

**An Investigation into Waste Reducing Vending Machine**

**Pens, Pencils, and Highlighters**

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## ABSTRACT

As a part of the new UBC SUB project, the AMS is implementing a waste-reducing vending machine. This machine will offer students reusable products, such as coffee cups, cutlery, and office supplies. This report assesses the feasibility of stocking refillable office supplies; specifically pens, pencils, and highlighters. The analysis is done using a triple bottom line assessment, looking at the social, environmental, and economic impacts of stocking such supplies.

For the social analysis, a survey was conducted that presented students with a collection of refillable school supplies and students were asked to choose their favourites. Information into the product's recycled content and cost were given to help aid the decision. The environmental analysis compared manufactures and specific models of supplies for the types of materials used, the amount of recycled material, the company's environmental policy, and packaging options in order to evaluate the environmental friendliness of products. With these recommendations, the economic analysis looked at which socially accepted, environmentally friendly products could be optimized from a cost perspective, and where these products can be purchased.

The final recommendation of this triple bottom line analysis is that the Waste Reducing Vending Machine be stocked with Pilot products:

- Pilot BeGreen B2P Gel Pen
- Pilot BeGreen Precise V5 Rolling Ball Pen
- Pilot Begreen Progrex 0.5mm Mechanical Pencil
- Their respective refills

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## LIST OF ABBREVIATIONS

UBC – University of British Columbia

SUB – Student Union Building

AMS – Alma Mater Society

GHG – Green House Gas

TBL – Triple Bottom Line

## **1.0 INTRODUCTION**

As a part of the new UBC SUB project, the AMS is implementing a waste-reducing vending machine. This machine will offer students reusable products, such as coffee cups, cutlery, and office supplies. This report assesses the feasibility of stocking refillable office supplies; specifically pens, pencils, and highlighters. The analysis is done using a triple bottom line assessment, looking at the social, environmental, and economic impacts of stocking such supplies.

The social section looks at the likelihood that these products will be accepted, based on the features and style of supplies that students like to use. The environmental analysis looks deeper into specific products and manufacturers of office supplies, and attempts to rank them based on a variety of environmental criteria. The economic evaluation compares different suppliers and retailers and analyses the different products that were recommended in the beginning two sections.

For our research, a wide range of primary and secondary research sources were used. These include: a survey was conducted of UBC students, manufacturers, suppliers, and retailers were contacted via phone, email, and personal interview. Secondary sources include research journals, manufacturer's websites, retailer's websites, and product catalogs.

## 2.0 SOCIAL ASSESSMENT

Social analysis is the assessment of the public's view of the products presented to them. If the products available in the vending machine are not socially acceptable then people will not buy them and the goal of inculcating sustainable awareness of writing tools will fail. The social analysis is conducted by a compilation of research from secondary and primary sources.

### 2.1 Secondary Source Research

Secondary sources provide insight to the public's response to sustainable pens, pencils, and highlighters through online resources and market assessments done by businesses. For online resources, articles from journals and newspapers were researched. For market assessments, we contacted the UBC Bookstore and the Staples located in UBC Village.

No online resources directly assessed the social impact of sustainable pens, pencils, and highlighters, but a few journal articles indicated they would be highly socially acceptable. According to Elkington (1994), "Not surprisingly, one of the most significant environmental trends of recent years has been the "greening" of the marketplace, often driven by the emergence of the "green consumer." (p. 92). With the public's increasing concern of climate change and preserving the planet there have been increasing interest in sustainability. This mentality has been adopted by many companies because of their own environmental concerns and also to maintain a good public face. Some companies have even dropped their lowest ranking environmental friendly suppliers (Elkington, 1994, p. 94). Business owners, such as Runyan, are proud to say "Our guests and employees see that we are 'walking the talk' when it comes to being green." ("Green Dry Cleaning Company Reduces Waste With Sustainable Office Supplies," 2010). Part of their sustainable initiative is to reduce waste and to use office supplies that are environmentally friendly. The candidate pens, mechanical pencils and highlighters for the vending machine fit these company's desire of sustainable needs by being biodegradable/recyclable, being made from recycled materials, and being refillable.

In addition to the support of sustainable writing tools, major manufacturers such as Bic, Pilot, Paper Mate, and Zebra offer eco-friendly lines of writing tools. These companies are well established, thus if they are making these products it means there is a market for them. To understand the social demand of these products, the stationery purchasers of the UBC Bookstore

and the Staples located in UBC Village were contacted for sales figures. Unfortunately, they were not able to disclose that information, but as shown later in the Economic Analysis section of this report, the demand is increasing as prices of eco-friendly stationery are comparable to non-eco-friendly stationery.

## 2.2 Primary Source Research

In order to narrow down product selection, a survey booth was set up at UBC’s SUB. The booth comprised of sample stationery supplies, a poster, and survey sheets. The sample stationery comprised of eco-friendly pens, mechanical pencils, and a highlighter for students to inspect and use. A variety of products were chosen for display to analyze the interests of the students. Factors that reflected the student’s purchasing decision were the look, feel, price, and if it could be refilled. The poster indicated what made each writing tool sustainable, the prices they were likely to be sold at in the vending machine, and the cost of refills if available. The survey sheets asked which of the displayed products would be bought if the person had to buy new stationery, and if they would refill their pens. On the backside of the page was an extended survey asking for preferences in pens, pencils and highlighters not relating to the displayed products. The survey sheets are in Appendix A. The poster used is displayed in Figure 1.

**Mechanical Pencils**

- Paper Mate Biodegradable**
  - Biodegradable
  - Available in 0.7mm lead only
  - \$6.47 per 2-pack
- Pilot Begreen Progrex**
  - Made from 71% post-consumer material
  - Available in 0.5 and 0.7mm lead
  - \$3.60 per 2-pack
  - \$5.33 per 3-pack
- Zebra Eco Jemie Clip**
  - Made from 72% recycled content
  - Available in 0.5mm lead only
  - \$3.50 per 2-pack

**Ink Pens**

- Paper Mate Biodegradable**
  - Biodegradable
  - Available in black and blue
  - \$3.99 per 2-pack
  - \$6.96 per 4-pack
  - Refills \$2.14 per 2-pack
- Bic Ecolutions Round Stic**
  - Made from 74% recycled material
  - Available in black, blue, and red
  - \$4.00 per 12-pack
- Zebra Eco Jimmie Clip**
  - Made from 75% recycled content
  - Available in black and blue
  - \$3.50 per 2-pack
  - \$21.00 per 12-pack
  - Refills for \$3.15 per 3-pack
- Bic Ecolutions Clic Stic**
  - Made from 62% recycled material
  - Available in black, blue, and red
  - \$4.29 per 4-pack
  - \$8.49 per 12-pack
- Zebra Eco Clip-On**
  - Made from 70% recycled content
  - Black, blue, and red three-in-one
  - \$3.99 each
  - Refill \$3.15 per 3 ink set

**Gel Pens**

- Pilot B2P**
  - Made from 89% post-consumer recycled bottles
  - Available in black, blue, and red
  - \$4.70 per 2-pack
  - \$6.99 per 3-pack
  - Refills for \$2.46 per 2-pack
- Pilot Begreen Precise Gel**
  - Made from 83% recycled content
  - Available in black, blue, red, and green
  - \$4.27 per 2-pack
  - Refills for \$2.35 per 2-pack

**Highlighter**

- Zebra Eco Zebrite**
  - Made from 74% post-consumer material
  - Double-ended: Chisel and fin point
  - \$3.60 per 2-pack
  - yellow
  - \$7.95 per 5-pack assorted colours

Figure 1: Poster used at survey booth.



Of the 50 surveys filled out, Table 1 displays how many were likely to purchase each product.

Table 1: Results from product display survey.

<b><u>Pens:</u></b>							<b>Purchase</b>	<b>Refill</b>
<b>Bic Round Stic</b>	<b>Bic Clic Stic</b>	<b>Paper Mate Biodegradable</b>	<b>Zebra Jimmie</b>	<b>Zebra Clip-On</b>	<b>Pilot B2P</b>	<b>Pilot Precise Gel</b>	<b>Yes</b>	<b>No</b>
12	5	11	15	20	15	13	23	26

<b><u>Mechanical Pencils</u></b>			<b>Purchase</b>	<b>Zebrite</b>
<b>Paper Mate Biodegradable</b>	<b>Pilot Progrex</b>	<b>Zebra Jimmie</b>	<b>(Highlighter) Yes</b>	<b>No</b>
10	18	22	24	26

The prominent candidates for the vending machine from a social perspective are the Zebra Eco Clip-On 3 colour pen, Pen Refills, Zebra Eco Jimmie Mechanical Pencil, and the Zebra Eco Zebrite Highlighter. Of the gel pens, the Pilot B2P is slightly more favoured than the Pilot Precise Gel and is the prime candidate as a gel pen.

The Bic Eco Round Stic and Clic Stic pens will not be considered as final candidates as they are non-refillable. These pens are cheap compared to the other pens, and were used to indicate which of the surveyed would prefer cost over sustainability. The survey indicates that nearly one quarter of every person prefers cheap pens, but we feel that in the absence of non-refillable pens they may purchase a refillable pen and consider refilling it later to save cost.

The survey revealed an equal demand for ink and gel pens. To satisfy the demand of an ink pen, the Zebra Eco Jimmie Clip is a final candidate. By comparing the results of this survey to the extended survey the impacts of these products can be predicted.

The extended survey investigated the current on sustainable products by asking which features people find appealing in purchasing their writing tools. The results are listed in Table 3 through Table 10 in Appendix B. Each number represents the number of times the box was ticked.

Of the 50 surveyed on the display products, 26 participated in the extended survey. Of those 26 only 5 said they refill their pens. Comparing this to the 23 out of 50 surveys who said they would purchase pen refills if available in the vending machine. This indicates that the presence of refills inspires the purchasers to refill their pens. The preference of black to blue ink was equally split. Nearly one in three said that they considered biodegradable materials when purchasing their pens. Nearly half say they want cheap pens. Since students are more likely to choose the affordable option, this explains why the biodegradable products did not favour well in the display survey; they are more expensive than their contenders. If biodegradable products were priced comparably to the other pens then they could be preferred.

For pencil lead refills, 0.5mm was favoured to 0.7mm by double. The Zebra Eco Jimmie Clip mechanical pencil is only available as 0.5mm, where the Pilot Begreen Progrex is considered as a final candidate as it is available as 0.5mm and 0.7mm. This leaves the option open for future expansion of the pencil selection within the vending machine.

The question of highlighter colours was addressed in the survey, and was answered the 19 surveys that said they use yellow while the highest of another colour was 4.

During the survey the participants were asked for their opinions on the line of products available and if they saw any of the eco-friendly products with scepticism. Only one questioned the sustainability of the products regarding the product's life-cycle carbon footprint. Nearly all participants accepted these supplies as a better alternative to expendable supplies. Some people expressed their favouritism of Pilot due to previous use of Pilot's VBall and V5 line of pens, which are available in Pilot's eco-friendly Begreen line but were not included in the display sample. Also, some had favouritism in mechanical pencils made by Pentel, but their eco-friendly products were of significantly less recycled material content compared to the other product samples and were not included.

### **2.3 Social Conclusion**

Our society is becoming more aware of sustainable methods and products as they become incorporated into our lives. The growing green movement indicates that some will purchase products that support this movement, if those products are not significantly more expensive. This is shown by the more expensive biodegradable pen and mechanical pencil doing poorly in the

survey. From the survey, products that are socially recommended as final candidates for the vending machine are:

- Zebra Eco Jimmie pen
- Zebra Eco Clip-On 3-colour pen
- Pilot B2P Gel Pen
- Pilot Begreen Progrex mechanical pencil (0.5mm and 0.7mm lead options)
- Zebra Jimmie Clip 0.5mm mechanical pencil
- Zebra Eco Zebrite highlighter
- All applicable refills

By popular demand the Pilot Begreen V5 and Begreen VBall pens should be considered as well.

The presence of refills with the products of the vending machine will encourage purchasers to refill their pens and pencils. The strong acceptance of these products indicates that even if these products need to be replaced in the future with different models at nearly the same price, they will continue to encourage the public of UBC to choose eco-friendly products.

## **3.0 ENVIRONMENTAL ASSESSEMENT**

### **3.1 Focus**

While researching the environmental impact of office supplies in the Green Vending Machine, the focus of our research included:

- Recycled Content within the Products
- Production Footprint
- Company Environmental Policy
- Refillables
- Packaging

The breakdown of these focus areas, as well as an overview of the findings, are found below.

#### **3.1.1 Recyclable Plastics**

Although the products that were researched are refillable and reusable, they still have a finite life and their disposal is considered. Having researched different types of plastics, the ease of recycling these plastics was investigated. A journal paper by Vanessa Goodship (2007) called “Plastic Recycling” looked at different types of plastics, and the ease at which they can be recycled. Some plastics appear to be easier and less costly to recycle than others due to the properties of the plastic. Therefore by selecting pens made of common, easy to recycle products, the products in the vending machine will be easy and cheap to recycle.

#### **3.1.2 Production Footprint**

While researching the environmental footprints of different products, the generic “green” labelling that many manufactures gave their products was considered unsatisfactory. Most manufacture’s websites gave the percent of recycled material in their products, some gave the types of plastics, and none gave information on the specifics of the manufacturing processes used to create their supplies. Companies being researched (BIC, Pilot, Paper-Mate, and Zebra) were all contacted via phone/email, but they were unable to give more information than on their website.

On their website, BIC and Pilot mentioned a focus on sustainability with respect to their manufacturing process. BIC meet the French *NF Environnement (NF 400)* standard, which is, “a

life cycle approach, which takes into account each step of the product life cycle: acquisition of natural resources, manufacturing process, packaging and transportation, usage of product, product disposal” (BIC Group, 2011). Pilot follows ISO 14001 for all of its factories and distribution subsidiaries (PILOT, 2011).

Although other companies did not have any data on manufacturing processes, most did give data on percent recycled content. Paper Mate is the only exception to this, as they focus on biodegradable products instead of recycled. The recycled content data is shown in Table 2.

**Table 2: Recycled content of products from researched companies.**

<b>Product:</b>	<b>Pilot Begreen Progrex Pencil</b>	<b>Zebra Eco Jemie Clip Pencil</b>	<b>BIC Ecolutions Matic Pencil</b>	<b>Pilot Ballpoint BPE-GP Pen</b>	<b>Zebra Eco Jimmie Pen</b>	<b>Zebra Eco Clip-On Pen</b>
<b>% Post-consumer material, by weight</b>	71	72	74	76.3	75	70

<b>BIC Ecolutions Round Stic Pen</b>	<b>BIC Ecolutions Clic Stic Pen</b>	<b>Pilot B2P Gel Pen</b>
74	62	89

The majority of products are around 70% post-consumer material by weight, and all of these products are within a reasonable margin of one another (with the Pilot B2P being the only real outlier).

### **3.1.3 Environmental Policy**

Along with the specific products that each company had in their various “green line” of products, we looked at each company’s general policy on environmental responsibility. Pilot has an environmental policy, and a *Begreen* line, which follows the ISO 14021 international environmental standard concerning usage of recycled material (PILOT, 2011). BIC has a “Global

Sustainability Program”, which outlines their goal of improving logistics and manufacturing to reduce GHG emissions and water usage. Their *Ecolutions* line also follows ISO 14021 (BIC Group, 2011). Zebra has a “Social Responsibility” section of their website, which talks about different charities that they support, but does not explicitly mention environmental responsibility (Zebra Pen Corporation, 2011). Paper Mate did not have any such policy posted on their website. BIC had the most thorough policy on environmental concern, as theirs gave specifics into raw materials, manufacturing, distribution, water usage, and end of life cycle (BIC Group, 2010).

#### **3.1.4 Refillables**

For each of pencils, pens, and highlighters, we looked at the different options for refilling the products, and the environmental sustainability of these options. For pens, we looked at the option of soy-based ink for the ink refills. We found that although this ink is common in news print, it cannot be used in ballpoint pens. Soy ink takes more time to dry than other inks for it has no evaporative solvents, and can only be used if followed by a dryer.

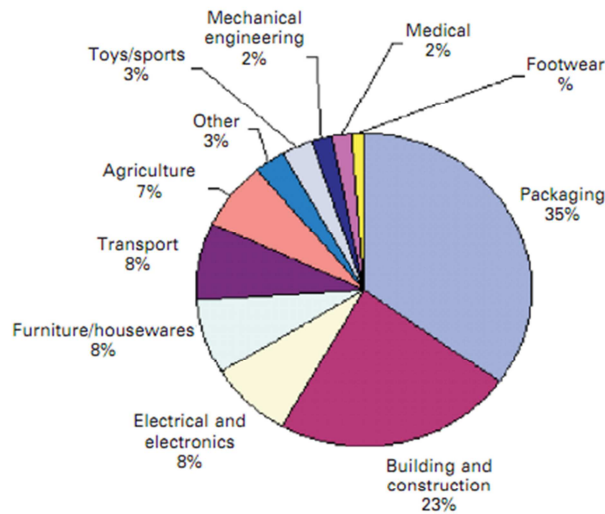
The only manufacture that gave specifics into the type of ink that they used in their refills was Pilot, which mentioned that their ink refills are water-based. None of the other manufactures gave specifics on the types of ink that they used.

For pencil refills, Pilot was again the only manufacturer that had a specific write-up about its pencil lead. It provides a 100% recycled content solution for 0.5 mm HB pencil refills. The other companies did not give specific information on their pencil lead.

None of the companies researched gave information on their highlighter refills. Nor did they offer a highlighter refill for any of their “eco” line products. The Zebra Zebrite that was used in our survey was the only eco line highlighter available from the companies we researched, but is a disposable product.

#### **3.1.5 Packaging**

Another point that was raised in the Goodship article was the amount of plastic that is used in packaging. According to their research, which was based on plastic usage in the UK, 35% of all plastic used was for packaging, as displayed in Figure 2.



*Fig. 1. Uses of plastics within the UK.  
[<http://www.wasteonline.org.uk/resources/InformationSheets/Plastics.htm>  
accessed 4.4.07]*

**Figure 2: Uses of plastics within the UK**

This stressed the need to stock supplies that are not individually packaged in plastic. It would be environmentally responsible to purchase products in bulk as many items in a single box rather than many individually packaged products. This would cut down on the carbon footprint of the products, the carbon footprint of transportation, and would make the products easier for the end users. All four of the companies contacted said that this would be an option, although it would limit order sizes to multiples of pre-determined ‘box’ sizes.

### **3.2 Recommendation**

BIC, Zebra, and Pilot all produced refillable, recycled pens and pencils that can be ethically purchased. Of these, BIC and Pilot are favored; BIC for their transparency and the lifecycle concerns, and Pilot for the types of plastics in the products. Their respective eco lines of products represent their global stances on environmental protection. Zebra did not provide much more information about their products or company other than the percent of recycled content in their products. For this reason, an informed environmental-based recommendation of their products cannot be made. Paper Mate focused their eco line on biodegradable solutions, and although sustainable, their product line is not well suited for the Green Vending Machine that is being placed in the sub as they are disposable.

## **4.0 ECONOMIC ASSESSMENT**

The focus of the economic evaluation for this project is to determine whether or not it is possible to supply sustainable, waste reducing pens, pencils, and highlighters for the vending machine at a competitive price compared to retail stores. Also, to determine the cost of supplying and maintaining the vending machine, and determining possible costs that the AMS could expect if the project goes forward and products are ordered.

### **4.1 GENERAL INFORMATION**

Justin Ritchie, the project stakeholder, has indicated that the vending machine has already been researched and that the AMS understands and accepts the costs of supplying and maintaining the machine. Therefore these costs do not need to be included in the analysis as the selected stationery products selected will not affect these costs. Recycling costs are also not being considered due to the fact that these products are refillable. The plastic bodies are meant to be continually reused, and if someone does decide to dispose of the product it can be done alongside regular plastics as all of the products are recyclable. Therefore after the social and environmental analysis have been completed to determine the most appropriate companies and types of pens, pencils, and highlighters to be placed in the vending machine, the economics of the project are used to show the best available solutions based on the cost of ordering and supplying products to the vending machine. This means that the cost of ordering the supplies from a manufacturer or supplier is the main economic factor that is to be considered.

To determine the ordering price of supplying the stationery products, different sources have been contacted with the intention of obtaining price quotes for specific products to buy and have supplied to the AMS. The first step taken was to speak with the different stationery manufacturers. The manufacturers contacted were BIC, Zebra, and Pilot as they were the top companies selected from the environmental and social analysis. Next, different local suppliers that manufacturers recommended were contacted, such as SP Richards. Finally, other immediate suppliers such as Staples, the UBC Bookstore, and the Outpost were contacted. As a last source, internet sources such as Amazon.com were used to obtain product pricing. Local suppliers, as well as Amazon, usually only carry specific brands of products; so only prices for products that were actually available are shown in this analysis.



In cases where minimum supply orders are needed to order products, total supply prices and quantities have been estimated as those required to completely fill the vending machine slots twice for extra supplies. Vending machines typically have 18 slots front to back, and we assumed 6 separate slots are available, one slot for each selected pen, pencil, highlighter, and one for each of their refills. Therefore, the total price for stocking the machine with products, and to have extra stock, will be the individual price multiplied by 36.

To fairly compare the prices of the different products all of their prices are shown as what the supply cost would be. In cases where quotes have been provided, these values are shown. In cases where direct quotes have not been provided it is estimated that the products are available at approximately 50% less than for regular consumers, due to bulk orders. This is based off of the prices that manufacturers have provided as well as from information provided by local sources. This will allow for the prices from the suppliers to be compared fairly to those that have been found either online or from store shelves.

## **4.2 ECONOMIC RESEARCH**

### **4.2.1 Bic**

BIC has been contacted directly and has shown interest in supplying products from their Ecolution product line and has provided, via email, a product catalogue with ordering costs. They have indicated that if our orders are less than \$750, in prepaid freight value, that local suppliers such as SP Richards should be contacted for BIC product orders. Appendix C shows the ordering prices for the appropriate BIC products from the catalogue.

### **4.2.2 Pilot**

A sales representative from Pilot, located in Vancouver, has also been directly contacted, via email and phone, and has indicated that they would be interested in supplying their “Pilot BeGreen” products for the machine but have not been able to provide any direct detailed pricing information. They have a number of high-quality sustainable and refillable Begreen products, so to include their products in the analysis, prices from the UBC Bookstore and from online sources have been used and are discussed in a later section.

#### **4.2.3 Zebra**

Zebra was contacted directly and is interested in providing products for the project. They have been able to provide pricing for Eco products. They have not indicated a minimum order requirement. Pricing information is shown in Appendix C.

#### **4.2.4 UBC Bookstore**

In researching the bookstore for appropriate products, it was determined they carry a range of sustainable, re-usable products, mainly from Pilot. After speaking with the bookstore's stationery buyer, he indicated that the bookstore is very supportive of the project and has been able to quote their product ordering costs. These products and their respective costs are shown in Appendix C. The bookstore stationery buyer noted that the bookstore would possibly be interested in supplying products through the bookstore, but would not be able to sell the products to us directly at their cost, but rather at a slightly marked up value of approximately 35%. This is much less than the shelf price, which is typically marked up by 190-200%, and is due to the fact that the bookstore is operating under the basis of producing a profit. He also noted that in his experience, students are not very concerned with the type of pen they are purchasing, but that selling price was the main factor. The cheaper the product, the more likely students are to buy it, an exception to this being specialty pens such as multi-colour pens. If this machine is located in an easily accessible area and the product prices are comparable to, or less than those of other supplier's, students are likely to buy the products from the machine. It was also noted that the price of sustainable, re-usable, products are now close to those of disposable products.

#### **4.2.5 UBC OUTPOST**

The AMS owned Outpost, located in the current SUB, was a second local supplier of office stationery. The Facilities and Retail Services Manager for the AMS, Jeffery Smith, is also very supportive of the project but is unable to provide any specific pricing or product information. Mr. Smith has shown concern that if they were to supply products in the machine, that the bottom line of the Outpost itself could be affected due to the fact that the price of the products in the machine would likely be lower than those in the Outpost.

#### **4.2.6 STAPLES**

The third local stationery supplier contacted was the UBC Staples located in the UBC Village. Staples carries mainly BIC products. After speaking with the store manager, Staples

does support the project but has not been willing to provide information of any sort, including specific product information. To include their products, the Staples website was used to determine their product pricing, which is summarized in Appendix C. To compare the website's marked up values to other product sources where ordering prices have been provided, it was estimated that the stationery products would be purchased at approximately 50% off of the shelf price due to the larger orders.

#### **4.2.7 ONLINE SOURCES**

For a final source of product pricing, internet sources such as [www.amazon.com](http://www.amazon.com), and [www.officesupplyhut.com](http://www.officesupplyhut.com) were used to determine the market selling price. Online suppliers often sell products at large discounts, so it is possible that their prices are less than the previously discussed sources. This will allow the products to be compared somewhat fairly to the products found using the local suppliers. It is noted that online sources, such as Amazon, do tend to be cheaper than buying products in a store. A summary of the products and prices found online, with their sources, is shown in Appendix C.

#### **4.3 ECONOMIC CONCLUSION**

The economic analysis has indicated which products can be purchased, where they can be bought from, and for what supply price. Refer to Appendix C for a list of the top performing products based on supply price. These supply prices, combined with the social and environmental analysis, will be used to come up with a final project recommendation based on a triple bottom line analysis.

## 5.0 CONCLUSION AND RECOMMENDATIONS

After completing a triple bottom line analysis on placing sustainable and refillable pens, pencils, and highlighters, in the “Waste Reducing Vending Machine”, the conclusion made is that these products should be included in the vending machine. It should be noted that after research was completed on finding both eco friendly and refillable products, that there are no available highlighters that fit this criteria. Only Zebra has an eco friendly highlighter, but it is not refillable. To replace this item in the vending machine, an additional pen or pencil can be selected along with its refill.

Based on the three TBL criteria, it is recommended that the following Pilot pens and pencils be used in the vending machine:

- Pilot BeGreen B2P Gel Pen
- Pilot BeGreen Precise V5 Rolling Ball Pen
- Pilot Begreen Progrex 0.5mm Mechanical Pencil
- Their respective refills

For the sake of economies of scale, ease of ordering, and reduction of transportation emissions, we chose to recommend products from a single manufacturer.

The objective of implementing the vending machine is to promote sustainability; therefore the environmental performance held a significant weight in determining the appropriate manufacturer and specific products. Each of these products is made from a high percentage of easily recyclable plastics. Although socially speaking these products were not the most preferred, as indicated by students, the environmental analysis has determined that Pilot is a top performing company on an environmental front. They have clearly displayed their commitment to being a sustainable company and truly consider their products environmental effects by completing full life cycle analysis, from manufacturing, to distribution, and disposal of the products. From the social analysis it was shown that students do, and would, regularly look to use their products and would consider buying them from a vending machine if supplied at an appropriate price. The economics of these products indicated that because these products are not being sold for a profit that the products will be able to be sold at an appropriate price, compared to purchasing the same products from other sources or even comparable disposable products. It is recommended that

products be purchased directly from Pilot as long as minimum order requirements are met. If not the UBC Bookstore has indicated that they are able to provide the products for the machine at relatively low costs as well.

If more products are required, or would like to be used in the machine for more variety, the Zebra Jimmie Clip 0.5mm mechanical pencil, Zebra Jimmie Eco Retractable Ballpoint Pen, Zebra Eco Zebrite highlighter, and all applicable refills can also be supplied. Zebra's products compare to those of Pilot, although they were lacking some information in the environmental analysis. They were indicated as being the most popular products from a social standpoint, which means that they may be sold more regularly.

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## Appendix A – Survey Sheets

### AMS Sustainability

#### Sustainable Writing Tools Survey for New SUB

1. Which of the pens at the Sustainable Writing Tools booth would you purchase from an AMS vending machine carrying sustainable products?

\_Bic Ecolutions Round Stic      \_Bic Ecolutions Clic Stic      \_Paper Mate Biodegradable

\_Zebra Eco Jimnie Clip      \_Zebra Eco Clip-On 3 colour

\_Pilot B2P Gel Pen      \_Pilot Begreen Precise Gel

2. If the pen refills are available, would you purchase and use them?

\_Yes      \_No

3. Which of the mechanical pencils at the Sustainable Writing Tools booth would you purchase from an AMS vending machine carrying sustainable products?

\_Paper Mate Biodegradable      \_Pilot Begreen Progrex      \_Zebra Eco Jimnie Clip

4. Would you purchase the Zebra Eco Zebrite highlighter from an AMS vending machine carrying sustainable products?

\_Yes      \_No

### Extended Survey

1. What are your preferred types of pen heads? Check all that apply.

\_Gel   \_Fiber Tip   \_Ballpoint   \_Roller Ball

2. Which of the following pen features attract you to buy it?

\_No Grip   \_Grip   \_Refillable   \_Biodegradable   \_Capped   \_Twist (Retractable)

\_Click (Retractable)   \_Cheap   \_Moderate   \_Expensive   \_Blue Ink   \_Black Ink

3. Do you refill your pens?

\_Yes   \_No

4. If you have a preferred pen maker, who is it?

\_\_\_\_\_

5. Which of the features interest you to buy your pencils (both graphite and mechanical)?

\_Graphite   \_Mechanical   \_0.5mm lead (mechanical)   \_0.7mm lead (mechanical)

\_No Grip   \_Grip   \_Biodegradable   \_Made from recycled materials   \_Cheap

\_Moderately priced   \_Expensive

6. What is your preferred pencil/lead hardness? You can list multiple.

\_\_\_\_\_

7. If you have a preferred pencil maker, who is it? Please specify whether graphite or mechanical.

\_\_\_\_\_

8. Which highlighter features attract you to buy them?

\_Slim (size)   \_Moderate (size)   \_Thick (size)   \_No Grip   \_Grip   \_Flip Cap

\_Refillable   \_Biodegradable   \_Cheap (price)   \_Moderate (price)

\_Expensive (price)

9. Which highlighter colours do you prefer?

\_Yellow   \_Orange   \_Green   \_Blue   \_Purple   \_Pink

10. If you have a preferred highlighter maker, who is it?



## Appendix B - Extended Survey Results

Table 3: Extended survey results on preferred pen features.

Gel	Fiber Tip	Ball Point	Roller Ball	No Grip	Grip	Refill-able	Biode-gradable	Capped	Twist	Click
11	2	17	9	3	16	5	9	5	1	11

Cheap	Moderate	Expensive	Blue Ink	Black Ink	Cheap	Moderate	Expensive	Blue Ink	Black Ink
11	2	1	11	11	11	2	1	11	11

Table 4: Extended survey of if the person refills their pens.

Yes	No
4	22

Table 5: Favourite pen maker in extended survey.

Bic	Pilot	Zebra	Paper Mate
4	9	4	1

Table 6: Extended survey results on pencil features.

Graphite	Mechanical	0.5mm	0.7mm	No Grip	Grip	Biodegradable	Recycled
1	17	18	8	2	12	6	5

Cheap	Moderate	Expensive
8	9	1

Table 7: Favourite pencil maker in extended survey.

Pentel	Staedtler	Bic	Zebra	Pilot
4	2	3	1	1

Table 8: Extended survey results on highlighter features.

<b>Slim</b>	<b>Moderate</b>	<b>Thick</b>	<b>No Grip</b>	<b>Grip</b>	<b>Flip Cap</b>	<b>Refillable</b>	<b>Biodegradable</b>
8	8	3	2	5	0	2	4

<b>Cheap</b>	<b>Moderate</b>	<b>Expensive</b>
8	4	0

Table 9: Extended survey on highlighter colours used.

<b>Yellow</b>	<b>Orange</b>	<b>Green</b>	<b>Blue</b>	<b>Purple</b>	<b>Pink</b>
19	3	4	4	3	4

Table 10: Favourite highlighter maker in extended survey.

<b>Sharpie</b>	<b>Pilot</b>	<b>Avery</b>	<b>Zebra</b>
1	1	1	1

## Appendix C – Economic Data

Table 11: Product Economic Summary

<b>Pens</b>		Our Unit Cost
Zebra	Sarasa Eco Gel Pen pen (12 multiple colors)	\$ 0.08
Bookstore	Pilot BeGreen Ballpoint Pen	\$ 0.11
Bookstore	Pilot BeGreen Rexgrip Ballpoint Pen	\$ 0.12
Bookstore	Zebra Jimmie Eco retractable Ballpoint Pen	\$ 0.12
Bic	Bic Ecolutions Round Stic: ballpoint pen (12 pack - blue)	\$ 0.14
Bookstore	Pilot BeGreen B2P Pen	\$ 0.15
Zebra	Clip Eco Stainless steel pen (12 pack)	\$ 0.15
Bookstore	Pilot BeGreen G-Knock Roller Pen	\$ 0.16
Amazon	Bic Ecolutions Round Stic: ballpoint pen (12 pack - blue)	\$ 0.17
Supply Hut	Pilot BeGreen Rexgrip Pen Retractable ballpoint (2 Pack)	\$ 0.17
<b>Pencils</b>		
Bookstore	Zebra Jimmie Eco Mechanical Pencil	\$ 0.12
Supply Hut	Pilot Rexgrip 0.5mm Mechanical Pencil (2 Pack)	\$ 0.17
Supply Hut	BIC Mechanical Pencil 0.7mm (12 Pack)	\$ 0.27
Bic	Bic Ecolutions Matic 0.7mm pencil (8 pack)	\$ 0.33
Amazon	Zebra's Eco Jimmie Clip Mechanical Pencil (12 Pack)	\$ 0.50
<b>Highlighters</b>		
Amazon	Zebra Eco Zebrite Double-Ended Yellow Highlighter (12 Pack)	\$ 0.45

Table 12: BIC Product Pricing

<b>BIC Pricing</b>			
<b>Product</b>	Price (\$)	Our Unit cost	Total Order (Price *36)
<b>Pens</b>			
Bic Ecolutions Round Stic: ballpoint pen (12 pack - blue)	\$ 1.68	\$ 0.14	\$ 60.48
Bic Ecolutions Clic Stic pen (4 pack - blue)	\$ 1.85	\$ 0.46	\$ 66.60
Bic Ecolutions Reaction pen (2 pack, blue)	\$ 2.34	\$ 1.17	\$ 84.24
Reaction Refill (2pack)	\$ 1.00	\$ 0.50	\$ 36.00
<b>Pencils</b>			
Bic Ecolutions Matic 0.7mm pencil (8 pack)	\$ 2.61	\$ 0.33	\$ 93.96

Table 13: Zebra Product Pricing

<b>Zebra Pricing</b>			
<b>Product</b>	<b>Cost Price (\$)</b>	<b>Our Unit cost</b>	<b>Total Order Price</b>
			<b>(Price *36)</b>
<b>Pens</b>			
Clip Eco Pen (blue, black or red) (12 pack)	\$ 2.49	\$ 0.21	\$ 89.64
Clip Eco Stainless steel pen (12 pack)	\$ 1.85	\$ 0.15	\$ 66.60
Sarasa Eco Gel Pen pen (12 multiple colors)	\$ 1.00	\$ 0.08	\$ 36.00
<b>Pencils</b>			
Only come in 12 packs, unit cost of 0.89 dollars	\$ 10.68	\$ 0.89	\$ 384.48
<b>Highlighters</b>			
Only come in 12 packs, unit cost of 0.83 dollars	\$ 9.96	\$ 0.83	\$ 358.56
** All refills are currently on back order			

Table 14: Bookstore Product Pricing

<b>Bookstore Pricing</b>				
<b>Product</b>	<b>Price (\$)</b>	<b>Price (Cost+35%)</b>	<b>Our Unit cost</b>	<b>Total Order Price</b>
				<b>(Price *36)</b>
<b>Pens</b>				
Pilot BeGreen Ballpoint Pen	\$ 1.00	\$ 1.35	\$ 0.11	\$ 48.60
Pilot BeGreen Rexgrip Ballpoint Pen	\$ 1.05	\$ 1.42	\$ 0.12	\$ 51.03
Pilot BeGreen G-Knock Roller Pen	\$ 1.42	\$ 1.92	\$ 0.16	\$ 69.01
Pilot BeGreen B2P Pen	\$ 1.32	\$ 1.78	\$ 0.15	\$ 64.15
Pilot BeGreen FEED GPA 4	\$ 3.58	\$ 4.83	\$ 0.40	\$ 173.99
Pilot BeGreen Greenball	\$ 1.69	\$ 2.28	\$ 0.19	\$ 82.13
Pilot BeGreen Greentecpoint	\$ 1.66	\$ 2.24	\$ 0.19	\$ 80.68
Zebra Jimmie Eco retractable Ballpoint Pen	\$ 1.05	\$ 1.42	\$ 0.12	\$ 51.03
<b>Pencils</b>				
Zebra Jimmie Eco Mechanical Pencil	\$ 1.05	\$ 1.42	\$ 0.12	\$ 51.03

Table 15: Staples Product Pricing

<b>Staples</b>					
<b>Products</b>	<b>Item #</b>	<b>Price</b>	<b>Unit Cost</b>	<b>Our Unit Cost</b>	<b>Total Order Price</b>
				(approx)	(Price *36)
<b>Pencils</b>					
Pilot BeGreen Progrex (10 Pack)	797434	\$12.99	\$1.30	\$0.65	\$233.82
Pilot BeGreen Progrex (10 Pack)	797435	\$12.99	\$1.30	\$0.65	\$233.82
Pentel Refills, 0.5mm HB, (12 Pack)	645527	\$10.46	\$0.87	\$0.44	\$188.28
Pentel Refills, 0.7mm HB, (12 Pack)	645520	\$10.46	\$0.87	\$0.44	\$188.28

Table 16: Online Source Information

<b>Officesupplyhut.com</b>					
<b>Products</b>	<b>Item #</b>	<b>Price</b>	<b>Our Unit Cost</b>	<b>Total Order Price</b>	
				(Price *36)	
<b>Pens</b>					
Pilot BeGreen Rexgrip Pen Retractable ballpoint (2 Pack)	PIL32373	\$ 2.04	\$0.17		\$36.72
Pilot BeGreen B2P Pen Retractable gel (2 Pack)	PIL31605	\$ 3.27	\$0.27		\$58.86
Pilot BeGreen G-Knock Retractable gel (3 Pack)	PIL31503	\$ 3.75	\$0.31		\$67.50
Pilot BeGreen Precise Retractable rolling gel (4 Pack)	PIL15044	\$ 5.03	\$0.42		\$90.54
Pilot BeGreen Precise V5 Needle Point Pen (3 Pack)	PIL26306	\$ 4.21	\$0.35		\$75.78
BIC Reaction Ballpoint Pen (12 pack)	BICCPGE11BE	\$ 14.53	\$1.21		\$261.54
Zebra Pen Refills (2 Pack)	ZEB87022	\$ 1.31	\$0.11		\$23.58
<b>Pencils</b>					
Pilot Rexgrip 0.5mm Mechanical Pencil (2 Pack)	PIL51221	\$ 2.06	\$0.17		\$37.08
BIC Mechanical Pencil 0.7mm (12 Pack)	BICMPE11	\$ 3.28	\$0.27		\$59.04

<b>Amazon.com</b>				
<b>Products</b>	<b>Item #</b>	<b>Price</b>	<b>Our Unit Cost</b>	<b>Total Order Price</b>
				<b>(Price *36)</b>
<b>Pens</b>				
Pilot BeGreen Precise Gel Fine Point Retractable Blue Gel Ink Pens (12 Pack)	15002	\$19.26	\$1.61	\$346.68
Zebra's Eco Jimmie Clip Retractable Ballpoint Pen (12 Pack)	22520	\$15.74	\$1.31	\$283.32
Zebra's Eco Clip-On 3-Color Retractable Ballpoint Pen (12 Pack)	26310	\$24.99	\$2.08	\$449.82
Bic Ecolutions Round Stic: ballpoint pen (12 pack - blue)		\$1.98	\$0.17	\$35.64
<b>Pencil</b>				
Zebra's Eco Jimmie Clip Mechanical Pencil (12 Pack)	52510	\$5.99	\$0.50	\$107.82
<b>Highlighter</b>				
Zebra Eco Zebrite Double-Ended Yellow Highlighter (12 Pack)	75050	\$5.41	\$0.45	\$97.38