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Green technology and its effect on the modern world

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ABSTRACT

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The background of this thesis is to give the reader knowledge about green technology. However, the reader should know about the past, present as well as the potential future beforehand.This thesis was completed using applied knowledge on green IT as well as user oriented design with a focus on planned obsolescence, and used literature research methods.The main sources are from web pages due to the contemporary nature of this topic. The goal of this thesis is that it will hopefully give the reader information about an obscure topic that is often not talked about. I have concluded that electronic waste is a much bigger problem than most people realize, but there is still hope for the environment and things are within an individual's control.

The reader will be given a background about technology to see why things are the way they are. Secondly, they will read the history to understand our growing dependency on oil, coal, and other pollutants. Following the history of technology is the history of green technology and what ideas have prospered or failed. There are important certifications and standards for products that the user can choose to buy, this will help the reader live a greener lifestyle with more informed decisions. The second half of this thesis will inform the reader of the effect on the environment, planned obsolescence, and sweatshop labor. The reader will see that these seemingly completely different things are in fact, actually connected and trigger each other.

The final part of this thesis offers the reader potential solutions that can be applied in individual homes. If the individual wants to expand on being greener to where they work, they are able to do that as well. Next, modular technology is featured because I believe that it offers a viable solution. Since humans will not suddenly stop being consumers, modular technology offers a somewhat guilt free way of updating or customizing your technology

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Keywords: Green technology, sustainable development, environmental problems

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1. INTRODUCTION

The topic of this thesis is about green technology and its effect on the modern world. It covers a wide variety of subjects, but the main ideas of this thesis are divided up into three main sections. The first section will give the reader a background about the history of technology, green technology, as well as different green initiatives, agencies and certifications for products.

The second section will talk about problems we face as a result from technology, as well as our potential future if we do not change our ways as consumers and how companies operate day-to-day. This will give the reader a very real glimpse into the future, so they may want to change the way they buy. Sweatshop labor is an important piece of this section, giving the reader facts about how sweatshops really are.

The third section will discuss possible solutions to this crisis that we are facing. These solutions will enable the individual reading this thesis to make easy changes that will make a huge difference in the long-run.

The idea is to start at home then implement ideas into their office, since that way is much easier. The purpose of this thesis is to provide the individual that is reading this with as much of the information that they could need on the problems we are facing, so they are aware of what is actually going on in the world. Secondly to equip them with possible solutions that they could then pass on to their peers that are either friends, neighbors, bosses, or even colleagues at their office space.

Many people are simply not even aware of green technology's existence, as well as not knowing how to live a greener life, many just do not understand the concept of green technology or think of it as something that is costly, or too difficult to do. I hope that this thesis will make the individuals that read this realize that living a greener life can actually save them money in the long-run, as well as that it isn't impossible to work your life around it.

It is important for the reader to understand that due to the way technology progressed, it has made us dependent on certain resources, such as coal. If the reader can observe just how long we have been dependent on resources that are harmful for the environment they can understand how it is

difficult to transition to greener solutions, due to our prolonged dependency. The potential future is included in this paper because many do not know what harsh realities we may be facing if things do not change soon.

Subsequent chapters will discuss green technology, and how to live a greener life. These tips will help one to adapt to a greener lifestyle.

My research questions are: How has green technology affected the world?

What kind of environmental problems technology is causing?

What can be done to make homes and offices greener?

2. HISTORY OF TECHNOLOGY

Technology has been around for longer than many of us remember. To most it seems like it has always been there, in some form or another. It is hard to determine the exact time that technology was invented, because you have to first define; what is technology? In the Stone Age technology was tools and weapons to hunt with, or even fire. In later periods technology was weapons and tools forged from metals. The wheel was invented in 9500 BCE and is seen as one of the most important pieces of technology ever created, since it enabled its users to be much more productive in transporting goods. The Egyptians were known for their technology as well as their engineering skills, using ramps to build the pyramids. The Chinese were known for their many technologies they created, such as a printing press, suspension bridges, paper, cast iron, gunpowder and many more inventions that are still in use today.

GREEKS

The Greeks were also very well-known for their many inventions as well as their vastly intricate architecture. The Greeks were actually known for creating the first piece of mechanical technology, a watermill. The Greeks were also known to experiment with wind power, making a wind wheel that would power an organ to play. But the most important invention that the Greeks created would be their steam powered engine, or Aeolipile (figure 1). (Schmidt, 1899. 230-231).

Figure 1 Aeolipile (Wikipedia 2016, cited 10.11.2016)

The way the Aeolipile worked was that it was a bladeless, radial steam turbine that spins when the central water container is heated. Torque is then created by steam jets exiting the turbine, much

like a rocket engine. The name is derived from the Greek word Ἀΐολος and Latin word pila – translates to "the ball of Aeolus", Aeolus being the Greek god of the air and wind. The Greek period is arguably the most important time in history, because it was the creation of mechanical technology. (Darling 2016, cited 1.1.2017).

One of the last Greek inventions is a newer find from an old shipwreck, known as the Antikythera mechanism. This piece of technology is basically the first known analog computer as well as an orrery used to predict astronomical positions, eclipses for calendrical and astrological purposes. This impressive piece of technology also followed the Olympiads, known as the cycles of the ancient Olympic Games. (Drupal 2016, cited 1.11.2016). This piece of technology consisted of various teeth and gears and is believed to have been created between 150-100 BC. This mechanism was so advanced, similar technology has not resurfaced until astromechanical clocks in the fourteenth century.

MEDIEVAL AND RENAISSANCE

Other well-known periods in history would be the medieval period and the Renaissance. This was also another great time of great technological progress that was made. This was the time period when mechanical clocks, glasses, and the vertical windmill were made. The medieval period also was when the first push button was invented, and the watermark to prevent counterfeiting. Since this time was a period of exploration, many strides in sailing technology were made in addition to other well-known inventions.

The Renaissance, known as the rebirth was the time of the scientific revolution, as well as the rebirth of architecture and art. During this period the cast metal type printing press was created, as a result more books could be created. (Gascoigne 2001, ongoing, cited 1.1.2017).

INDUSTRIAL REVOLUTION

One of the last important periods would have to be the industrial revolution. This time was when consumers started buying more, thus the companies that existed had to create more supply to keep up with the demand. Textile manufacturing, mining and transport by steam engine was introduced. This is also one of the first documented times where child labor was used in factories due to the

children's small size, which enabled them to access the smaller parts of the machinery and repair them.

One of the driving forces that allowed the industrial revolution to take place was the use of coal, a cheap resource that there seemed to be an abundance of. Coal powered everything at this time, in factories as well as in homes. Pollution was dangerously high at this time, just like it still is today. London constantly had a fog looming over the city, people called it "pea soupers" implying that the fog was as thick as pea soup. The abundance of coal led to the first steam engines, which later paved the way for the automobile. (Gascoigne 2001, ongoing, cited 1.1.2017).

NINETEENTH CENTURY

In the nineteenth century steam engines were installed in steamboats and trains. To make trains safer, the telegraph was invented, so that stations could communicate with each other, to avoid accidents. Other technology was also created, such as the incandescent light bulb, which is similar to the ones we use today. More products were able to be created due to workers now working in shifts. Some industries, such as the shoe industry was mechanized during this time thanks to the invention of sewing machines. Since the discovery of steam engines, many businesses were using steam to power their factories. This may seem green in theory, but wood and/or coal was used, which made the city high in pollution levels. Petroleum was discovered at this time, but was still being studied, therefore not much was known about it. (Gascoigne 2001, ongoing, cited 1.1.2017).

TWENTIETH CENTURY

The Twentieth century arguably saw the most change, mass production, assembly lines and the invention of the automobile were made in the beginning of the century, which already was a huge stride ahead. Military research brought early computers, mobile phones, improved radios, and jet engines. During this time, electricity became more affordable, although invented earlier it was too expensive for widespread usage, so only the wealthy could afford it. Towards the end of the century, the World Wide Web, otherwise known as the internet and GPS technology were invented. (Gascoigne 2001, ongoing, cited 1.1.2017).

TWENTY-FIRST CENTURY

Lastly, the present day,the twenty first century. This century has just begun, so it remains to be seen just how far humanity will progress with its technology.

Most people have cell phones, and computers at their disposal due to them becoming more affordable and reliable than they were in the previous century. In this age people are working on quantum computers, drone technology, nanotechnology, alternative fuel sources, virtual reality, and much more.

Arguably one of the most important pieces of technology so far would be the large hadron collider, which has been used to discover dark matter and the higgs boson. Humans in this period have also sent robots to mars, one of which is continuously streaming data back to NASA. There are plans on sending humans to Mars, which until recently was believed to be a one way trip, due to solar radiation, but NASA and others, are working towards making space suits and ships better at protecting the people in them, from said radiation. NASA has planned a manned mission to Mars by 2030, 61 years after initially landing on the Moon. (NASA. 2014. Cited 22.4.17)

Unfortunately coal is still in use today to generate 44% of the world's electricity, despite it being the worst polluter. (UCSUSA. Cited 22.4.17) Green technology is a newer concept, therefore it is not widely used. The goal of green technology is the practice of environmentally sustainable computing. Green computing's goal is to minimize the negative impact of IT operations on the environment by creating as well as disposing of computers and related products in an environmentally-friendly way.

These past inventions may not all seem to be relevant, especially if they are no longer in use. In fact, all of these inventions served a purpose. What are their purposes, you ask? Well think of them as stairs, each step may seem insignificant, but in the end it leads to something, an end result.

3. BRIEF HISTORY OF GREEN TECHNOLOGY

The usage of green technology goes back further than many people think. Green technology seems to be a completely new concept that the majority do not know much about. Green technology, or renewable energy have been around for thousands of years. Wind was used to carry ships over water as early as 7000 years ago by the Egyptians. The primary sources of renewable energy in history were; human labor, animal power, water power, wind, and firewood.

In the 1800's wind turbines powered irrigation systems for farming, and in 1830 a book was written by John Etzler who talks about a city that is run by wind, tidal, and solar power. In the 1860's, when fossil fuels were beginning to be used, people feared about already running out. "The time will arrive when the industry of Europe will cease to find those natural resources, so necessary for it. Petroleum springs and coal mines are not inexhaustible but are rapidly diminishing in many places. Will man, then, return to the power of water and wind? Or will he emigrate where the most powerful source of heat sends its rays to all? History will show what will come." (Mouchot 1873, cited 10.11.2016).

It is amazing how people back then already feared about running out of fossil fuels, so they wanted to go back towards more renewable technology. Today we are so dependent on fossil fuels it seems like it is an impossible task to switch over to alternative energies.

Wind power has been around since 5000 B.C. propelling boats in the nile river, and is still in use today for mainly commercial use. (Wind energy foundation. 2016. Cited 22.4.17) The power produced by the wind turbine is only as good as the wind it receives, so these units have to be strategically placed. Wind turbines are usually placed together in groups, called "wind farms".

Geothermal energy comes from thermal energy, stored in the earth. It is not certain how long it has been around, but it only exists in certain regions. Some geothermal energy locations were historically used as hot springs, or for even heating homes, but now has been changed to create energy.

Solar power technology is quite new, since it requires complex and expensive panels that can store the sun's energy. Solar energy is widely used in homes, or even flat land that receives a lot of sun, such as deserts. The power can be stored, or sold to whoever needs it.

Hydro-power uses the power of flowing water to generate electricity. In 2015 it generated 16.6% of the electricity in the world, as well as 70% of the total of renewable energy generated. Hydro-power exists in many forms, such as dams, rivers, and other small installations. Hydro-power is already being produced in over 150 countries, making it the most widely used form of renewable energy. (REN21. 2016. Cited 22.4.17)

Did you know that in the 1900s electric taxi cabs were widely used in Manhattan, or that in California solar power was widely known about and was used to heat showers, or that windmills were used to draw up water in the Midwest to help with drought? In fact the electric vehicle company (EVC) was the first invention of an electric car (figure 2), called the electrobat. Although the range was only fifty to one hundred miles, it was still impressive. (Madrigal 2011, cited 10.11.2016)

Figure 2 Electrobat (Madrigal, A.2011, cited 10.11.2016)

Yet, the mystery of this taxi company that was created by two men still remains. This was such an excellent idea, and was even improved until it became city-wide. The reason why we do not have electric taxis today is because when these taxis were spread over the city, they simply were not cared for and maintained properly. The drivers were not trained properly, so it was not simply an issue of laziness, but due to the failure of this the company was forced to shut down and were replaced by the taxis that we see today.

Solar power was widely used in California homes, it was mostly used to power heaters back in the 1940's. Solar power was so commonly used, it almost became the main source of power back in the 1970's. Due to the increasing demand for solar power, the company creating the heaters had to move to a bigger manufacturing space. Unfortunately this caused the price to go up which led consumers to look elsewhere. (Gerhardt 2011, cited 12.11.2016.)

Gas heaters were created after discovering a plentiful amount of natural gas in southern California, which is what people switched to save money. This is what killed the business of solar heating. In 1973, as a result of the OPEC oil embargo, the Solar Energy Research Institute (SERI) came to be. The goal of this institute was to advance all solar technologies, unfortunately due to inadequate federal funding, too broad of a research subject, and an unsuited director impeded SERI's ability to fulfill its goal. (Gerhardt 2011, cited 12.11.2016.)

SERI for the most part had to give up, so there hasn't been much progress with solar technology. No one knows why majority of people do not know about the history of green technology, or why we do not pursue it more, especially now that it seems to be more of a priority. (Gerhardt 2011, cited 12.11.2016.)

4. GREEN INITIATIVES AND CERTIFICATIONS

Green technology and other Eco-friendly products are still a new concept to many. Technology has made quicker advancements as time goes on, but many have not stopped to think about the effects it could have on the environment. It was not until 1992 when Energy star was launched by EPA (Environmental Protection Agency) in the United States of America. They created a voluntary program that helps organizations to save money while also reducing their emissions when they successfully identify products that have superior energy efficiency. These products generally use 20–30% less energy than required by federal standards. The list below are some major green initiatives. There are plenty more, but these are the most well-known:

- *Climate Savers Computing Initiative (CSCI)* an effort to reduce electric power consumption of all PCs in active/ inactive states. (Schnitt 2007, cited 12.1.2017).
- *The Electronic Product Environmental Assessment Tool (EPEAT)* can assist in buying greener computing systems. A Council evaluates computing equipment on 51 criteria - 23 required and 28 optional, measuring a product's efficiency and sustainability. Products are rated Gold, Silver, or Bronze. (Case 2010, cited 12.1.2017).
- *The Green Grid* is a global association dedicated to advancing energy efficiency in data centers and business computing ecosystems. Companies such as AMD, APC,Dell, HP, IBM, Intel, Microsoft are responsible for its founding. (The green grid 2017, cited 12.2.2017).
- *Energy star* is an association started by the Environmental Protection Agency (EPA) in 1992 which labels products that use 20–30% less energy than required by federal standards. As of 2006, more than 40 000 energy star products are available. (Energy Star 2017, cited 3.3.2017).
- *TCO certification* promotes sustainably designed IT products. Certified products meet a broad criteria scope including requirements for socially responsible manufacturing, environment as well as health and safety throughout the products life cycle. (TCO development 2017, cited 4.4.2017).

5. PROBLEMS

There are many problems that we are facing today as a result from the progression of technology. In the following section, main issues will be discussed. Technology has definitely helped advance our species further than we could have ever imagined. Technology has greatly improved the lives of many on Earth. It also has saved countless human lives, for example; putting expendable robots in harm's way instead of humans.

However, progress has come at a high cost. The first section will discuss a concept known as planned obsolescence, a subject that is not widely known due to the secrecy of manufacturers. The second section will talk about sweatshop labor, another concept not known to many. Companies try to keep sweatshop labor secret, so not much is known about what goes on in a sweatshop.

The subsequent chapter will discuss the effects, or consequences of our consumer lifestyle; excessive e-waste, otherwise known as environmental waste. The effect on the environment, as well as the possible potential future will give the reader a better idea of what we are actually putting our planet through, and the danger of not changing before it is too late.

5.1 Planned Obsolescence

Planned obsolescence has been around arguably since 1924, its first victim was the light bulb. This is quite ironic since light bulbs typically are used to represent good ideas. Planned obsolescence has been described as "a desire to own something a little newer, a little sooner than necessary" (Stevens, B.2010. 13.11.2016). The Phoebus cartel came into existence in 1924 and controlled the quality of light bulbs until 1939. (Krajewski 2014, cited 13.11.2016).

The cartel wanted to regulate light bulbs and implemented a rule that light bulbs must last less than 1000 hours or the makers would be fined, or possibly face severe consequences from the intimidating gang. It may seem shocking that lightbulbs created prior to 1924 lasted more than 1000 hours, when in fact a light bulb made in 1904 is still going to this day in the Livermore fire station, making it more than 100 years old. Light bulbs were also quite durable before the 1000 hour rule

was put into place, so along with the lifetime of bulbs being dramatically reduced, manufacturers had to also make the bulbs more delicate. In 2 years thanks to the cartel, light bulbs went from a lifespan of 2500 hours to less than 1500 hours, then to the standard 1000 hours in 1932. (Dannoritzer & Michelson 2010, cited 13.11.2016.)

There was even a patent filed for a light bulb that lasted 100 000 hours, but never made it to the market due to the existence of the gang at the time. The light bulb was only of course the start for planned obsolescence to bleed into other industries, and is responsible for creating a culture of consumers. Since products were now regulated in terms of quality, companies could compete on a more level playing field. (Dannoritzer & Michelson 2010, cited 13.11.2016).

Consumerism has existed for quite a long time, it mainly came to be during the industrial revolution (1820-1840). The abundance of various materials and inventions drove down the price of most goods. People started to shop for fun instead of necessity, buying more clothes and appliances than the usually did due to the low prices. The problem at this time was that things lasted too long in the eyes of the companies. People would buy a fridge for example, and it would last for a lifetime. Although not much was done at the time, companies sought out to shorten the lives of appliances, etc. to make people buy more, therefore to raise profits for the company. This was of course all possible thanks to the light bulb. (Dannoritzer & Michelson 2010, cited 13.11.2016).

Appliances were made to last during the stock market crash in 1929, so the consumer market faded away. People barely had enough to eat and survive, let alone afford things that they didn't necessarily need. In 1932 Bernard London published a paper that was called "ending the depression through planned obsolescence", getting credited for coining the term planned obsolescence. Although he may not be the person who created the term, it was the first documented use of the term. His goal was "restructuring society around a body of experts whose mandate was to achieve an equilibrium of supply and demand that would eliminate technological unemployment." (London 1932, cited 14.11.2016), and that the problem was not the companies, but the human relationships. He goes into further detail about why human relationships are to blame, and states that the buyers are paralyzed and have no buying power. The factories are not to blame since they can still produce product without any problems.

His solution was simple, he wanted to plan the obsolescence of technology, causing the need for people to buy products, thus stimulating and jump-starting the economy once more.

In the 1930's Dupont created extremely durable stockings made from nylon, and the workers were told to bring pairs home to their wives to test. (Dannoritzer & Michelson 2010, cited 13.11.2016).

The women were thrilled that at the durability of these new stockings, claiming that they were the longest lasting pair they had ever owned. The nylon was so strong that it was used in the army for materials in parachutes, ropes and airplane cords. But the workers faced a crushing dilemma, sure the testers were more than pleased with their durable product, but that meant that they would ultimately be buying less of them, unlike the other brands already on the market. Thus the engineers of the nylons made them more fragile, to keep their business profitable. (Dannoritzer & Michelson 2010, cited 13.11.2016).

In a movie called "the man in the white suit" (1951) follows a man who is obsessed with creating an everlasting fiber. He creates a wonderful fiber that never wears out, as well as that it repels dirt. The fabric is glowing white (due to being slightly radioactive), and he showcases it in the form of a white suit. The industries want the fiber at first, but then realize what the consequences would be; once the consumers have bought all the fabric they want, the demand for it will sharply decline, thus killing many businesses in the process. The man decides to continue with his invention elsewhere, but is chased by an angry mob. His suit falls apart over time and the angry crowd pulls sleeves off, then becomes pleased that his invention has failed. (Rovi. Cited 22.4.17)

Brooks Stevens, an American industrial designer popularized planned obsolescence by designing trendy products in the 1950's, making consumers always crave the newest version of that product. Although he mainly focused on automobiles and motorcycles, he designed many products. He was rather unique, because he didn't want to release products that were poorly made that break easily, instead he wanted to create the desire in the consumer to want the newer products. This can be seen today with the constant release of smart phones.

Constantly releasing products on a yearly cycle was fairly common at this time, both General Motors and Ford released newer, slightly better models each year to entice more and more customers to buy. Although consumerism in addition to planned obsolescence were alive and well in the United States, in poorer countries such as the Soviet Union they were not. Due to the communist economy planned obsolescence could not survive since there was a shortness of many resources, many say that it just simply did not make sense for planned obsolesce to exist there. Things remained for the most part, built to last.

There is a reason why planned obsolescence seems to work, because it works on a deep psychological level. Why do people keep buying stuff that they do not need, and simply just want? It can be to impress certain social circles, or to give the consumer a sense of belonging if you have similar technology. Also, to maybe feel more superior to others. If the customer does not upgrade to the latest and greatest product, they may be mocked by others. (Greutman, L. 2016. Cited 22.4.17).

This guilt together with shame start off from the companies, their goal is to get you to feel bad about your inferior older model, and that you **need** to get the newest one. This shaming can spread to your peers, who wonder why you haven't "upgraded" yet. The simple use of that word implies that the latest product is a huge step up from your current model, which is why people get excited when companies come out with new products.

Planned obsolescence is still a major influence on the products released today, but is causing conspiracy with the consumers. Apple made an ill-planned product in 2001, called the iPod. People went crazy for it, but didn't realize the extremely limited life cycle of the product. The iPod had a sealed battery that was not replaceable once it ran out. The only solution given to the consumer was to simply buy a new one. (Kahney 2011, cited 1.12.2016).

A class action lawsuit called Westley vs. Apple featured consumers who were angry for sinking over $200 into an obviously faulty product. What resulted from this lawsuit was a statement from Apple " it would give vouchers and a year's extended service warranty to people with proof of purchase, whose iPod batteries did not last as long on a single charge as had been stated. Those who experienced battery failure - where the iPod played for 50% or less than the advertised time of eight hours - should be able to claim a new iPod, have it fixed, or get a $50 (£28) credit for Apple products."(BBC news 2005, cited 13.11.2016) (Kahney 2011, cited 1.12.2016).

Although this was seen as a victory, Apple still makes products that are extremely difficult to repair, eventually implementing a tamper-proof screw in their products that do not come out with a regular screwdriver. Plenty of different technologies are seen as disposable, the manufacturers claim that it is cheaper to get a new one instead of repairing the old product. To replace the battery of an iPod shuffle it is $50, or the same price to get a new one. Toshiba even sent a cease and desist order to a website that shared instruction manuals on how to repair their products (Kyle 2012, cited

4.4.2017). With so many companies discouraging repairs, it's no wonder why there is so much e-waste in the world today. (Jones 2016, cited 2.12.2016).

Programmed obsolescence is another part of planned obsolescence, it involves the companies adding software to the product, making it slow and maybe even less responsive. This is the most apparent with printer cartridges that can be disabled, despite having ink left. Some cartridges have been reported to be as full as 50%. There are more than 350 million printer cartridges thrown away each year into North American landfills, and only 70% of the cartridges make it to the recycling bins. (Cartridge World 2016, cited 13.11.2016).

In more recent news, France has passed legislation in 2015 that now requires that manufacturers and vendors must declare the intended product lifespans as well as informing consumers how long spare parts for said product will be produced. In addition to this, from 2016 forwards the manufacturers must repair or replace the appliance for free, any defective products can be replaced within two years of its original purchase date. (SGS 2015, cited 13.11.2016).

What this means is that they are essentially creating a mandatory two-year warranty on all appliances. If manufacturers do not do this they can face fines of 15 000 €. This movement is gaining awareness and is spreading to the European Union who want to eliminate planned obsolescence all together. Although this requirement is rather new, it definitely could have the power to change the world. (SGS 2015, cited 13.11.2016).

Another point to consider is that do the consumers really care that this is going on? People in developed countries have a better standard of living due to companies trying to create better and better products each year. People have the option to buy cheaper electronics as binge purchases, but also have the option to buy more expensive items that they know will hold their value, unlike their cheap counterparts.

When one buys something that isn't too expensive, they must assume that it will not last as long as something more high-end, so if you want more durable commodities, they can acquire them elsewhere. Planned obsolescence has a bad reputation, people often blame it for shoddy workmanship becoming commonplace in today's world but it has definitely done some good. First off, it ended the depression through consumerism. Secondly, there would be no economy (at least to today's extent), no malls, no designers/ brands as well as no jobs.

If there is plenty of competition in a certain industry, it can produce superior products. For example, Japanese cars had longer lifespans, so Ford was forced to make longer lasting, better cars to try to draw in more customers.

In 1969 the average age of a passenger vehicle was 5.1 years, now it is 11.4 years. (Hadhazy. 2016, cited 15.11.2016). Air bags were also added as a standard feature to cars due to the high levels of competition, a feature that was once only used in luxury cars. Technology today seems to be something that many humans living in developed countries cannot seem to live without. This is definitely a problem, since people are getting increasingly glued to their technology. The average person spends over 8 hours on electronic devices, meaning that they spend more time on devices than sleeping. 4/10 check their phones during the night if it wakes them. More time is spent checking emails than eating breakfast. This is dangerous of course, since the nearly constant exposure can lead to poor sleep. Poor sleep can cause a myriad of other issues such as weakened immune systems, increased risk of heart disease, high blood pressure and even diabetes. People who do not get the required amount of sleep can also become more susceptible to mental health disorders such as anxiety, depression and decreased fertility. (Davies 2015, cited 2016; Khaleeli 2015, cited 2016; Spinks, R. 2015, cited 2016.)

5.2 Sweatshop labor

Sweatshop labor is almost inarguably a direct result from planned obsolescence and from our consumer culture. Many are unaware just how major a role sweatshop labor plays in their daily lives. Almost everything you own in fact, comes from a sweatshop. Those that are aware may choose to ignore that sweatshops even exist, or are naïve of the working conditions. Merriam Webster defines a sweatshop as "a shop or factory in which employees work for long hours at low wages and under unhealthy conditions". (Merriam-Webster, cited 22.4.17)

Sweatshops have been around since 1830-1850 and started with the clothing industry. Due to the industrial revolution driving down the prices of goods, the consumer was born. The supply had to keep up with the increasing demand of goods. Due to sweatshops existing in poorer neighborhoods, a lot of immigrants and others started working to earn wages. Although many workers and other activists have successfully campaigned for rights for the sweatshop workers, or

at least to improve working conditions. Unfortunately, not much has changed in the 166+ years they have been in use.

Sweatshops have expanded to other industries, in the present day the most well-known for creating technology. Since sweatshops are against the law, it is unknown just how many are in existence. It is safe to assume that the numbers are easily in the thousands, just within the United States. Sweatshops are most well-known for assisting in developing countries, where workers would rather get paid small wages than none at all. Despite all the drawbacks, it can bring some wealth to these countries. Some examples of countries that are known for having sweatshops are: Bangladesh, Romania, Costa Rica, El Salvador, China, Dominican Republic, India, Vietnam, Honduras, Indonesia, Armenia, Brazil, Haiti, Taiwan, Mexico, and the United States, as well as its territories. (Moore 2011, cited 11.11.2016.) China is the most famous for creating a wide range of electronic products.

While some countries may gain some wealth from sweatshops, the bad outweighs the good they may bring. An estimated 168 million children, ages 5-14 are forced to work, (Do something, cited 11.11.2016.) The worker's wages are barely enough to cover cost of living expenses. "In Hongkai (China) Electronics for example, workers' minimum monthly wage was $138 USD in October 2010. There was a $6 USD deduction for dormitory accommodations, a $40.50 USD deduction for food, a utilities fee deduction, and a $15.30 USD deduction for social insurance, which left $76.20 USD. If workers have other expenses or financial responsibilities, such as vocational education classes or financial support of their parents (one of the main reasons migrant workers seek work in cities), it would be impossible to meet their living costs with only $76.20 USD. In this situation, workers find themselves with no other option but to work excessive overtime." (China labor watch 2011, cited 11.11.2016.)

In one of Apple's Pegatron factories (in China) in 2014 got caught failing to protect their employees. An undercover reporter working as a sweatshop employee experienced being forced to work 12 hour shifts 18 days in a row. If the workers fell asleep they were forced to work overtime. If they failed to show up, they were fired. Sweatshops like these also force their female employees to take mandatory pregnancy tests as well as birth control pills to avoid maternity leave or providing the appropriate health benefits. The workforce population of sweatshops consists of 85-90% female employees. (Do something, cited 11.11.2016.)

China labor watch also sent investigators to work in the top 10 major electronics factories. These companies are known for assembling products for Apple, Dell, HP, Nokia, Motorola, and Sony. In their 8 months of observation and employee interviews they discovered not only unethical conditions, but illegal under Chinese law. "Nine of the ten factories allegedly forced their workers to work as many as 40 extra hours of overtime each week and nine paid a basic wage that "did not provide workers with the means to afford basic living costs". The report claimed that "on one HP assembly line, workers were required to complete their assigned task every three seconds, while continually standing over a ten-hour period".(China labor watch, cited 11.11.2016).

Sweatshops are often found guilty of human trafficking. Workers have been tricked into starting work without informed consent, or are kept to work through debt or mental duress. This is more likely if the workforce is children or the uneducated poor. Sweatshop labor has also spread to prisons for cheap labor within the US. In many ways sweatshops are like a prison you feel like you could not escape from. The conditions in these facilities are notoriously bad that it has caused many employees to commit suicide in various ways, the most popular being leaping to death from the building itself. Therapy, in the company's eyes is too expensive, which is why they put up suicide nets instead.

Figure 3 shows a breakdown of the costs associated with the IPhone 5 by Apple. As you can see the production is only $8,00 out of the total manufacturing costs of $226, making it one of the cheaper parts of the process. (Sherman 2013, cited 1.1.2017; Poushiter. 2016, cited 1.1.2017).

iPhone 5 Manufacturing Cost Estimates	
Flash Memory & RAM	$20.85
Display & Touchscreen	$44.00
Processor	$17.50
Sensors	$6.50
Cameras	$18.00
Cellular Radio	$34.00
Wireless Radio	$5.00
Battery	$4.50
Power Management	$8.50
Mechanical Parts	$33.00
Packaging	$7.00
Production	$8.00
Licensing Fees	$20.00
Total Cost	*$226.85*

Figure 3 Cost of Iphone 5 (Sherman, J. 2013, cited 1.1.2017)

Figure 4 shows smart phone ownership in several different countries. As you can see, Korea has a 100% ownership rate for 18-34 year olds, whereas Pakistan has only a 13% ownership rate in the same age group. Korea also has the highest ownership for the older age group featured, 35+, at 80%. This graph shows just how common it is to own a a smart phone, although some countries own more than others, which raises the question of just how many phones are actually being produced.

		USE THE INTERNET*	OWN A SMARTPHONE†

Country	Total %	Age 18-34 %	Age 35+ %	Diff
United States	72	92	65	+27
Canada	67	94	58	+36
France	49	85	35	+50
Germany	60	92	50	+42
Italy	60	88	52	+36
Poland	41	75	25	+50
Spain	71	91	64	+27
United Kingdom	68	91	60	+31
Russia	45	76	29	+47
Ukraine	27	56	13	+43
Turkey	59	81	39	+42
Jordan	51	60	41	+19
Lebanon	52	74	37	+37
Palestinian territories	57	73	39	+34
Israel	74	87	67	+20
Australia	77	95	70	+25
China	58	85	43	+42
India	17	27	9	+18
Indonesia	21	39	7	+32
Japan	39	77	31	+46
Malaysia	65	88	46	+42
Pakistan	11	13	7	+6
Philippines	22	31	14	+17
South Korea	88	100	83	+17
Vietnam	35	56	17	+39

Figure 4 Smartphone ownership (Poushiter 2016, cited 1.1.2017)

So why do sweatshops exist? Studies show that if companies doubled the wages of sweatshop workers, the cost would increase by 1, 8%. Many consumers would be willing to pay 15% more to know that it did not come from a sweatshop.

Many companies such as Apple have attempted to make amends by offering a pay increase in their Foxconn factory from £91 to £203 per month. (Vinvent 2014, cited 2016; China labor watch 2011, cited 2016; Foster 2010, cited 2017). This isn't a complete fix, but appears to at least be a step in the right direction.

5.3 E-Waste

In the previous section, the reader discovered the horrific conditions in sweatshops. Many are unaware of just how bad these conditions are. Many do not know how to dispose of technology properly, this section will not only educate the reader but will also warn them as well. Many of wary of recycling their old technology, due to privacy issues. The device still holds sensitive information that can be easily recovered, and simply deleting it does not actually remove it from the hard drive. If the user is worried about this, the hard drive should be safely removed and be physically destroyed somewhere safe. If this is not an option, look for recycling centers that sign NDA's. (Vidal 2013, cited 1.1.2017.)

You may see electronic recycling centers or bins, or maybe even drives every so often. You are encouraged to bring any electronic products, or printer cartridges to get them recycled safely, but sadly the Silicon Valley Toxics coalition estimates that 80% of e-waste is shipped abroad to developing countries. (Vidal 2013, cited 1.1.2017.) Many companies that claim to dispose of electronics safely, in fact do not. Many use 3rd world countries as dumping grounds because it is cheaper than proper disposal with professionally trained employees.

The people of these developing countries are then left with no other option than to salvage the valuable materials (such as copper) within machines, or to attempt to repair the technology. Some of the effected countries have succeeded in repairing the technology, and have even turned profitable businesses out of selling the technology that they repair. This already shows a major difference in attitude towards technology, a first world country discards the "old technology" which to them is useless (despite maybe not being that old), and third world countries try to repair it.

Despite these countries trying to make the best out of their situations, the environmental effects still linger. On average a computer contains 8 pounds of lead. (Vidal 2013, cited 1.1.2017.) Lead can

cause nerve disorders and joint pain in adults. High levels of lead in children have been associated with brain damage and anemia, according to the Centers for Disease Control and Prevention.

Cars are also harmful, they may leak fluids such as oil, which can contaminate food and water supplies, or even kill of people and wildlife. (Virogreen 2014, cited 20.3.2017).

Figure 5 shows what countries receive electronical waste (or E-waste), and how it is distributed. Electronic waste comes from all over the world, North America, and Europe are the major contributors to this problem. It is scary to see that not just one country is to blame, in fact many countries are at fault here. Many are in denial about how universal of a problem this is. As you can see, China and India are the main recipients of the waste. (Virogreen 2014. Cited 3.20.2017)

Figure 5 E-waste recycling. (Virogreen. 2014, cited20.3.2017)

Figure 6 shows the worst electronic offenders. It is shocking to see the top offenders are European countries, many may not be aware of this, which is quite unfortunate. If the public is not aware of how bad things actually are, they are unable to do anything about it.

The World's Worst Electronic Waste Offenders
The biggest per-capita e-waste generators in 2014 (lbs per capita)

Country	Value
Norway	62.4
Switzerland	58.0
Iceland	57.3
Denmark	52.9
United Kingdom	51.8
Netherlands	51.4
Sweden	49.2
France	48.9
United States	48.7
Austria	48.6

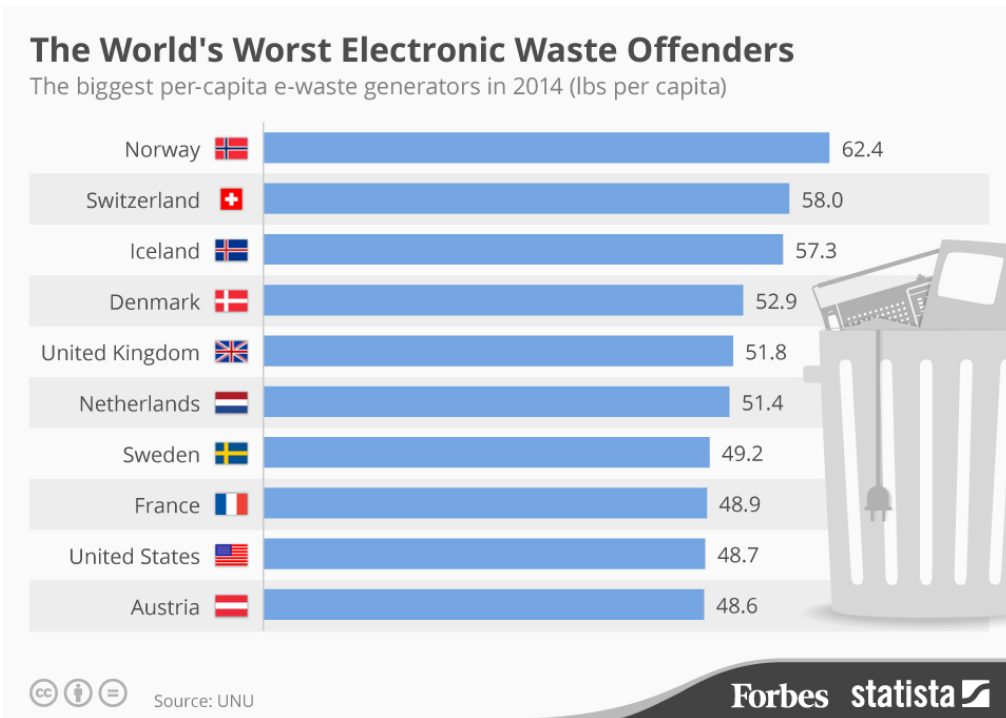Source: UNU   Forbes statista

Figure 6. E-waste recycling (Virogreen 2014, cited 3.20.2017)

Figure 7 shows just how much e-waste has increased, although 2013 shows signs of improvement with the highest amount of e-waste recycled. This is good news, because in recent years the public knowledge about properly disposing of electronic waste has increased. It is unsure how the figures have changed over time, but the chart definitely shows a trend of improvement in the right direction.

E-Waste Generation and Recycling 2000 - 2013

Tons of E-Waste

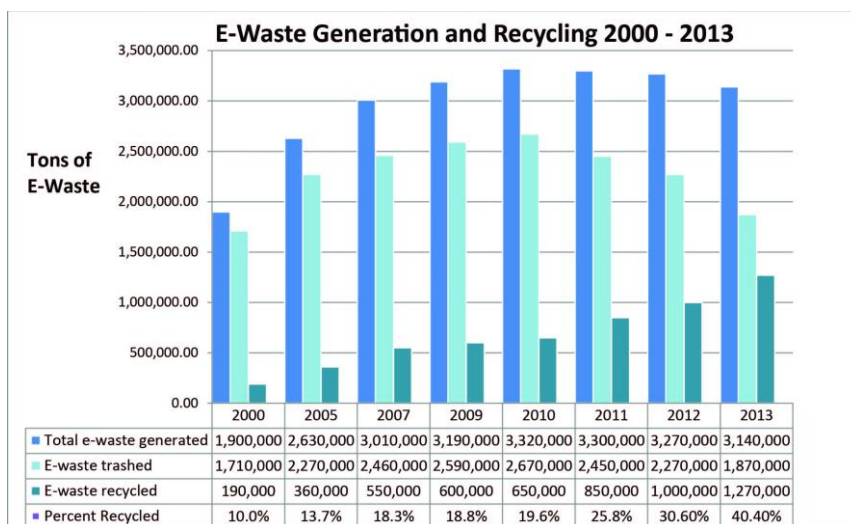|	2000	2005	2007	2009	2010	2011	2012	2013
Total e-waste generated	1,900,000	2,630,000	3,010,000	3,190,000	3,320,000	3,300,000	3,270,000	3,140,000
E-waste trashed	1,710,000	2,270,000	2,460,000	2,590,000	2,670,000	2,450,000	2,270,000	1,870,000
E-waste recycled	190,000	360,000	550,000	600,000	650,000	850,000	1,000,000	1,270,000
Percent Recycled	10.0%	13.7%	18.3%	18.8%	19.6%	25.8%	30.60%	40.40%

Figure 7 Facts and figures on E-waste recycling (electronics take back coalition 2014, cited 3.20.2017)

Figure 8 shows the amount of tons of e-waste products that were either recycled or trashed. As you can see, mobile devices have the lowest recycling rate at 11%. The highest rate of recycling is computers along with monitors and hard copy devices. It is unfortunate to see that only 27% of the total material actually gets recycled.

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%

Figure 8 Facts and figures on E-waste recycling (electronics take back coalition 2014, cited 3.20.2017)

Figure 9 shows the recycling rates for a fairly wide variety of products. Furniture and small appliances have the lowest rate of recycling, whereas auto batteries and newspapers have the highest. Could car batteries be the highest due to strict recycling regulations, or simply because many auto shops dispose of them instead of the user? (Sherman 2010, cited 1.12.2016; Davies 2014, cited 1.12.2016.)
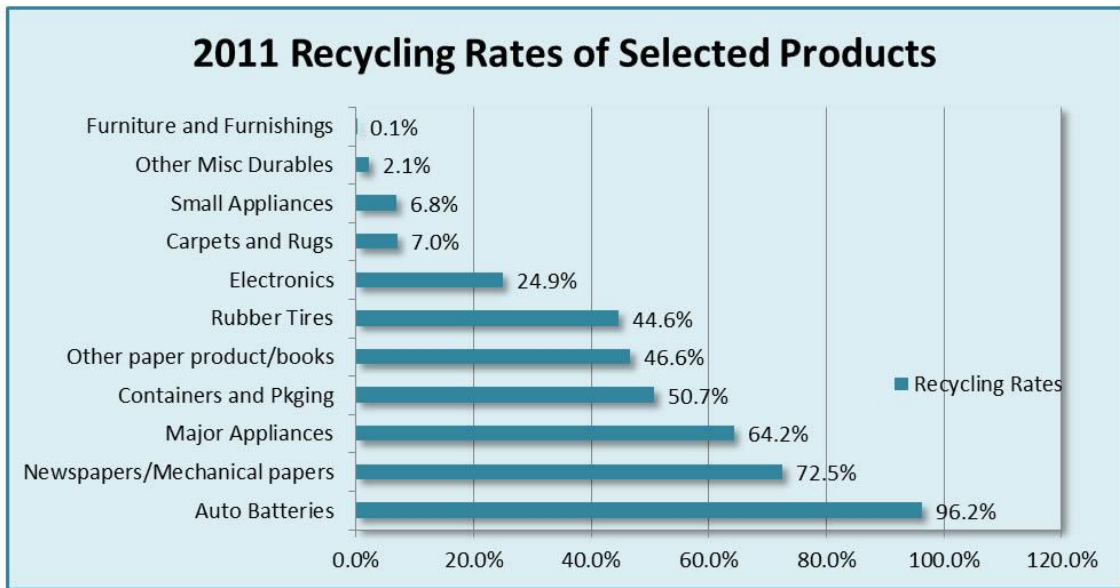
Figure 9 Facts and figures on E-waste recycling (Electronics take back coalition 2014, cited 3.20.2017)

5.4 The effect on the environment

One of the biggest ways technology and our never-ending quest for oil has changed the environment is causing the near to sometimes complete extinction of multiple species. There are only 880 mountain gorillas left in the world, 200 live in The Virunga National Park in the Democratic Republic of Congo (DRC). The mountain gorilla is the species of gorilla that is slowly increasing its numbers due to several conservation efforts. The park is also home to 218 mammal species, 706 bird species, 109 reptile species, 78 amphibian species and more than 2,000 species of plants. Unfortunately with oil concessions 85% of the park is allocated for it. "Habitat loss and degradation, exploitation and climate change are the main threats facing the world's biodiversity. They have contributed to a decline of 52% in the Living Planet Index since 1970 – in other words, the number of mammals, birds, reptiles, amphibians and fish with which we share our planet has fallen by half." (WWF 2016, cited 1.1.2017).

It has been said that to keep up with our energy and resource demands we would need 1.5 earths, since we are already exceeding supply. The population is also growing fast, with an expected population of 9.6 billion by 2050. With this growing population not only comes more energy and resource demands, but also more space. Majority of the human population lives in cities, and cities will have to expand to fit the growing population. How can we accommodate these extra people when we are already struggling? Nearly one billion people suffer from hunger, 760 million live

without fresh, clean water, and over 1.4 billion do not have access to a reliable electricity supply. (WWF 2016, cited 1.1.2017).

Figure 10 shows humanity's ecological footprint. You can see that carbon has been the main component. Carbon comes from fossil fuel, which has become increasingly used, as shown in the graph below.
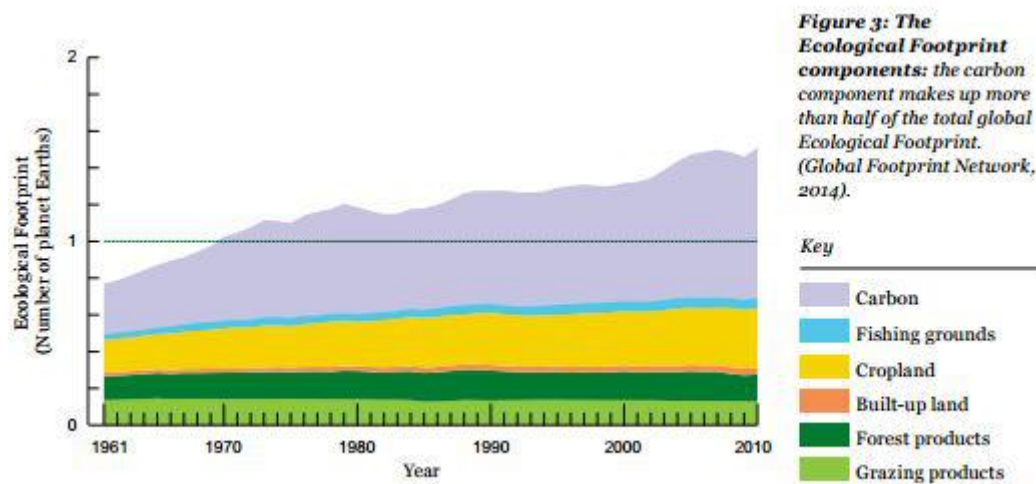

Figure 10 Living planet report 2016 (WWF 2016, cited 1.1.2017)

Humans live in the predictable and also stable environmental conditions of the last 10,000 year period known as the "Holocene". This period made it possible for settled human communities to evolve and eventually develop into today's modern as well as complex societies. Now we are on the cusp of entering a new period called the "Anthropocene". During this period human activities are the largest drivers of change on the planetary scale. This critical change has the potential to change all life on earth as we know it. (WWF 2016, cited 1.1.2017)

Currently there are several large patches of garbage floating around in the Pacific Ocean. It is the result of mixing tides. The "continent" sized mass is made up of mixed trash. Figure 11 shows how long various items will take to decompose in the ocean. The most shocking is fishing line with 600 years and glass bottles are undetermined.

Figure 11 Garbage in, garbage out (US National Park Service 1998, cited 1.1.2017)

This patch is huge, many aquatic animals get stuck in it, as well as birds that mistake it for solid land and then get entangled in it. When these various items decompose, they are releasing various toxins into the ocean, sometimes even making the ocean not able to sustain life. One of the more widely known toxins is bisphenol A (BPA), linked to health and environmental problems.

The patches stretch from Japan to the west coast of the states, they are named the Western and Eastern garbage patches. These two patches are somewhat linked together due to the North Pacific Subtropical Convergence Zone, a few kilometers north of Hawaii. In this zone, the warm waters mix and swirl with cooler waters, creating a connection between the two patches. Another key factor that contributes to these patches are gyres, which are circular ocean currents that form due to Earth's different wind patterns as well as the rotation of the planet. Gyres are similar to tornadoes, the center being calm and stable. The arms of the gyre draw in debris into the calm center where it forms together and eventually gets trapped. (National Geographic 2017, cited 1.1.2017.)

The reason why so much trash remains is because practically none of it is biodegradable, and may just break down into smaller pieces. What makes it an impossible clean up job is due to many of the plastics breaking down, the island is mainly comprised of micro plastics which can be small enough to not be able to be seen by the naked eye. The smaller pieces are of course intermixed with bigger items such as water bottles, fishing lines or articles of clothing. (National Geographic 2017, cited 1.1.2017.)

This impressive patch was discovered by a boat racing captain, Charles Moore in 1997 who was competing in a race from Hawaii to California. While racing he noticed more and more pieces of plastic surrounding his ship. Unfortunately not many facts are widely available about this patch, since it is too dangerous to explore. Most of the debris is under the surface, so this makes it impossible to even measure. (National Geographic 2017, cited 1.1.2017.)

It is estimated that 80% of the debris comes from North America and Asia, and 20% from boaters, oil rigs and cargo ships that dump into the ocean. Most of the debris is fishing nets. These nets are often discarded if they get rips due to the low cost. Nets are a huge problem, with animals getting tangled in them, or turtles confusing their meals of jelly fish for plastic bags. Since animals cannot digest the waste, it usually stays in their stomach, or causes them to die. Plankton and algae are also at risk, since the plastic on the surface blocks the light from reaching them. If they die out it will cause other animals to die out due to decreased food. (National Geographic 2017, cited 1.1.2017.)

With things like the Pacific garbage patch, it makes you wonder how it got to be like this. The patch is a direct result from our consumer culture. It isn't surprising that majority of the patch is various pieces of plastic, because plastic is so widely used. Plastic is used to wrap practically everything, and majority of bottles are even plastic. Plastic bags have also been found as well. Scientists were able to collect 750 000 bits of micro plastic in a single kilometer, making it a staggering 1.9 million bits per square mile.

Due to its remote location, no nation will take responsibility to attempt to clean this patch up, or even raise funding to do so. Charles Moore said that it would "bankrupt any country" that tried it. However, several organizations are trying to stop the patch from growing. Nets are being made to scoop up the micro plastics. The National Ocean and Atmospheric Administration's marine debris

program estimated that it would take 67 ships one year to clean up less than one percent of the ocean. (National Geographic 2017, cited 1.1.2017.)

In addition to clean-up efforts, David de Rothschild created a catamaran out of plastic bottles, and named it the Plastiki. He sailed it successfully from San Francisco, California to Sydney Australia. The goal of this expedition was to show the durability of plastic, and that it can be reused instead of disposed of, especially in harmful ways. Scientists firmly believe that going towards more biodegradable options would be the most effective way to reduce the size of the patch. There are now several campaigns for companies to move away from harmful disposable plastics and to move towards reusable or biodegradable materials instead. (National Geographic 2017, cited 1.1.2017.)

Unfortunately these do not seem like much of a solution, but the progress is slow with this, the main problem is the enormous size of the patch, making it seem like an arduous task that will never be completed. (Petr 2015, cited 1.11.2016; Stanic 2016, cited 12.12.2016; Rinkesh 2009, cited 1.11.2016.)

5.5 The potential future

Technology has existed for such a long time, that many of us have not thought about the bad effects it has on the environment. Many people simply buy technology out of boredom or simply because they want the newest edition. As mentioned in the earlier sections, technology has for the most part severely polluted our world. Global warming was discovered, as well as the hole in our ozone layer. The scary thing is that some of the things that we were warned about if we did not change our ways are already starting to happen. (WWF 2016, cited 1.1.2017).

If you want to know what is going on in the world, you simply turn on the news. You may be shocked at all the bad news, increasing amounts of droughts, floods, hurricanes, glaciers shrinking, intense heat waves, and sea levels rising. Scientists have been warning us about these effects of global warming for decades, but it is a different story now that they have started occurring. It is not certain how the future will be like, but it will get worse if we do not change our ways.

The global temperature will increase 2.5 to 10 degrees Fahrenheit in the next century. (NASA 2007, cited 15.1.2017). This may be good for some regions, but bad for many. Rainfall will both increase

and decrease in regions, leading to some areas to be flooded whereas other areas will go through severe droughts. Heatwaves will be stronger, and will last longer, and hurricanes will be more frequent as well as more severe. Winters will be colder and will last longer. These facts are all quite scary, but out of all of them, this may be the most devastating of them all; that by 2100 the sea level will rise 1-4 feet, putting some cities completely underwater. This is a result of the polar ice caps melting, maybe even to the point of depletion. (NASA 2007, cited 15.1.2017.)

Over the years, it will only get worse, if the previous ones were not scary enough. No one knows for sure what will happen, but it will eventually lead to mass extinctions and probably the end of all life on earth.

6 GREEN SOLUTIONS

From the previous sections, one could assume that our world certainly is headed towards a bad direction, if people simply do not change the way that they behave. This includes many things, the main ones are consumer buying habits and how we live our day-to-day lives. Easy changes can make a great difference, for example if every UK office worker used one less staple a day, we would be saving 120 tons of steel.

Every year, more than 14 billion pounds (6 billion kilograms) of garbage is dumped into the world's ocean. Most of it is plastic, and is toxic to marine life (Rinkesh 2009, cited 1.11.2016). The declining health of our environment is a direct result of millions of decisions made without considering the effect on the world. Many are to blame such as poor governance, policies with narrow-minded focuses on economic growth. Businesses concentrate on short-term profits and do not account for long-term costs. There are always better choices to be made, even if they aren't necessarily the easy ones.

These facts are definitely quite shocking, but people have the power to make a difference in the world, after all about 75% of the content in landfills is actually recyclable. (Do something, cited 11.1.2017). The next sections in this thesis will hopefully equip the reader with solutions on how to live a greener life, as well as hopefully getting others to change their ways as well. Many underestimate the power of the individual, especially the power that many of them have when they agree on issues that are important to them. The consumers are the only ones that have the power to truly change the world, even though it may not seem that way, basically consumers control how companies operate.

6.1 How to make your home greener

Making life changes may seem difficult, but it is actually easiest to start at home to see how it goes. After successfully implementing green lifestyle changes in your home, it is then possible to suggest ideas to your place of work.

Way of Living:

- Do not litter, pick up litter on or around your property
- Try not to buy things encased in plastic
- Buy only what you need, no impulse buys
- Buy clothes with natural fibers (ex: washing fleece emits plastic particles)
- Leave shoes at the door to prevent extra cleaning and germ spreading
- Try to carpool to work or school
- Use cloth napkins instead of paper napkins
- Share your magazines, papers and books with friends or family
- Reuse scrap paper
- Put on a sweater instead of turning heating up
  More involved:
- Only buy officially certified Eco-friendly products
- Only buy organic and fair trade items
- Try to repair or re-purpose old clothes, or donate
- Shop at thrift stores or secondhand stores
- Go meatless one or two days a week
- Combine errands into one trip

Household:

- Open curtains for natural light instead of using electricity
- Buy a dishwasher (Energy Star 2016, cited 12.1.2017).
- Grey water recycling*
- Air dry laundry
- Limit showers to 5 minutes, install eco showerhead or turn off water when lathering
- Start a compost bin
- Start a home garden
- Buy low-flow toilets
- Replace non-stick pans with longer lasting cast iron pans
- Use reusable containers and bags
- Improve house insulation
- Check for leaky pipes

Green Technology:

- Turn off technology and/or appliances when not in use

- Use power bricks that enable you to make sure many things are off

- Recycle, sell or give away old devices/ components

- Buy LED, CFL (compact fluorescent bulbs) or other long lasting bulbs

- Try to repurpose old technology

- Have heating and air conditioning on when needed, make sure it's not going non-stop

- Go paperless

- Virtualization and cloud computing

- Invest in rechargeable batteries

- Do more things electronically (ex: voting, filing taxes, and various tickets, and meetings)

- Ask boss about possibility of distant working

- Get rid of screen savers and allow products to go into sleep mode

- Order things online or walk / bike, instead of using up fuel

- Install a meter app on your phone to monitor power usage and habits
  More involved:

- Try to repair technology instead of replacing it entirely

- Buy a hybrid / electric car

- Use booster apps (closes open apps) to make phone batteries last longer

- Use power saving modes for maximum efficiency on all devices

- Check certifications for product purchases

*"using waste water from an activity (e.g. showering) to supply another activity (e.g. toilet flushing). The toilet cistern will empty automatically if it becomes too full or the water is older than 24 hours. This prevents bacteria." (Sustainable earth technologies, cited 14.1.2017; Staff writer 2016, cited 14.1.2017; Borboa 2017, cited 17.3.2017.)

6.2 How to make your office greener

After successfully implementing greener lifestyle changes in the home, you may find that most of these ways become second nature. Living greener may inspire the reader to make their workplace greener. This section should aid the reader in this pursuit.

If the reader is not in charge of a company, or has any authority to make changes in their workplace, there are still things within their control. This may come as a pleasant surprise to the reader, because many feel that they are helpless if they are not in a high up position in their company. Simply ask your boss/supervisor who is in a superior position for permission. This section will also help readers who are running their own company, and can be applied to companies of various sizes.

Did you know that an office of 100 people produces (on average) 20 bags of waste a week. This fills one 1 100L waste bin a week, or filling fifty 1,100L waste bins in a year! The most startling part of this is that 90% of this waste is recyclable. (Staff writer 2016, cited 20.12.2016)

Easy ways to be greener:
- Implement recycling in the office
- Remember: Reduce, reuse, recycle, repair and think
- If recycling already exists, make sure employees are aware
- Educate employees on what can and cannot be recycled (cardboard, plastics, cd's, glass fluorescents, and IT equipment
- Remove personal trash bins, centralize it
- Purchase recycled paper
- Install water hippos in toilets (a device that sits in the cistern of the toilet and reduces water used with each flush) or use low-flow toilets
- Encourage employees to carpool or bike to work
  Americans spend 47 hours per year in traffic, 3.7 billion hours and 23 billion gallons of gas wasted in traffic each year (Verchot 2014, cited 20.12.2016) 8 billion gallons would be saved if every commuter car in the US carried one more person

- If possible, give employees a locker for changes of clothes and storage of bike supplies
- Remove excessive light bulbs to prevent over-lighting
- Encourage employees to keep scrap paper for notes
- Buy organic and fair trade products (tea and coffee)
- Ban non-reusable containers
- Use eco-friendly cleaning products

More involved:

- Digitize
- Implement double-sided printing
- Start a campaign to switch off inactive lights and office equipment
- Switch to green web hosting, this means you can reduce carbon emissions and can use an eco-label on your website (the most popular being greengeeks)
- Measure your carbon footprint to see areas of possible improvement
- Install printer, and computer timers, so they shut down after office hours
- Replace inefficient technology, such as lightbulbs with more efficient technology (lower wattage, compact fluorescents and LEDs)
- Implement light sensors in areas that are not used often (bathrooms and meeting rooms)
- Make sure boilers, AC units and radiators are properly maintained
- Make sure heating and cooling systems are set up optimally (not used during holidays, evenings or weekends) and are around 20-22c
- Ensure landfill waste is collected by a contractor who offers zero to landfill services (incineration)
- Use credible carbon offset program to offset any extra emissions that you cannot reduce on your own

(Staff writer 2016, cited 20.12.2016; Dunn 2010, cited 20.12.2016; Suzuki 2014, cited 3.2.2017; Sustainable business toolkit 2016, cited 3.2.2017.)

If the company follows these tips, they may become carbon neutral. This is accomplished when balancing a measured amount of carbon released with an equivalent amount sequestered or offset

by buying excess carbon credits. The term carbon refers to processes that are related to releasing carbon dioxide into the atmosphere. Such processes include transportation, energy production and other industrial processes. (Whitman 2016, cited 20.12.2016; Adharanand 2008, cited 20.10.2016; Mays. 2013, cited11.11.2016; O'Neill 2010, cited 2.2.2017; Tomlinson. 2010, cited 3.3.2017.)

6.3 Modular technology

"Eighty-one percent of the energy a computer necessitates is expended during production, according to a study from the United Nations University. That is, it takes more energy to create the computer than it takes to run the computer for its entire working lifetime. That makes computers different than other household appliances, which tend to use more energy during their running lifetime than in production. As a result, no matter how zealous you are about turning off your computer, you are still implicated in a huge initial energy output. (Digital trend, cited1.11.2016). The UN has calculated that producing the average computer and monitor requires 530 pounds of fossil fuels, 48 pounds of chemicals and 1.5 tons of water." (Soltan 2016, cited 20.12.2016).

This may seem bleak, but modular technology could be a viable solution that can increase the lifespan of your computer, thus changing these numbers dramatically. Modular design is a "design approach that subdivides a system into smaller parts called modules that can be independently created and then used in different systems" (Spacey 2016, cited 4.4.2017). Modular designs are often significantly lower in cost, as well as they add flexibility and augmentation abilities for the user. Modular systems have existed for longer than one may think, but examples include; cars, computers, elevators, wind turbines, pipe systems, and railroads. Most offices in current times are even designed in a modular way by using partitions instead of individual offices, commonly known as cubicles.

Modular design may be a possible solution for things that you must buy, but offers a greener way of doing so. Instead of throwing a whole unit out, such as a computer, what if you could just upgrade parts of it? With pc computers this is already possible. If a part breaks or is out of date, you can simply replace it with a newer one. Although this isn't a complete solution, it would at least reduce the amount of e-waste in the landfill each year.

This technology is already expanding to phones, such as the phone called the Ara, by google. The Ara offers 6 different slots on the phone where you can upgrade and customize your phone to your liking. Attachments include additional speakers, kickstand, more screens, or a better camera. The user is even able to change all of this, so instead of getting rid of your 'old' phone, you can refresh it instead. Google is even interested in creating modules that can test water purity in developing countries. Recently Google has stated that Ara will have some limitations, you will not be able to swap out the core components. These components include: processor, memory, battery or storage. Although Google has not announced the release date of this phone, it is expected to be available to consumers later 2017. (Trusted reviews 2016, cited 1.1.2017.)

Other modular technology includes the Braven BRV-PRO, a modular waterproof Bluetooth speaker. The speaker allows the user to swap out components that allow an array of features. The user can increase the battery life with solar panels, a flashlight or stacking plates to create a stereo setup. The Blocks smartwatch is a modular smartwatch that had enormous success on kickstarter allows the user to switch out watch faces and even the straps. Some modules included are cameras, processors, GPS, additional batteries, contactless payment, and even a heart rate monitor.

Although desktop computers are already considered modular, Acer with their Revo build is a computer with magnetic components. The user can add a wireless power bank, portable hard drive, other computer components and even graphics chips. (Trusted reviews 2015, cited 1.1.2017.)

These examples are of course not the only examples of modular technology, they are simply the most well-known at this point. Each day increasing numbers of companies are hopping on the new trend of modular technology. Although none of the previously mentioned products have hit market yet, they are hoping to be successful and to change the world.

The idea behind modular technology is that it is all around a cheaper option. The initial cost is low for the user, as well as replacing parts is cheaper instead of replacing the entire unit itself. Although it is not a complete solution, but it is definitely a greener solution that still supports the consumer lifestyle. (Murugesan 2012, cited 1.1.2017; Baroudi 2009, cited 1.1.2017.)

7. CONCLUSION

Green technology is an important concept that every individual should be well acquainted with. Understanding the past of technology in addition to green technology is crucial to understand the potential future of green technology.

The direct results of our consumer lifestyle are often hidden from the public eye because it is not a pleasant topic to think about, but it is important to get the truth to enable solutions to pollution, planned obsolescence, and e-waste and sweatshop labor. Since these things are often swept under the rug, the public may not know much information about these topics until it is too late to fix, with irreversible damage.

Modular technology offers a solution that would make both sides happy. Manufacturers save money by specializing in certain parts, instead of being responsible for creating whole units. The other side, the consumer gets the savings passed on to them. Modular technology offers customizable, and even replaceable components that can easily be replaced.

Although modular technology is not a complete solution because it still creates more e-waste, it is a major step in the right direction. Modular technology is a stepping stone to other solutions that can be even better. For example, technology can be biodegradable after 5-10 years, depending on the appliance.

One of the greatest aspects of green technology is that it enables individuals to live their lives, but in a greener way that is not harmful to the environment. Since green technology covers a variety of appliances, making it within reach to be more green in everyday life.

8. DISCUSSION

Starting off on this thesis, I will admit that I had fairly limited knowledge about green technology. I had taken a course on how to be green. The course had piqued my interest, which led me to do research. Another course that inspired this thesis was user interface design, although we talked about planned obsolescence briefly, it had also caught my interest.

When it came time for me to think of a thesis topic, it took me awhile to figure out a way that these two seemingly disconnected topics could intersect. Green technology offered a solution, because after research I found out that they are indeed connected.

After starting my thesis I found out more about the history of technology, green technology as well as a more in depth awareness of sweatshop labor and planned obsolescence. I also was unaware about how bad it really was with e-waste. I was shocked when I found out that electronic waste is shipped to developing countries, even when the individual who recycled the e-waste believes that they took it to a credible recycling center.

Sweatshop labor was another shock to me, I did not know just how poor the conditions were, as well as how low the wages are. I was happy that many companies are trying to make amends for this.

Modular technology was another area for interest for me, since I did not know much about it. I had seen the google phone, but I did not know other products that are also coming to the market. The tone of this thesis changes throughout the essay. I wanted to create 3 distinct parts; general information and background, the problems, and solutions.

Although this thesis was very enjoyable for me to write, I did run into a few problems. It was extremely difficult to find books with the information I needed. It was much easier to find information electronically from more current sources. There were not many books even about one of my subjects of focus, let alone all of them.

I recommend further research, it could include cloud computing or more up to date information at the time, because things are constantly changing. Modular technology will have more information,

hopefully. I was unable to find a lot of information about it, and in the future they will know if it was successful or not, as well as some examples. Maybe by then some of them will actually be released to the public and improved upon. I wanted to include it even though I knew there probably would not be much, because in my opinion it is definitely something that people should look out for, or at least for them to know that the amount of greener technology is just going to increase with time.

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