UBC Social Ecological Economic Development Studies (SEEDS) Student Report

An Investigation into Reusable Food Containers

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Abstract

With the future construction of the new Student Union Building (SUB), Alma Mater Society (AMS) intends to use this opportunity to contribute to the campus sustainability goal by researching and utilizing various green and sustainable ideas. One of these ideas involves the installation of Green Vending machines within the SUB that contain a variety of green reusable products. The exact brand and type of reusable products is still undecided so our goal is to research a variety of these and propose a worthy candidate. The purpose of this report is to report those findings on a sample of reusable containers and recommend the ideal reusable container to place into these Green Vending machines.

Our sample of reusable containers consists of the Ziploc plastic container, the Snapware Glasslock glass container and the LunchBots steel container. These brands were picked by popularity and cost, and the materials were picked by popularity among other reusable products. Our report analyzes the life cycle of each of these products in terms of their economic, environmental and social impacts. Some assumptions were made on the exact facilities and methods used to extract, manufacture and recycle these products. A student survey was conducted to find out the preferred price for these reusable containers and emails were sent to communicate with our local recycling facility to understand how our products may be recycled.

The price of purchasing and recycling the Ziploc containers is relatively cheap compared to the other products but they negatively impact the environment and society with their non-biodegradable nature, and their toxic pollution generated from their production and recycling processes. The Snapware containers cost too much according to the survey and it costs nearly twice as much to recycle. Its influence on the environment and society are not much better because they are non-biodegradable and generate silica pollution. Although the LunchBots largely affects the environment in a negative way, they also contribute to the growing steel market and employ a great deal of people. To conclude, the Ziploc containers should be chosen for the Green Vending machines because they are cheaper in terms of purchase price and recycling cost.

List of Illustrations

Glossary

Life-Cycle Assessment: is a technique to assess environmental impacts associated with all the stages of a product's life from-cradle-to-grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling).

Triple Bottom Line Assessment: is a decision that takes into account the social, environmental, and economic impacts.

1.0 Introduction

In today's society, with growing population and increasing demand for energy, the usage of green products has become one of the most important sustainability topics. By simply using a reusable container, we can save significant amounts of money and energy. In this report, we have investigated three different brands that use different materials for reusable containers: Ziploc (Plastic), Snapware (Glass), and LunchBots (Stainless Steel). For each brand, we have analyzed the life cycle using the triple bottom line assessment method, exploring the economic, environmental and social impacts of using it. Based on our results and findings, we will suggest one brand amongst the three to be sold by the green vending machine in the new Student Union Building in the University of British Columbia.

The life cycles analysis involves studying each stage a produ ct's life cycle. The cycle below (figure 1) shows each stage of a life cycle.

Figure 1 – The life cycle of a product.

2.0 Research Results

This section includes the results and findings of our research. We have performed a Triple Bottom Line assessment for each container brand and divided the research results into three sections: economic, environmental and social.

2.1.0 Ziploc

Ziploc containers are produced by SC Johnson and are made out of plastic. This section investigates the economic, environmental and social sides of using Ziploc containers in the new SUB.

2.1.1 Economic Aspect

As the University of British Columbia or the city of Vancouver are not responsible for the extraction or manufacturing stages, we will only assess the distribution and recycling stages of the containers' life cycle.

The average retail price of a pack of 2 - 4 Ziploc plastic containers is $3.00 (Ziploc Products). This means that each container costs roughly $1.00 to buy. To assess whether UBC students would buy re-usable containers at this price, we have conducted a survey and asked 100 students the following question "Would you buy a re-usable plastic container for $1?" The vast majority answered the question with "yes" as shown in the pie chart below (figure 2).

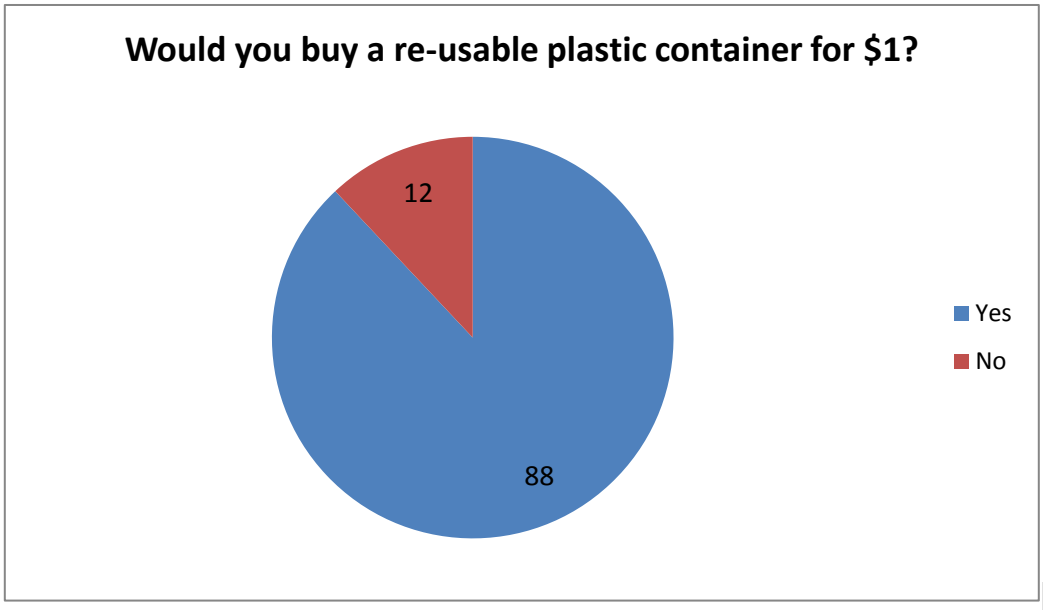

Figure 2 – Survey Results.

Since the city of Vancouver will be responsible for recycling the containers at the end of their life cycle, it is important to take into consideration the recycling cost of these containers. According to the annual report of Encorp Pacific, the net cost of recycling plastic containers is between 3 and 4 cents depending on the size of the container (Ecorp Pacific, 2010). The report also shows that plastic is significantly cheaper to recycle than other materials aside from Aluminum.

2.1.2 Environmental Aspect

Water bottles, lunch containers, and food bags; plastic containers have played an important role as one of the most common materials to make different types of containers. However, it has always been a controversial issue on how this, so called, two-bladed knife would impact our environment. While research has shown how badly plastic containers can damage our environment, the society cannot live without the huge convenience plastic containers bring to us. However, some large companies, such as Ziploc, invest large amounts of money on advertising and promoting their products as "green" as possible by collaborating with Recyclebank and push this idea to the market that Ziploc products are now recyclable. Is this an innovative invention that would bring us to another generation of the recycling process or yet again the same hypnotizing strategy that big industries have always been doing? How would this change the biased view from the society on how plastic containers impact the environment?

To begin with, most plastic containers are made from a non-renewable natural resource: petroleum also known as crude oil. The extraction of this raw material simply involves the removal of oil from the reservoir (oil pool). However, this process is costly and sometimes environmentally damaging. In fact, offshore exploration and extraction of oil often disturbs the surrounding marine environment. One of the most famous oil spills would be the Deepwater Horizon oil spill (also referred to as the Gulf of Mexico oil spill or the BP oil disaster) which flowed unabated for three months in 2010.

Furthermore, industrial practices to manufacture plastic can lead to polluting effluents and the use of toxic intermediates, the exposure to which can be hazardous (Pollution Issues-Plastic). For example, there have been problems in the past resulting from the exposure of workers to toxic vinyl chloride vapor during the production of polyvinyl chloride (PVC).

Researchers believe that the toxic air from the plastic manufacturing facilities can case DNA disturbances and increase the animals' risk of cancer and damage their reproductive systems. Moreover, spillage of plastic pellets that goes into sewage systems, and eventually to the sea to be ingested by animals, has hurt the wildlife.

Finally, most of these plastics cannot be recycled as conveniently as glass or aluminum, so they often end up as landfill instead. To help reverse this trend and offset its potential product waste, the Ziploc brand has partnered with Recyclebank to inspire families to increase recycling behavior and divert more than 100 million pounds of waste from the landfills within 24 months. In addition, Recyclebank also offers reward points for recycling Ziploc products which have been proven to increase the rate of cycling by a large amount.

2.1.3 Social Aspect

Ziploc plastic lunch containers are composed of mainly polypropylene and this type of plastic is synthesized from various products of crude oil (How Are Plastics Made?).The extraction of crude oil is quite a large industry and impacts many at a social level. For one, this specific industry employs more than 2,200 people in BC, as seen in (figure 3) on the next page, and more than 161,600 in the United States. Despite the fairly large international and local employment rate, the work conditions of these extraction sites are quite unsafe and harmful to the employed. Although the average hourly wage is about $28.90 in BC, the employees there are required to do highly strenuous tasks for longer periods of time, which tend to be around 12 hours a day (United States Department of Labor). In addition, these employees are subjected to dangerous work environments that are prone to explosions and are exposed to hazardous and harmful materials such as hydrogen sulfide, sulfur dioxide and heavy metals, which can cause numerous health problems. (Webley, 2010).

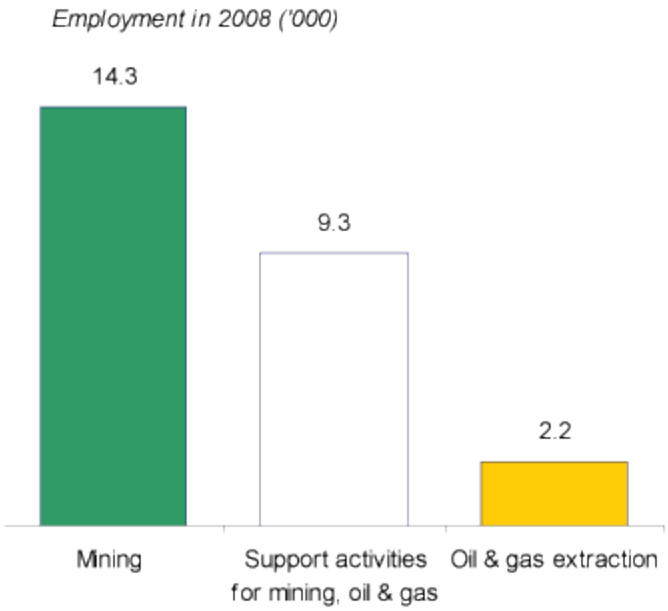

Figure 3 – Chart of Employment in the Mining, Oil & Gas Extraction Industry (Mining, Oil & Gas Extraction).

The plastic manufacturing industry employs around 91,530 people in Canada but the industry has a typical hourly wage of about $12.00 in Ontario (Ontario's Plastics Industry). The work conditions are often extreme and involve the employee to work with dangerous equipment and in very hot environments filled with harmful fumes that cause temporary illnesses such as troubled-breathing, liver and kidney problems and other respiratory problems (Taylor & Connelly, 2009). Apart from the workers, nearby residents are also negatively impacted by plastic factories. These residents are forced to live with the toxic fumes that escape from plastic factories, as shown in (figure 4), and contract health problems including skin conditions, memory loss and troubled-breathing (Alison, 2009). Although it is not known whether or not SC Johnson utilizes facilities such as these produce or purchase their polypropylene plastic, the majority of the characteristics apply to most of the existing plastic facilities.

Figure 4 – Plastic Factory in China (Note 1-- Say 'No' to plastic bags , 2011)

For the actual product manufacturing, a portion of the workforce is represented by the 12,000 or more people that SC Johnson employs worldwide. 5,000 of these people are hired to work outside of the United States. Despite the poor working conditions in some existing plastic production plants, SC Johnson was awarded as the top preferred company to work at in the range of year 2010 to year 2011. Once the product is manufactured, it is distributed to people in over 70 countries all around the world (SC Johnson's 125-Year Commitment to Being a Best Place to Work Recognized by Inaugural Great Place to Work Global List, 2011).

Ziploc containers are highly versatile and can cater to the needs of any typical UBC student or UBC housing resident during their useful life stage. These containers are safe to use in the microwave to heat up any food you buy on campus or bring from home, freezer to keep your food for the next day and dishwasher to clean and reuse the container in place of disposable, non-biodegradable and non-recyclable containers. Unlike non-reusable containers, they are also air tight so you can save your food for later consumption. The lines on the side for measuring can also help aid in any cooking you want to do with the container. In addition, Ziploc's plastic containers are deemed as free of bisphenol A (BPA), which is a chemical thought to be capable of causing various prostate cancers. Typically, these containers can last for years so you can definitely reduce a great deal of the disposable container waste that goes into the landfills (Ziploc® Brand Containers with the Smart Snap® Seal).

Once the Ziploc containers reach their end lives, they will either be recycled or disposed of but these processes can have a negative social impact. Plastic containers can be recycled but the process itself can be harmful and in some ways, more harmful than when it is first synthesized. Employees at plastic recycling plants have to deal with health issues and poor working environments with high temperatures and toxic fumes. Residents near plastic recycling facilities have to deal with allergies caused by the toxic gases in the air or the toxic material that reach bodies of drinking water. In China, plastic recycling plants engage in child labour practices and these are the plants that will likely take in our plastic containers (Gurnon, 2003). When these containers are disposed, they are simply going to be dumped into a landfill or somehow find their way into our water bodies. Adding to the capacity of the landfills will affect people in a great way because there are those who live in areas near landfills. Such inhabitants develop serious health problems that can involve the heart, lungs and brain (How Dangerous is it Really to Live Near a Landfill? (And How Near is Too Near?)).

2.2.0 Snapware Glasslock

Snapeware is a California-based company (About Snapware) that produces containers for food or storage. Their Glasslock line of consists of glass containers of different sizes. This section includes the results of our triple bottom line assessment of these containers.

2.2.1 Economic Aspect

To assess the economic feasibility of Glasslock containers in terms of their life cycle, we have decided to analyze two stages of the life cycle; distribution and recycling/disposal. Since the company is based in the United States (About Snapware), the University of British Columbia and the city of Vancouver are not involved in the extraction and manufacturing stages. In addition, there are no special costs required during the containers' useful life.

The retail price of an individual Snapware Glasslock container is between $7.99 and $12.99 depending on the size of the container. (Snapware Products) Assuming that the vending machine in the new SUB will charge a similar price, we conducted a survey and asked 100 students and current SUB visitors about their opinions. The results of the survey are shown in the pie chart below (figure 5).

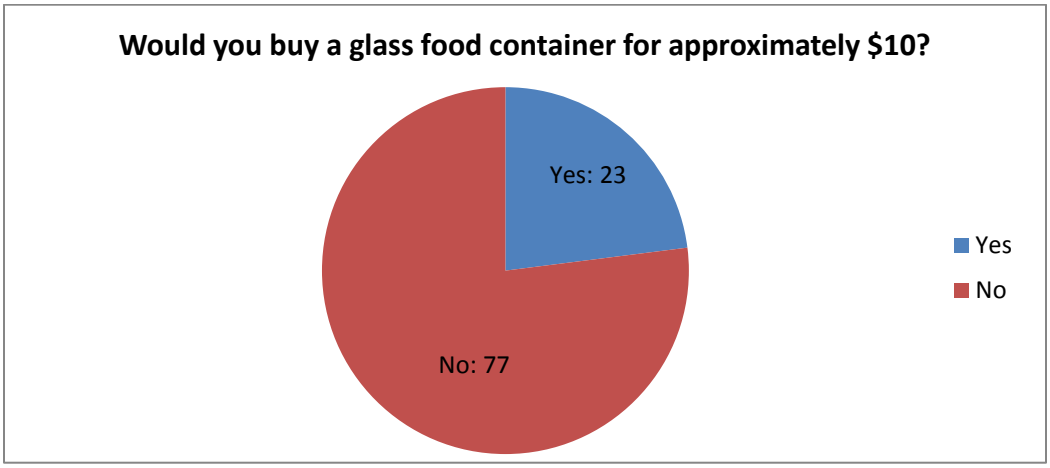

Figure 5 – Survey Results.

While 23 of the students answered "Yes", the majority (77) answered the question with "No." When asked about the reason for the choice, many stated that plastic containers are a much cheaper alternative or that they can simply bring containers from home.

At the end of the container's useful life, it will be recycled by the city of Vancouver. The 2010 annual report by Encorp Pacific shows that the cost to recycle glass is 10 cents per container (Ecorp Pacific, 2010). This number is almost twice as much as the cost to recycle a plastic container of the same size.

2.2.2 Environmental Aspect

As with all highly concentrated industries, glassworks suffer from moderately high local environmental impacts. Due to the fact that they are mature market businesses, they usually remain in the same location for a long time which results in residential influences such as noise, water pollution, and air pollution. There are two main sources of noise that comes from glass factories: forming machines and truck movements. The forming machines can produce noise levels of up to 106 dBA by the operation of compressing air. Typically, 600T of raw materials has to transport in and out the factory every day, which means that there will be a lot of truck movement noises.

In addition, water is an important factor in this industry; it is used to cool furnaces, compressors, and unused molten glass. Most factories use water mixed with emulsified oil to achieve this process. However, this oil laden water mixes with the water outflow stream thus making water pollution. Some factories have water processing equipment that filter the water and remove the emulsified oil, but they do not produce perfectly clean water.

Furthermore, the burning of gas in air will produce Nitrogen Oxides, which are produced in large amounts by gas fired furnaces. Some factories with air pollution problems will try to solve this issue by using liquid Oxygen. However, the logic of this given the cost in Carbon of not using regenerators and having to liquefy and transport oxygen is highly questionable. Moreover, the glass melting process will also produce a significant amount of Sulfur Oxides, which are also a source of air pollution.

Finally, the most significant environmental impact is the production of carbon dioxide by the burning of fossil fuels in the furnace heating process and electricity production in order to supply the compressors. Normally, producing one ton of glass will also produce about 500 to 900kg of carbon dioxide in the areas using a gas fired furnace and coal fired electricity.

2.2.3 Social Aspect

The bowl portion of the Snapware Glasslock containers is made with silicon dioxide (silica), which is actually found in sand. To extract this material, there are silica mines that exist in various parts of the world. This type of mining involves a portion of the 9,700 people in BC engaged in the mining that excludes those that mine for metals, oil, and gas. Their wage is approximately $27.96 per hour (Mining, Oil & Gas Extraction). Even so, workers within these mines tend to have to deal with troubled breathing due to the silica dust in the air as well as risk contracting silicosis, which can be deadly and is resulted from breathing in crystalline silica dust. Surrounding residents are also afraid of the possible health problems as silica dust can easily be found in the atmosphere and often coat people's property (Sand mining surges in Wisconsin, 2011). The lid on these containers is made of polypropylene and its impacts on the society are similar to those discussed in the Ziploc plastic container section.

The manufacturing of glass also affects people within a close distance to it regardless of whether or not you are inside or outside of the facility. Often, workers inhale glass microfibers and handle chemicals such as phenol-formaldehyde resin, which causes coughing, breathing problems and skin conditions. The people who live close to the facility are affected greatly by the generated noise and chemical or dust pollution in the air and water (Respiratory and skin health among glass microfiber production workers: a cross-sectional study, 2009). The manufacturing of the plastic lid should also have the same social impacts as the entire container from Ziploc. To manufacture the overall product, World Kitchen, the distributor of Snapware, provides around 2,800 jobs to people (About Snapware). In the end, the manufactured product is distributed to people living in the United States, Canada and Asian by World Kitchen.

Glasslock containers are also a good choice to use in place of disposable containers because they are also quite multi-functional. You can use these containers in the oven, microwave, dishwasher and freezer so there is little limitation to the usage of the product. For most people, one would be concerned about the durability of a glass container but this container in particular is made to be shatter-resistant as well as made out of tempered glass. This attribute will definitely add years to the lifetime of the product and eliminate the need for non-reusable containers. The fact that this product is air-tight and leak-proof allows the user to take their food around with ease. Similar to the suggested plastic container, Glasslock containers are also BPA

free so it is safe to hold your food in. Because the container is made of glass, toxic material will not enter or come into contact with your food like certain plastic containers. As an added bonus, customers are also currently given a 3 year warranty on this particular item (3.5-cup Rectangle Glass Container).

After the useful life stage, this product will either undergo its stage of recycling or disposal. Glass recycling plant emissions affect both its employees as well as nearby residents. For instance, these plants tend to release carcinogenic and toxic substances that end up coming into contact with the people. Apart from that, the biggest problem involves silica that can be found in the powdered glass emissions and is thought to be connected to cancer development (Edwards, 2007). The disposal path of glass is similar if not the same as that of plastic due to its non-biodegradable nature and can also negatively influence society in the same way. The only upside to the glass in the landfills is that it will not expel toxic substances from within it like certain plastic materials.

2.3.0 LunchBots

LunchBots produces food containers made out of stainless steel. As with the previous sections, this section contains the findings of our research presented in terms of the life cycle of these containers.

2.3.1 Economic Aspect

The entire life cycle of stainless containers offers numerous amounts of employment opportunities in many places of the world. On a global scale, logistics of stainless steel making contributes greatly to the world's commerce. Many international partnerships are formed in many cases due to transportation of raw materials and finished goods from one part of the globe to another.

Local Economy

Cities and towns close to mines and manufacturing sites often benefit economically by means of increase in tax revenue, improved public services and goods and increase in investment in the area, or even the country. In 2009, Australia along exported more than $31 Billion in iron ore; which equates to 2.5% of Australia's total GDP (International Monetary Fund, 2010).

World Commerce

Australia exports about 98% of its iron ore (Australian Trade Commission). This creates a secondary industry of shipping these ores to other international locations to be further processed. Just like the internet is the informational highway for electronics, ships are the highways to transport raw materials and finished goods around the world. Therefore, transportation of goods can potentially represent a sizeable share of the world's economy. An example can be illustrated with a Transnational Corporation (TNC) such as Wal-Mart.

Wal-Mart retails many items which are made in China. The products are then transported, likely with container ships, to the local distribution centres around the world. These centres then truck the products to the local Wal-Marts. As seen in this example, the resources required to transport goods are very sizeable and it can be easily understood that these activities create jobs and investment opportunities.

2.3.2 Environmental Aspect

Considering the life cycle of stainless steel, it is not difficult to see that the raw material and refining stages can potentially be the most environmentally damaging. Support systems in mines and process plants often use large amount of water and fuel. In many cases, the flue gases and liquid effluents are quite toxic. Western nations such as Canada and the United States have implemented regulatory constrains such as the Clean Water Act and Clean Air Act on their industries. However, such regulations, if they exist, are only loosely followed by participating industries. This section focuses on the mining effect of air, water and land.

Impact on air quality

According to the Government of India's "Comprehensive industry document on iron ore mining", the mining and processing of iron ore give off mainly the following aerial substances:

- SO_X;
- NO_X;
- CO; and
- Dust.

These are all considered as greenhouse gases (GHGs) and many scientists believe they are one of the causes of global climate change (Ministry of Environment and Forests, Govt. of India, 2007). The following diagram (figure 6), taken from the said document, illustrates where these substances, as well as liquid effluent are given off during the process.

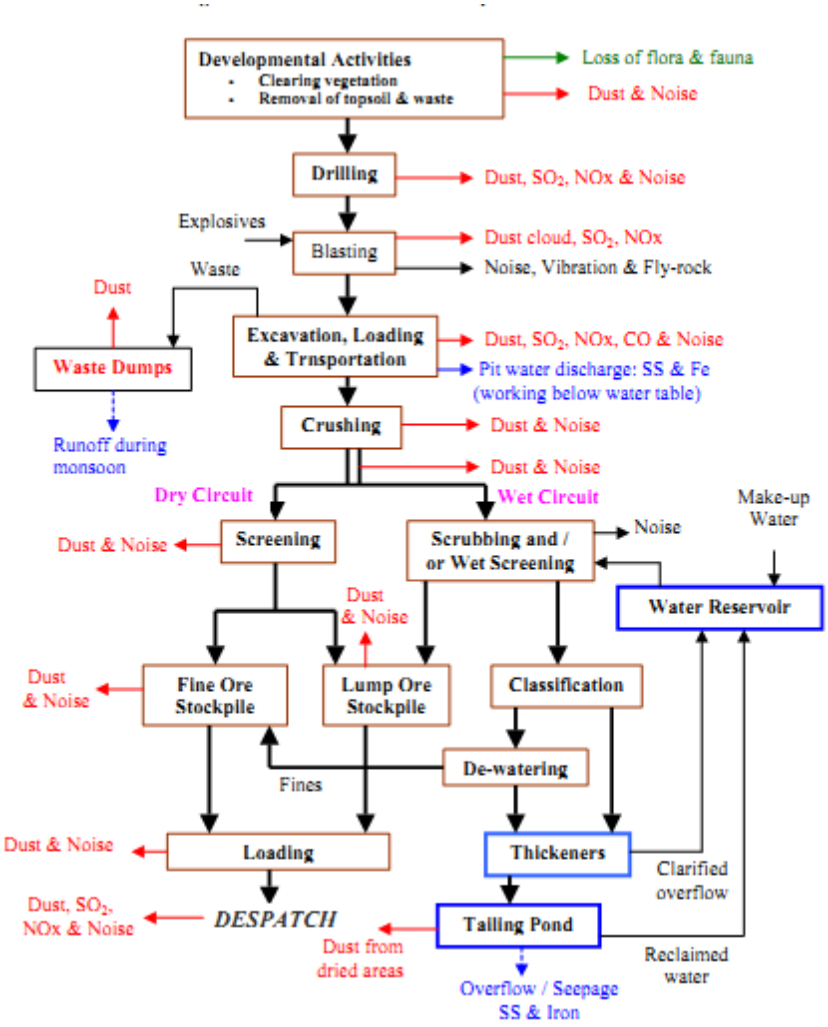

Figure 6 - Pollution caused by Iron ore mining.

Impact on water

Water is often used for lubrication and as a heat and mass transfer medium. In many cases, water is contaminated and untreated when it is discharged into, for example, a tailings pond. Again, according the Indian government, the contaminated water bodies have great negative implications on the surrounding eco systems. For example, thousands of ducks were killed by Suncor Energy's tailing pond in Fort McMurry in October 2010 (CBC News, 2010). Potable ground water supply can also be affected through seepage if the overlaying contaminated water body is not contained properly.

Impact on land

As mentioned above, iron ore extraction typically uses open pit mines because it is lower in cost than underground mines. Open pit mines requires clear cutting of overlaying trees and the removal of overburdens in order to get to iron ores. The removal of trees also removes their carbon monoxide absorbing abilities. In addition, the relocated overburden can cause serious ecologically problems as they can displace animal habitats.

2.3.3 Social Aspect

The making of the LunchBots stainless steel lunch boxes contains many layers of complexity and challenges. From iron extraction to retail sales, the transformation from raw materials to finish products has great social implications in many locations of the world. The most noticeably is likely to be employment and its effects on nearby towns and cities.

Employment

The following table (table 1) concludes the finding of the United States Geological Survey (USGS) on the world iron production tonnage.

2010 World Mine Production of Iron	
Countries	Production (million tones)
China	900
Australia	420
Brazil	370
India	260
Russia	100
Ukraine	72
South Africa	55
Other Countries	50
USA	49
Canada	35
Iran	33
Sweden	25
Kazakhstan	22
Venezuela	16
Mexico	12
Mauritania	11
World Total:	2430

Table 1 – World Iron Production (USGS).

For example, according to the government of Western Australia, roughly 342 million tonnes of iron ore is extracted from the region with a workforce of 26,051 people (Western Australian Department of Mineral and Petroleum Resources, 2001). This gives approximately 76 employees for every million tonnes of iron ore extracted. Assuming this statistic is true of the world, more than 1.8 million people are needed to be employed to up keep the world production.

Mining Towns

There exist many towns, of even cities, which rely heavily on the life of nearby mines and/or manufacturing factories. In China, factories became towns where employees work, reside and their children have an education. In Canada, Fort McMurry and Fort St. John are almost entirely supported by the oil and gas industry in their areas. According to a recent research the Real Estate Investment Network (REIN), Fort St John's real estate market is predicted to outperform hundreds of other towns and cities in British Columbia due to its impending boom in the natural gas sector (Zwambag, 2011). These examples show industries have direct social influence on nearby towns and cities.

3.0 Conclusion and Recommendations

In conclusion, we have investigated three brands of reusable containers that use three different materials: Ziploc (Plastic), Snapware (Glass) and LunchBots (Steel). The results of our research show that the extraction of raw materials and the manufacturing stages for each have their toll on the environment. Being dependent mainly on petroleum, the plastic industry takes some of the responsibility of the environmental damage caused by oil spills and the disruption of wildlife. On the other hand, the glass and steel industries are responsible for greenhouse emissions as well as water and noise pollution.

In addition, when comparing the social impacts of the three brands, we found that by creating reusable and recyclable products, they all promote sustainability and conservation of natural resources and the usage of either will deliver the same message to the community. Furthermore, all three companies as well as their related industries provide many job opportunities to nearby communities.

In the end, when comparing the three products based on their economic, social and environmental impacts, we found that while they all have positive impacts, none of these impacts is significant enough to outweigh the damage caused by producing the containers. Therefore, we have decided to base our final decision on financial aspects.

The results of a survey that we have conducted targeting UBC students show that students are more willing to buy Ziploc containers than others due to the low cost of these containers. In addition, we have found through research that plastic is in fact cheaper to recycle than glass and steel. Therefore, we recommend selling Ziploc containers in the Green Vending Machine at the new SUB.

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