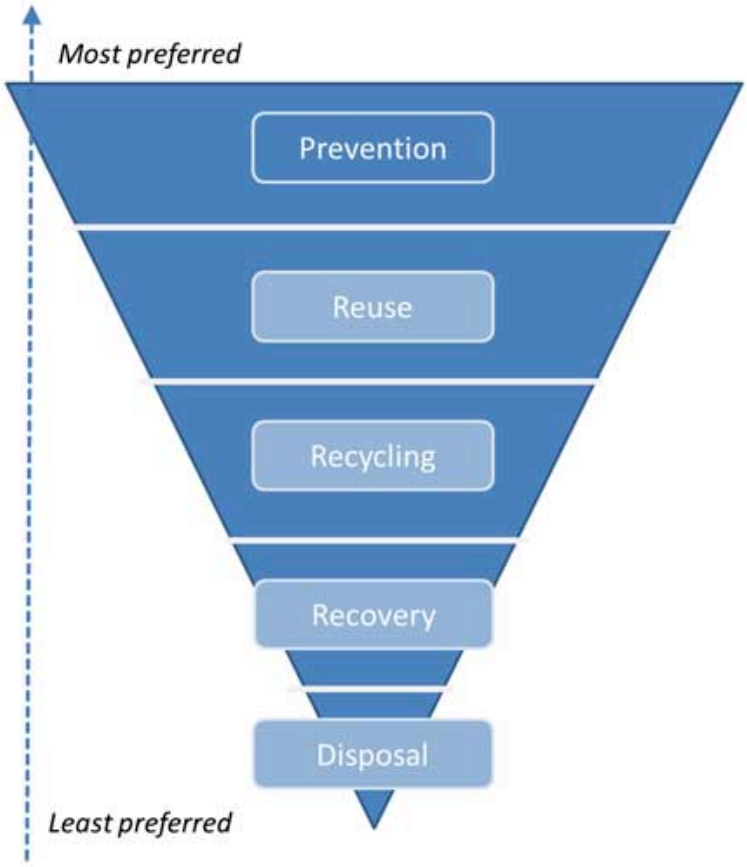
Currently most manufacturers of electronics take no responsibility for their products after they are sold. Not only that, Hester and Harrison write about how corporations' practices contribute to unsustainable management, including "various systematic tactics [that] are embedded in new technology and electronics…[They] often lower prices and [create] new designs each year, proliferating decreased lifecycles, the incorporation of hazardous substances and procedures…[This leads to] increased generating of waste both during production and at the end of life" (Hester and Harrison, 2009, pg. 2).

In order to influence companies to be more sustainable, William McDonough and Michael Braungart (2002) explain several EPR concepts including the theory *technical metabolism* in which the resources or "technical nutrients" of a product are deliberately crafted so that they can be removed from a worn-out product and then they can go back into the production of new goods (pg. 109-110). The current linear cycle of "cradle to grave" for electronics is destructive to the environment and has various negative impacts on both individuals and the industry (McDonough and Braungart, 2002, pg. 112). To begin with, cradle-to-grave cycles for products do not maximize value for the resources that go into making electronics. They are simply used for one product and when it reaches its end-of-life, the component parts—even

when they are still usable—are disposed of along with the discarded device. If electronics were made to be reused at their EOL, then it would be easier for manufacturers to take back their products and reuse them in the production of new products. Hence, this is why EPR and CSR tactics are needed in order to legitimize sustainable electronics product life cycles.

McDonough and Braungart analyzed various electronics in their research into present manufacturing, and the average flat screen television they studied consisted of 4,360 chemicals (McDonough and Braungart p.110, 2002). While several of these chemicals were toxic, there were also various valuable nutrients that went to waste when these electronics were dumped into landfills. They suggest a better alternative would be isolating biological nutrients "allow[ing] them to be *upcycled* rather than recycled—to retain their high quality in a closed loop industrial cycle" (McDonough and Branungart, 2002, pg 109-110). To explain the advantages of upcycling they cite the example of a well-made hard computer case. Rather than have it be recycled into inexpensive flower pots—which many components could be—they suggest it would generate more value if it was re-used in its same condition, in a more expensive product like a medical device or a car part (McDonough and Branungart, 2002)

Figure 5: Waste Management Hierarchy source UNEP (2011)



EPR initiatives make electronics manufacturers liable and responsible for the materials of their products after they have reached their EOL. But EPR tactics can also be used to help improve the lifespan of products, while additionally increasing their reparability. Redesigning these electronics so that they can be easily disassembled and have their reusable materials isolated more conveniently would make it more appealing for the electronics industry to take advantage of this more sustainable practice.

In Figure 5 above, the Waste Management Hierarchy adopted from UNEP 2011, shows a strategy that can be used to help makes electronics more sustainable.

While most people simply dispose of their used electronics (often in the trash), the alternate options of prevention, reuse, recycling and recovery should be encouraged and put in use to limit the amount of e-waste being dumped and left to pollute and harm the surrounding areas. As Victor writes, if our current manufacturing methods continue that harm done will be devastating. He believes that ecosystem services have limits and without altering our current means of production our limits to growth for the environment will be reached very soon (Victor, 2008).

Technology has the potential to help mitigate and alter environmental impacts; through innovation technology has often allowed us to do more with less (Victor, 2008). As it stands now, the recycling of electronics is performed largely by manual laborers and the exposure to toxic components brings with it lots of health risks. Technological advances could for example lead to the making of machines which could recycle used electronics. This would eliminate work for those in the developing world who depend on recycling electronics but the work is unsafe and hazardous. Another complication is that though technology *can* help make manufacturing both more efficient and sustainable, electronics companies need to make safely recycling their products a priority and then invest the money to carry out the research to find innovative recycling technology.

Recognizing the "cradle to grave" lifecycle of products or trying to create closed loops within manufacturing are both innovative ways to create a new market opportunity as well as exercising environmentally sustainable and more efficient products (Milani, 2004). Industries can profit from recycled components, which they

don't often do now. While it may cost more upfront to recycle their products they will save money by re-using their components.

4.1 Green Product Innovation

Product differentiation is a common business strategy that can be used to help companies stand out amongst competitors because it allows for the development of unique qualities and/or products. Green product innovation is seen as a form of environmental product differentiation in which companies incorporate new or unique environmental aspects to their products that makes them different from other products of the same sort. They can have a competitive edge over other product makers who are perceived as polluting and unsustainable. Some business scholars argue that it does pay to be green: "firms can increase profits if they set ambitious environmental targets, lobby for tighter not looser government regulation, and make the environment the central organizing principle of their businesses" (Reinhardt, 1998).

Environmental deterioration and pollution are often not factored into market prices; therefore they can be seen as externalities (Reinhardt, 1998). If regulatory bodies don't make manufacturers pay for their effect on the environment, then they will rarely take steps to lessen their impact. However, if companies take steps to address this issue, for example by trying to extend the life of their products to eliminate excessive waste—this can be seen as a CSR tactic. To successfully implement environmental product differentiation—which would give a company a competitive advantage-- several bases must be covered:

1. Willingness for customers to pay for environmental features.
2. The company must create reliable evidence about the environmental characteristics that its products entail.
3. The innovation must be guarded from the potential of competitors trying to duplicate.

(Reinhardt, 1998).

By following these three strategies, companies are likely to be profitable through utilizing environmentally friendly products. These tactics boost competitiveness and strengthen a company's brand image.

Manufacturers could adapt a more responsible and sustainable approach by replacing current practices of waste management by reverse logistics, which can be defined as:

> "'the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin, for the purpose of recapturing value or proper disposal.' 'Reverse logistics' differs from waste management as the latter is mainly concerned with the efficient and effective collection and processing of waste: that is, products for which there is no longer any reuse potential" (McKinnon, Browne, and Whiteing, 2012, pg. 254).

Green product design and innovation should be assessed in a way that it not only analyzes the environmental impact of materials used, but to measure the full scope—comprehensive political, social, and imaginative territory of electronics (Gabrys, 2011, pg. 153). By doing this, green product design will be more effective and efficient, generating less waste and actually becoming more sustainable.

Some electronic companies including Samsung and T-mobile have begun to feature green products, specifically cell phones. Both are made of eighty percent recycled materials; other features include a carbon neutral handset, operating manuals that are only available online not as paper, bio-degradable, corn-based bioplastic casing, and no hazardous metals. The Samsung Blue Earth was introduced in 2009 and had solar panels on the back and software that tracks the user's reduced carbon emissions. It is no longer available and it's not clear from the manufacturer's website if the company is responsible for the phones at their EOL. (Samsung, 2014).

4.2 Basel Convention

The main reason why developed countries tend to export their waste is because developing countries often have less environmental restrictions, as well as less means to monitor the pollution (Bradford, 2011, pg. 313). The lack of global regulation has led to the massive dumping of hazardous waste from industrialized countries into developing countries.

The Basel Convention was implemented to fight this. It is a treaty governing the trans-boundary movement and disposal of hazardous wastes that bans such

waste from being transferred to other nations. The Convention was developed by the United Nations Environment Programme in 1989 (GAO, 2008). The treaty designates that a country may only dispose of its hazardous waste after obtaining written consent from the receiving country. This initiative has been accepted by 170 countries—including almost all industrialized countries with the exception of the United States (BAN, 2012). Though it signed the treaty in 1990, the US has yet to ratify it.

So while the Convention is supposed to stop the illegal dumping of e-waste, and countries support it in theory, there are still loopholes such as America's non-ratification. The US continues to ship off their e-waste, the bulk of it to China (Bradford, 2011, pg. 307). Since the United States produces more hazardous waste than any other country, the urgency for them to get ratification and figure out a way to manage their waste more environmentally stable is dire (Bradford, 2011, pg. 306).

In 1996, to protest the fact that China is the recipient of much of the United States' hazardous waste, the government there issued an official dispute to the Secretariat of the Basel Convention. They charged the US with the illegal transportation of waste. Unfortunately "China has no avenues of direct legal redress against the United States under the Basel Convention" (Bradford, 2011, pg. 308-309). The lack of legal redress for offenders is a major weakness of the Basel Convention and there needs to be much more regulation and official penalties and fines to make it effective.

Although the Basel Convention has not stopped the trans-boundary movement of hazardous waste completely, it has led governments and environmental watchdogs like Greenpeace to draw the public's attention to corporate offenders. If their reputations are tarnished enough they could begin to follow the convention's regulations (Nath, 2012).

4.3 E-waste reduction tactics

ENERGY STAR is a dynamic voluntary government/industry partnership program established in 1992 through the United States Environmental Protection Agency (EPA). Its purpose is to help both businesses and consumers lessen their environmental impact while saving money as well, through enhanced energy efficiency (ENERGY STAR, 2014). In Canada ENERGY STAR works with Natural Resources Canada to help advocate environmentally friendly electronics (ENERGY STAR, 2014).

The United States' EPA brings forth two separate monitored certifications to look out for when finding an adequate e-waste recycler. The two certifications standards that the United States uses for safe e-waste recycling are Responsible Recycling Practices (R2) and E-Stewards (EPA, 2014). These standards help distinguish between an e-waste recycler that exports overseas with unsafe working conditions and one that that recycles this waste in an ethical and safe manner.

Many major manufacturers like Dell, LeNovo, Toshiba, and Apple have take back programs for their used products making attempts to be accountable for them at their EOL. There are also several retailers that have electronics take-back

systems. Because of Staples' partnership with Hewlett-Packard (HP), Staples takes-back several types of used electronics (no matter what brand) including desktop computers, laptops, printers, scanners, faxes, cameras. They do *not* take back televisions or stereo equipment (ETBC, 2014). Best Buy is another company that takes back electronics as well, including televisions.

According to Staples' website page "Easy on the Planet" Staples is an E-Stewards Enterprise (an American environmental certification). E-waste from the take-back program is sent to Electronic Recyclers International (ERI), which is also a certified E-Stewards recycler. The company claims it refurbishes and recycles electronics' usable parts and its process "captures valuable metals and plastics for reuse in new products and keeps toxic materials out of landfills and incinerators" (Staples 2014).

There is no public tracking of the manufacturers/retailers recycling of e-waste so it is difficult to know if their claims are to be believed. However the take-back programs do represent an acknowledgement that e-waste is their responsibility and that many consumers will recycle their e-waste if they know there is a way to do so.

There is a theory of "zero waste" that has emerged in order to reduce the amount of waste generated. In this theory waste diversion is the main form of implementation. Waste diversion, "directs garbage away from landfills or incinerators through reuse, recycling, composting or gas production through anaerobic digestion. Waste diversion is a key component of effective and sustainable waste management" (FCM, 2009). Diverting waste helps eliminate

dependency on landfills, offers benefits for composting, provides efficiency with the lifecycle of recyclables, reduces GHG emissions and toxins that are generated from landfills and encourages environmentally sustainable behavior and development within communities (FCM, 2009). Waste diversion can be considered a good form of EPR because it can motivate electronics companies to limit the amount of waste output when consumers are done using their products, making their products either more repairable or recyclable.

Ontario Electronic Stewardship (OES) sponsored a program and easily accessible website called recycleyourelectronics.ca in which consumers could identify the electronic device(s) they wanted to recycle as well as drop off depot locations near them. The OES worked with a combine of manufacturers and recyclers with the aim to recycling and managing e-waste.

The success of the OES program has been questioned by some. Professor Don Dewees and policy consultant Usman Valiante who are both experts on EPR wrote a scathing critique of the initiative in 2010. They claimed that "after a year of operation OES has only reached 40 per cent of the annual electronics recycling target it set for itself." The authors also went on to criticize the program because its budget is opaque, wondering "how many millions has OES accrued in eco-fees not expended on recycling? OES isn't required to tell, so no one knows" (Dewees and Valiante, 2010, updated 2012).

The OES—and with it eco-fees charged to the consumer buying electronic products—was scrapped in 2013 because the Ontario government conceded it was

not reducing waste at the rate it had set out to. The OES was replaced by the Waste Reduction Authority and according to Environment Minister Jim Bradley that shifted the cost of recycling from consumers to producers. The new body now also has powers to fine companies not living up to recycling goals (Brennan 2013). The Ontario government is also aiming to bring in Individual Producer Responsibility (IPR) tactics so manufacturers are responsible for managing life-cycle impacts of their products (MOE, 2013). It is too early to judge if the new government policy is more effective than the old one in reducing and managing our e-waste.

Conclusion

Many activists feel that if left unchecked, the accumulation of our e-waste will be catastrophic. What will happen to the billion smart phones people will own in 2015 if they are all replaced in twenty-two months, the average length of time people give up their current ones?

There are so many factors which have led to the crisis in hazardous electronic waste. Manufacturers design and produce electronics they know won't last. They don't care because they aren't responsible for what happens to their products after they're sold. They can't be responsible, it would be too costly, and it would cut into their profit too much.

They focus on designing new and better gadgets that actually may not really be new or better. They market the goods as being essential to our lives and our work. Consumers genuinely function better at home and in their workplaces than previous generations because of the wonderful functions computers and cell phones

and apps perform. But they are also swayed by cultural norms that convince them they will be happier and superior if they have more capacity and higher resolution on their devices. Governments talk about policy that will regulate waste management, but industry lobbies against it, or finds loopholes so they can carry on being polluters without penalties. "Recyclers" see that workers in developing countries are unprotected by labor laws and are willing to do the dirty and dangerous work of stripping toxic devices. So they break international laws to dump used products far away from home while law makers are unable to catch them and stop their illegal dumping.

Because there are so many causes that have led to the e-waste crisis, there have to be many layers of solutions. Change has to happen in the electronics industry, in government and in peoples' attitudes.

"Probably the most important step toward preventing the collapse of our technological society is to convince those who exert the greatest influence that it is in their own best interests to promote the necessary value changes" (Huesemann and Huesemann, 2011, pg. 141). The electronics giants must become more sustainable in their manufacturing. They are the ones who have to change their values and make profit secondary to global environmental health. A starting point is making products with longer lifecycles and higher grade, longer lasting batteries so consumers are not continuously accumulating and upgrading electronics. Producers need to also find component parts that are not as hazardous as the heavy

metals and toxic plastics they now use. If manufacturers don't change voluntarily government has to step in and require they adopt EPR and CSR standards.

Those producers who don't accept new standards of cradle-to-cradle manufacturing have to face more serious consequences. Governments have to stop being indecisive and make laws that have no loopholes so current practices of irresponsible manufacturing are penalized. Technology can hold the answer for ways to improve production. Innovation costs a lot but if manufacturers commit to re-using and recycling their component parts, they can find new marketing opportunities. They can also find new opportunities if they commit to green products.

Governments also have to create laws that can be applied to those shipping toxic waste to landfills in developing countries or burning them in incinerators at home. There have to be serious consequences for them too. Governments can also play a role in motivating manufacturers by giving them financial incentives to accept EPR standards.

And consumers have to change. Schools, public awareness programs and environmental watchdogs can help educate people to the hazards of our throw-away culture. Individuals need to be more accountable for their own role in the accumulation of e-waste—their unthinking, reckless and greedy hunt for a better phone or HD screen. If people insist on continually throwing out their used devices rather than keeping them longer, or finding responsible recyclers, municipal

governments should consider charging for their disposal, in the same way cities like Toronto charge for household garbage collection.

Finally, millenials are the super-consumers of gadgetry. And they're the ones who if they can't change their near-addiction to phones and screens are going to inherit a world that is filled with the toxic earth and air. So change has to start with them.

Acronyms

BFR Brominated Flame Retardants

BAN Basel Action Network

CIRA Canadian Internet Registration Authority

CSR Corporate Social Responsibility

ETBC Electronics Takeback Coalition

EPA Environmental Protection Agency

EOL End of Life

EPR Extended Producer Responsibility

GAO Government Accountability Office

GHG Greenhouse Gas

OECD Organisation for Economic Co-operation and Development

OES Ontario Electronic Stewardship

PVC Polyvinyl Chloride

RoHS Restriction of Hazardous Substances

StEp Solve the E-waste Problem

WEEE Waste Electrical and Electronic Equipment

Appendix

ONTARIO REGULATION 393/04
made under the
waste diversion act, 2002
Made: December 14, 2004
Filed: December 14, 2004
Printed in The Ontario Gazette: January 1, 2005
WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

Interpretation
1. In this Regulation,
"waste electrical and electronic equipment" means a device that is waste, that required an electric current to operate and that is,

(a) a household appliance, whether used inside or outside a home, including any device listed in Schedule 1,

(b) information technology equipment, including any device listed in Schedule 2,

(c) telecommunications equipment, including any device listed in Schedule 3,

(d) audio-visual equipment, including any device listed in Schedule 4,

(e) a toy, leisure equipment or sports equipment, including any device listed in Schedule 5,

(f) an electrical or electronic tool, including any device listed in Schedule 6, but not including a large-scale stationary industrial tool, or

(g) a navigational, measuring, monitoring, medical or control instrument, including any device listed in Schedule 7, but not including any implanted or infected medical instrument.

Designation
2. Waste electrical and electronic equipment is prescribed as a designated waste for the purposes of the Act.
schedule 1
household appliances

1. Air purifier
2. Air conditioner
3. Answering machine
4. Barbeque starter
5. Blender
6. Bottle or can dispenser
7. Can opener
8. Carpet sweeper
9. Clock
10. Clothes dryer
11. Clothes washer
12. Coffee grinder
13. Coffee maker
14. Curling iron
15. Dehumidifier

16. Dishwashing machine
17. Electric hot plate
18. Fan
19. Food processor
20. Freezer
21. Fryer
22. Glue gun
23. Hair dryer
24. Heat gun
25. Heater
26. Hot drink dispenser
27. Humidifier
28. Iron
29. Kettle
30. Knitting machine
31. Microwave oven
32. Mixer
33. Radiator
34. Razor
35. Refrigerator
36. Scissors
37. Sewing machine
38. Slicing machine
39. Solid product dispenser
40. Stove
41. Toaster
42. Toaster oven
43. Toothbrush
44. Vacuum cleaner
45. Vacuum sealer
46. Watch
47. Water purifier
48. Weaving machine
49. Weigh scale

schedule 2
INFORMATION TECHNOLOGY EQUIPMENT

1. Analog computer
2. Automatic teller machine (ATM
3. Bar code scanner
4. Calculator
5. CD-ROM drive
6. Computer disk drive
7. Computer keyboard
8. Computer mouse
9. Computer terminal

10. Copier
11. Joystick
12. Mainframe computer
13. Microcomputer
14. Minicomputer
15. Monitor (CRT)
16. Monitor (LCD)
17. Monitor (Plasma)
18. Personal computer (Desktop)
19. Personal computer (Handheld)
20. Personal computer (Laptop)
21. Personal computer (Notebook)
22. Personal computer (Notepad)
23. Personal digital assistant (PDA)
24. Point-of-sale (POS) terminal
25. Printer
26. Computer router
27. Computer flatbed scanner

1. Typewriter

schedule 3
TELECOMMUNICATIONS EQUIPMENT

1. Antenna, transmitting or receiving
2. Broadcast equipment (including studio), for radio or television
3. Cable television transmitting or receiving equipment
4. Citizens' band (CB) radio
5. Closed circuit television equipment
6. Fax machine
7. Global positioning system (GPS)
8. Infrared wireless device
9. Intercom system
10. Local area network (LAN) communication equipment
11. Modem
12. Pager
13. PBX (private branch exchange)
14. Satellite television transmitting or receiving equipment
15. Switching equipment
16. Telephone (Cellular)
17. Telephone (Cordless)
18. Telephone (Wire line)
19. Telephone answering machine
20. Telephone carrier line equipment
21. Telephone carrier switching equipment
22. Telex machine
23. Traffic signal
24. Wide area network communications equipment

schedule 4

AUDIO-VISUAL EQUIPMENT

1. Amplifier
2. Audio player (tape, disk, digital)
3. Audio recorder (tape, disk, digital)
4. Camera (film, tape, disk, digital)
5. Equalizer
6. Headphone
7. Microphone
8. Mixing board
9. Musical instrument
10. Preamplifier
11. Public address system
12. Radio
13. Receiver
14. Speaker
15. Television (CRT)
16. Television (LCD)
17. Television (Plasma)
18. Television (Rear projection)
19. Tuner
20. Turntable
21. Video player or projector (tape, disk, digital)
22. Video recorder (tape, disk, digital)

schedule 5

TOYS, LEISURE EQUIPMENT AND SPORTS EQUIPMENT

1. Action figure and accessories
2. Arts, crafts or hobby device
3. Building set
4. Doll
5. Game or puzzle
6. Infant or preschool toy
7. Learning or exploration toy
8. Outdoor or sports toy
9. Plush toy
10. Vehicle
11. Video game and accessories

schedule 6

ELECTRICAL AND ELECTRONIC TOOLS

1. Bender
2. Blower
3. Cutter

4. Disperser
5. Drill
6. Fastener
7. Folder
8. Grinder
9. Hammer
10. Joiner
11. Lathe
12. Lawn mower
13. Mill
14. Nail gun
15. Nibbler
16. Planer
17. Polisher
18. Punch
19. Riveter
20. Router
21. Sander
22. Saw
23. Screwdriver
24. Shear
25. Soldering gun
26. Sprayer
27. Spreader
28. Staple gun
29. Trimmer
30. Vacuum
31. Welder
32. Wrench

schedule 7
NAVIGATIONAL, MEASURING, MONITORING, MEDICAL OR CONTROL INSTRUMENTS

1. Alarm system
2. Analyzer
3. Automatic environmental controller or regulator
4. Cardiology equipment
5. Dialysis equipment
6. Drafting instrument
7. Fertilization tester
8. Fire detection and alarm system
9. Freezer
10. Hearing aid
11. Heating regulator
12. Humidistat
13. Instrument for industrial process control
14. Irradiation equipment

15. Laboratory analytical instrument
16. Laboratory equipment for in-vitro diagnosis
17. Medical equipment, ultrasonic
18. Medical radiation therapy equipment
19. Meteorological instrument
20. Meter
21. Nuclear medicine equipment
22. Oscilloscope
23. Process controller
24. Pulmonary ventilator
25. Radiation detection or monitoring instrument
26. Radiotherapy equipment
27. Refractometer
28. Scanner (CT/CAT)
29. Scanner (MRI)
30. Scanner (PET)
31. Smoke detector
32. Soil testing or analysis instrument
33. Surgical support system
34. Surveying instrument
35. Temperature instrument
36. Thermostat

Made by:

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Minister of the Environment

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