

UBC Social Ecological Economic Development Studies (SEEDS) Student Report

Investigation into Sustainable Rental Services for UBC Bookstore

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EXECUTIVE SUMMARY

In September of 2014 UBC Bookstore presented students enrolled in APSC 261: Impact of Technology 1 with a request for recommendations on items that can be used to expand their rental service beyond simply textbooks. The following is a summary of the findings from the investigation conducted from a team of 5 students of that year's APSC 261 class. The team members are as follows: Ajaydeep Singh, Clifton Lok, Giles Fernandes, Steven Stewart and Sean Sanjoto. This document contains the following sections; background information, study methodology, findings and recommendations.

BACKGROUND INFORMATION

Before proceeding further with presenting the results of the investigation it is important to first define the Triple Bottom Line (TBL). TBL is a set of criteria for evaluating action with 3 components and they are social, environmental and financial. Although the focus of this investigation is to find a suitable item for the UBC Bookstore to add to their rental service, the Triple Bottom Line was put into high regard when evaluating concepts for the recommendation.

STUDY METHODOLOGY

The overall methodology for this investigation was to generate rental item concepts and then evaluate them with regards to the TBL. Data used to evaluate the concepts was then gathered through primary research in the form of an in-person survey with students and secondary research.

It was decided to target the students living in UBC's residence for the rental service expansion. Rental item concepts were generated with consideration to articles that students living on their own would use. Five concepts were generated: microwave, mini-refrigerator, coffee machine, kettle, hot-water-boiler and television.

To gauge interest and obtain data to evaluate the five concepts, 57 students living on 4 of UBC Vancouver's residential dormitories, Walter Gage, Place Vanier, Totem Park and Marine Drive were surveyed. The survey evaluated the interest, need and acceptable pricing range for the five concepts.

Secondary research was then conducted to determine the capital costs and environmental impacts of the most favourable concept. The environmental impacts include life-time energy consumption and pollution from transportation.

FINDINGS

From the survey results, it was determined that mini-refrigerator is the most promising concept with 57% of the participants showing interest in renting a mini-refrigerator while the other options showed interest less than 50%. During the survey process students pointed out how having a private refrigerator prevents food theft so in regards to social impacts of the Triple Bottom Line, the mini-refrigerator concept performs well because it provides peace of mind to students that their food will not be stolen.

After a lifecycle analysis of mini-refrigerators it was found that providing a mini-refrigerator rental service would introduce a positive environmental effect. Because many students who buy mini-refrigerators end up disposing their refrigerators after graduation. By providing a rental service, UBC can reduce the number of mini-refrigerators thrown out every year. However, it was also observed that if more students started renting refrigerators in addition to the common units provided in UBC residences, it would increase the average electricity usage. So in regards to the environmental part of the Triple Bottom line, the refrigerator concept has both positive and negative effects.

From the economic perspective the mini-refrigerator concept performs well. The survey showed that students are only willing to pay up \$35 to rent a mini-refrigerator for a four month school term. By following the UBC Bookstore's book rental pricing model of approximately 50% of new book purchasing price, it was estimated that the annual profit of a rental mini-refrigerator is \$36.10. This was calculated assuming the unit would be rented out each term and using an initial capital cost of \$125 per unit, a \$25 per term pricing model and a nine-year service period.

RECOMMENDATION

From this investigation it was determined that mini-refrigerators are a viable option for expanding the UBC Bookstore's rental service. Students have expressed a need for this

service and it would assist students in their life in UBC residence. The service will provide an alternative to purchasing new units and thus help reduce the number of refrigerators thrown out annually. Furthermore it was found that the concept is economically sustainable as well. So with regards to the Triple Bottom Line, this investigation has determined mini-refrigerators to be a sustainable option for expanding the UBC Bookstore's rental service. The recommendation is for the UBC Bookstore to rent out mini-refrigerators to students at \$50 per school year (8 months) or \$25 dollars per school term (4 months).

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GLOSSARY

- **Triple Bottom Line** - an accounting framework that incorporates three dimensions of performance: social, environmental and financial.
- **Global Warming Potential (GWP)** - a relative measure of how much heat a greenhouse gas traps in the atmosphere. The GWP compares the amount of heat trapped by a certain mass of the released gas to the amount of heat trapped by a similar mass of carbon dioxide.

LIST OF ABBREVIATIONS

- **UBC** - University of British Columbia
- **SEED** - Social Ecological Economic Development Studies
- **TBL** - Triple Bottom Line
- **APSC** - Applied Science
- **CO₂** - Carbon dioxide
- **MJ** - Mega Joule
- **Kg** - kilogram

1. INTRODUCTION

“Like many universities, UBC has a history of pursuing strong operational sustainability goals and targets. And, like many universities, UBC emphasizes teaching and research on sustainability. Where UBC demonstrates innovation is in going a step further to integrate the efforts” (UBC Sustainability Initiative Website, 2014). In line with UBC’s corporate and operational commitment to sustainability, the UBC Bookstore is looking to expand their rental program to make a profit, while achieving social and environmental sustainability.

The UBC Bookstore currently rents textbooks extending the use of the books, and enabling students to save money and wants to explore other products students see as rental possibilities on campus. This could include, but is not limited to sporting equipment (e.g., paddle boards), clothing (e.g. suits dresses/handbags for grad/first interviews), transportation (e.g. bikes, bike carts, cars) leisure equipment (e.g. hammocks, croquet sets), camping equipment (e.g. tents, sleeping bags, flashlights), lab materials (e.g. lab coats, goggles), and room supplies (e.g. printers).

The project was proposed by the UBC Bookstore but the other stakeholders for this project include the campus student population, and also a small proportion of non-campus students. The project solution has been developed in communication with the marketing and product staff of the UBC Bookstore. Our main contact at the UBC Bookstore has been Ms. Rebecca Irani (Marketing Manager) in coordination with Ms. Jennie Orpen (Merchandise Manager), Ms. Jenny Fuentes (Finance Manager), and Ms. Anna Li (Operations Director).

The main question posed by the UBC Bookstore is:

What products can the UBC Bookstore rent and make a profit, while also being socially and environmentally conscious.

In this process the stakeholder requested us to review current rental options on campus and in the marketplace and conduct a literature review of rental options and best practices

in the marketplace. The stakeholder suggested development and distribution of a questionnaire to gauge student interest in renting a wide variety of items in various categories (as described above). Based on the results of the survey, the stakeholder wanted the group to select one category that is suitable for renting, and conduct a TBL assessment of a rental system for 1-3 items within that category. The end goal of this investigation was to propose item(s) that would be most viable for a rental service at UBC Bookstore, recommend options (including operational and administrative process) for the Bookstore to include this item(s) in their rental program, and compare the proposed rental system to the standard buying/selling system.

This report elaborates an investigation on candidates that can fulfill the UBC Bookstore's needs while performing well with regards to the TBL. In the following sections these three criteria will be explored in depth in order to determine which of the household appliances are viable for rental. The items investigated are: microwave, mini-fridge, coffee machine, kettle, hot-water-boiler and television.

2. PROJECT PROPOSAL

The UBC bookstore tasked a SEEDS student group with performing analysis of rental markets that the bookstore could participate in. From researching campus residence regulations and a market survey, this report suggests that the bookstore has a viable rental program opportunity in the form of semester-long compact refrigerator rentals.

According to the survey, there is a marketable demand for rentals at \$25 per school semester. At this cost, there is market reach of over 1600 students who do not currently own a mini-fridge, would be interested in renting, and would be willing to pay the suggested price. A capital budget of \$125 per fridge will allow purchase of residence-typical three cubic-foot mini-fridge/freezer units with environmental certifications such as *Energy Star*. Purchasing up to 5% of the market reach, 80 units, is deemed viable while also ensuring that every fridge is fully utilized during the program pilot period.

Through the current UBC Bookstore textbook rental delivery services, it is also possible to implement this service to deliver mini-fridges. The UBC Bookstore also holds storage room so it is possible to store these fridges when they are not in use. This is a good opportunity to hold the fridges during summer term when the student population is minimal and not expected to be a viable rental population. The refrigerator-renting scheme should mimic the existing infrastructure in place for textbook rentals; this would require students to provide their student identification and a damage deposit. With many functions already being implemented with textbook rentals, managing damage payments and stock is of no difficulty. When they have signed for renting the Mini-Fridge the rentee may choose to have the fridge delivered to their house this way the students do not have to carry the fridges themselves making it more appealing to rent. Utilizing existing textbook resources, such as staff and vehicles, refrigerators may be picked up at dormitories for return to bookstore storage.

In summary, as detailed in the following sections, providing compact refrigerator rentals improves student life and reduces environmental damage. Therefore, with appreciation to the triple bottom line approach, UBC Bookstore mini refrigerator rentals is seen as a viable option

3. METHODOLOGY

The group first brainstormed what kind of goods or services the UBC Bookstore are able to provide. As mentioned by the stakeholders before, UBC has access to spare storage area which gives the team to explore goods and services that requires large storage areas. With this in mind the team had come up with a list of items that we think that potentially be something that students need. Afterwards the team will rank each items, the following items are the team's rankings:

- Household Appliances
- Foot Scooters
- Bicycle
- Printer
- iClicker
- Rice Cooker

- Hot Pots
- Projector

This is the first step into the investigation. When the ranking is done the team researched each item to get a sense of each of their viability. It is found that when dealing with vehicular items such as Foot Scooters, Bicycles, and skateboards it is hard to keep track of their status as it is easy to move hence easier to be stolen. It was also mentioned by the UBC Bookstore representative that there was many issues with dealing with stolen items. Also it was found that renting furniture and appliances was a big issue in the UBC community. Continuing the investigation, doing a survey is beneficial to see the market for renting furniture and appliances. The different furniture and appliances considered was the following:

- Mini Fridge
- Microwave
- Hot Water Kettle / Hot Water Boiler
- Coffee Maker

UBC student who lives on campus is the perfect survey candidate for the data as they are the most likely to be interested in renting items. The team surveyed 57 UBC students who lived on campus and the result shows that most of the students considers renting Mini Fridges as the main item that they are interested in. The next leading item that the students consider is coffee makers.

The team is then required to use the TBL style analysis for the chosen goods or services. The TBL style analysis will provide the team with insight for the People aspect, Profit aspect, and Planet aspect. This will be explained in the next section.

4. TRIPLE BOTTOM LINE ASSESSMENT

There is a corporate culture shift towards addressing the Triple Bottom Line (TBL). The Triple Bottom Line is described as: “an accounting framework that incorporates three dimensions of performance: social, environmental and financial. There is no universal

standard method for calculating the TBL. Neither is there a universally accepted standard for the measures that comprise each of the three TBL categories (Slaper & Hall, 2011). The following sections outline each individual component of the Triple Bottom Line.

4.1. SOCIAL CONSIDERATIONS

The second consideration in the TBL analysis is the social considerations. The aim and value of UBC Bookstore's rental program is to provide items for rental that benefit students. For our items, the primary beneficiaries are the UBC residents. Students and faculty that temporary live on campus are a prime target for this rental program as they are in need of goods on a term basis. Kitchenware and other household goods are among the things that are only used during the term and require storage otherwise. This is where the proposed idea benefits UBC residents. If the bookstore can pick up and deliver these items while charging a competitive price against the alternative, buying the item, then both parties would profit.

In order to validate our theory we conducted an in-person survey at each of residences (Walter Gage, Place Vanier, Totem Park, Marine Drive) and posted an online survey to determine what items would residents be willing to rent and for what price. show that 68% of those interviewed lives on campus and the remaining lives off campus. By adding up the total amount of people interested in renting each item from Table 2 we see that 57% of residents surveyed would consider renting a mini-refrigerator and the total interest in the other options was less than 50%.

Do you live on UBC Campus in student residence?

Answered: 57 Skipped: 0

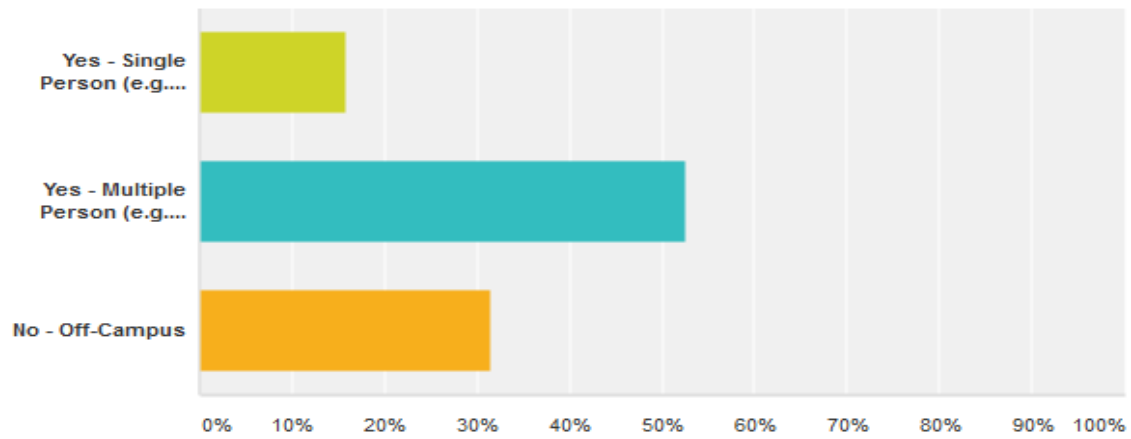


FIGURE 1: SURVEY RESULTS FOR HOUSING LOCATIONS

TABLE 1: TABULATED HOUSING LOCATION RESULTS

Answer Choices	Responses	
Yes - Single Person (e.g. Totem, Vanier, Suite)	15.79%	9
Yes - Multiple Person (e.g. Gage, Fairview, Thunderbird)	52.63%	30
No - Off-Campus	31.58%	18
Total		57

How interested would you be in being able to rent these items for your personal residence?

Answered: 57 Skipped: 0

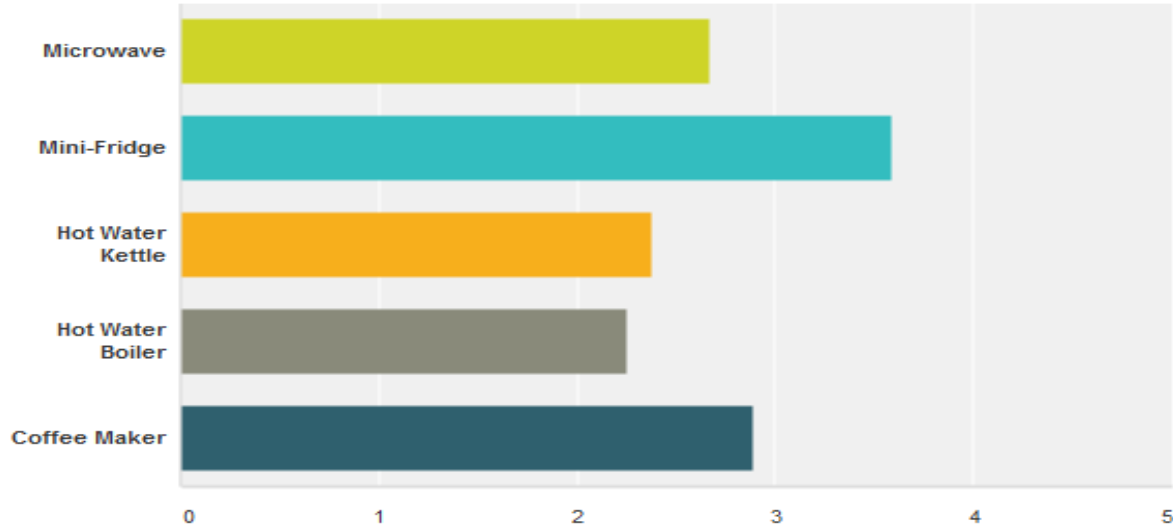


FIGURE 2: INTEREST IN RENTING DIFFERENT HOUSEHOLD APPLIANCES

TABLE 2: RENTAL ITEMS UNDER CONSIDERATION WITH RESPECTIVE DEMAND PERCENTAGE

	Really Interested	Interested	No Opinion	Not Interested	Really not interested	Total	Average Rating
Microwave	17.54% 10	8.77% 5	7.02% 4	56.14% 32	10.53% 6	57	2.67
Mini-Fridge	39.29% 22	17.86% 10	7.14% 4	33.93% 19	1.79% 1	56	3.59
Hot Water Kettle	5.36% 3	14.29% 8	8.93% 5	55.36% 31	16.07% 9	56	2.38
Hot Water Boiler	3.51% 2	10.53% 6	14.04% 8	50.88% 29	21.05% 12	57	2.25
Coffee Maker	19.64% 11	16.07% 9	12.50% 7	37.50% 21	14.29% 8	56	2.89

The results from Figure 2 and Table 2 indicate there is an interest in renting mini-fridges suggests that some social value is gained. While the reason for their interest was not captured from this survey we can speculate that residents like the idea of having a small person fridge, which they do not need to store while they are away. During the survey some students mentioned that they liked the idea of having a personal fridge so that their

food does not get stolen. Another good reason that students may consider buying a mini-fridge is that first year residences only have one fridge per floor. This is inconvenient and also often leads to stolen food. Due to this, it may be concluded that the majority of rentals would come from first years rather than from residences with a lower number of people to one fridge.

As mentioned before, a perk for renting from the UBC Bookstore is that, the mini-fridge will be picked up and delivered. This provides scenarios where residents have to find someone willing to store it and transport the fridge between the locations. A friend of one of the members of this team used her barn to store a few mini-fridges for her friends, which inconveniences her and those who have to transport it there. By renting mini-fridges with pick up and delivery, we are benefiting students in a social manner.

4.2. ECONOMIC CONSIDERATIONS

A significant consideration of the triple bottom line is the economic consideration. Without a distinct profit, a business venture is unsustainable, no matter the intentions of a company. Outlined by the client, the bookstore, the following terms are proposed:

- Storage is unlimited
- Initial Capital is unlimited
- Marginal Staffing is unlimited
- Proposal must be profit neutral or positive

By ignoring the costs associated with storage, capital and staffing, the principal costs in a rental operation are the purchase of the equipment. The principal income would be the rental costs collected in the operation. Thus, one component of this project's research is to find that there is sufficient interest at a viable price. To note, the bookstore historically rents textbooks annually at approximately 50% of cost with an expected lifetime of two to three years. This leads to a similar cost-return of selling books directly.

Having directed the projects focus to specifically mini-fridges through the survey results, the market size can be deduced. This project intends to focus on campus student

residences. In total, this population numbers approximately 9400 (as reported on UBC’s website: www.you.ubc.ca). Based on the survey results below in Figure 3. 57% show indicated a positive response to the prospect of renting a mini-fridge. The market reach is thus the population multiplied by the viable responses totalling 5360 students. Another question indicates that 61% of respondents do not personally own a compact refrigerator. Thus, the prospective market consists of 3270 students. From this, depending on price, the viable market changes in size.

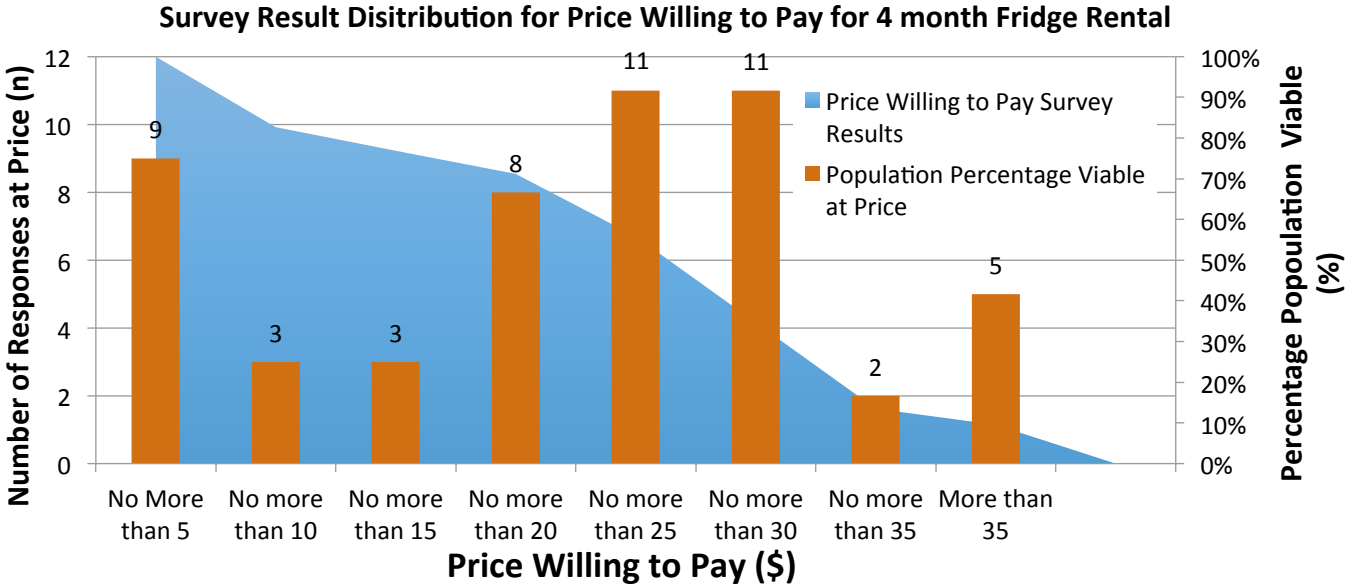


FIGURE 3: SURVEY RESULTS OF PRICE WILLINGNESS TO PAY FOR 4-MONTH FRIDGE RENTAL PERIOD

The figure above indicates the responses regarding willingness to pay for a compact fridge. Respondents were prompted to indicate the maximum price they would be willing to pay to rent a refrigerator for one school term (four months). The red histogram indicates the number of responses at each cost point. The blue area indicates the percentage of responses viable at each price. Evidently, it is clear that if price is zero, every student would rent a refrigerator, whereas if price increases significant past \$35, the market size approaches zero. A linear fit can be brought to this curve, approximately relating that for every increase in \$5 over a base \$5, the prospective market reduces 12%.

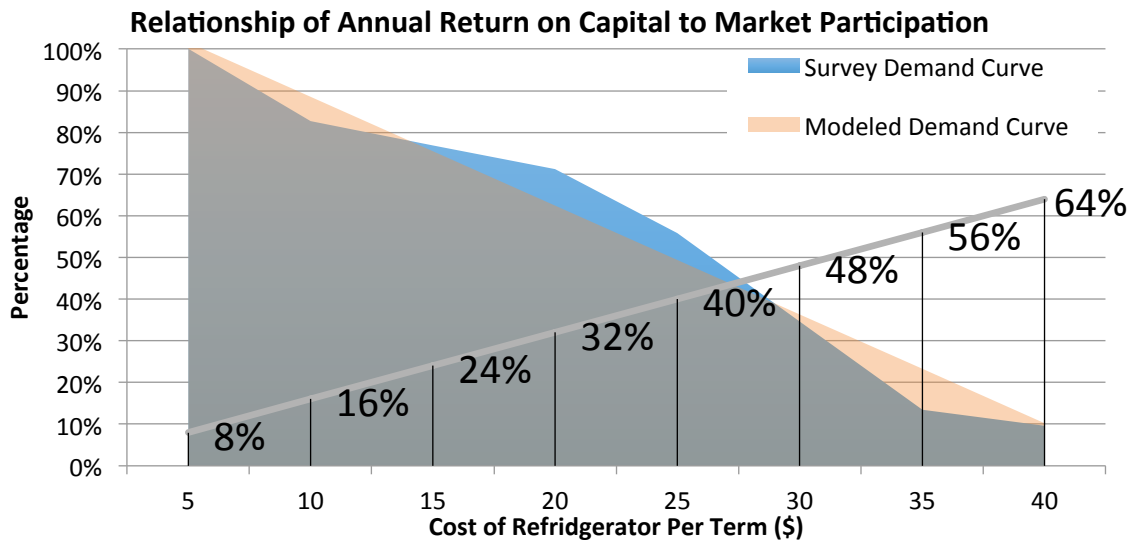


FIGURE 4: MARKET DEMAND CURVE BASED ON SURVEY RESULTS SHOWING ANNUAL COST RETURN

Setting the rental term cost must consider many factors. These factors include the capital cost, expected life-span and rental utilization of the refrigerators,. Consumer reports indicate the typical life of a compact fridge to be nine years (Study by Bank of America, 2007). Concerns about compact refrigerators being less durable are not ignored, as full size refrigerators have typical life spans of thirteen years. Having a lower return on capital is suitable, as a nine-year lifespan doubles or even triples the useful life of a rental textbook. Evaluating units on the market, it is evident that at market price, a three cubic-foot refrigerator comes to a typical cost between \$100 and \$150 (Walmart and Best Buy websites). Considering the environmental impacts, the fridges in question are only considered if they maintain an Energy Star rating. This is the end-cost to a user. Purchasing refrigerators in bulk would allow the bookstore to possibly save costs through wholesale distributors. Therefore, moving forward with the average cost of \$125 provides a pessimistic estimation of the bookstores cost per fridge. Utilization of the fridge is another factor to consider. Because the student population is large for the school year and minimal during the summer, it is a safe assumption to plan for units being used for two academic terms per annum. Any usage of the refrigerators during the summer can be considered an added benefit. If the required storage to have rental options during the summer is not viable, rental operations for refrigerators may not be offered. Therefore, this

analysis assumes zero summer rentals. Based on market size, the bookstore is suggested to operate with a number of refrigerators such that every unit is used per each academic term.

Combining fridge life, cost and utilization would provide a range of reasonable prices. Based on anecdotal responses in line with the survey results, many students reasoned, "About five dollars a month seems fair." Thus, this analysis suggests a term cost of \$25, leading to an annual rental charge of \$50. The market Participation at this price point is 50%, leading to a market reach of 1635 students. This report suggests keeping initial rental stock under 5% of the market reach to ensure that the pilot program receives full rental utilization. Furthermore, this price point provides a 40% annual return, similar in line for shorter-lived textbook rentals. Amortizing the capital cost of a refrigerator over the lifespan of nine years is an annual degradation of \$13.90 per year. This leads to an annual surplus per unit of \$36.10.

The finalization of a profit value would require specific evaluations of storage, transportation and labour costs. With respect to the information provided by the bookstore, this analysis assumes storage is of no concern, nor is labour or transportation. The bookstore indicates storage infrastructure exists, while it already maintains on-campus rental product delivery services via vehicle. Thus, large costs are already invested. The marginal cost of providing fridge delivery will be minor, as the delivery scheme could require students to move the units the last-leg to their personal residences.

In concern for maintenance and cleaning, a policy can be enacted that a fridge must be returned cleaned, de-frosted, and damage free. If this is not adhered to, a student may be charged a cleaning fee. Typical to the UBC Bookstore's damage policy for textbooks (UBC Bookstore, 2014), if a refrigerator is returned in an unusable state, the full retail amount will be charged to the renter's on-file credit card information. In cases where there is cosmetic damage, the renter will be charged on a case-by-case basis a small percentage of the retail amount. To ensure charges are not falsely charged, renters will, with a bookstore representative, note any existing damage on the refrigerator.

Considering that the damage on a refrigerator is cumulative, it may be necessary to reduce the rental cost for visibly damaged units, or the cost will How often this occurs must be established through service.

4.3. ENVIRONMENTAL CONSIDERATIONS

Over the past few years, a growing number of businesses have recognized the global trend of environmental awareness and have subsequently started considering environmental impact in a similar vein to monetary profit. Although the UBC Bookstore would require any rental program expansion to make profit, they would not do so with associated detrimental environmental impact. Any positive environmental impacts would add to the total “TBL profit” generated.

The main source of environmental impact in a rental program is transportation of service between the provider and the customer. The amount of impact created is directly proportional to the distance between the provider and the customer, the frequency of transport, and the type of transportation that is used for the rental service (Khumboon, Kara, Manmek, & Kayis, 2009). As explained above, the mini-refrigerators would be rented out for one or two academic terms. They would be delivered to and picked-up from the student residences at the beginning and end of the term. The transportation of the mini-refrigerators would be done using the delivery truck that the bookstore currently owns. The bookstore currently delivers pre-booked textbook packages at the beginning of each term for students living on residences. The delivery and pickup of the mini-refrigerators would be combined with these textbook delivery trips, thus reducing the environmental impact that would be generated from transportation of the rental mini-refrigerators. Since the service is for students living on-campus, the maximum distance that these mini-refrigerators would need to be transported to is 2.3 km (from UBC Bookstore to Walter Gage Residence; this is based on the driving distance obtained from www.maps.google.com) and delivering to more than one residence in the same area would reduce this further. The frequency of transportation would be two times a year on an average. Renting it for a longer period (8-12 months) would lead to a lower environmental impact compared to shorter rental periods of 4 months. Renting it for a

lower time period would cause a significantly higher environmental impact from transport of the mini-refrigerators, as it would also require special trips for pickup or delivery.

Another important factor/indicator that was considered in the environmental assessment was the life cycle environmental impacts during the mini-refrigerator's entire lifetime. Figure 5 below shows the closed loop life of a product raw material acquisition to its treatment and disposal.

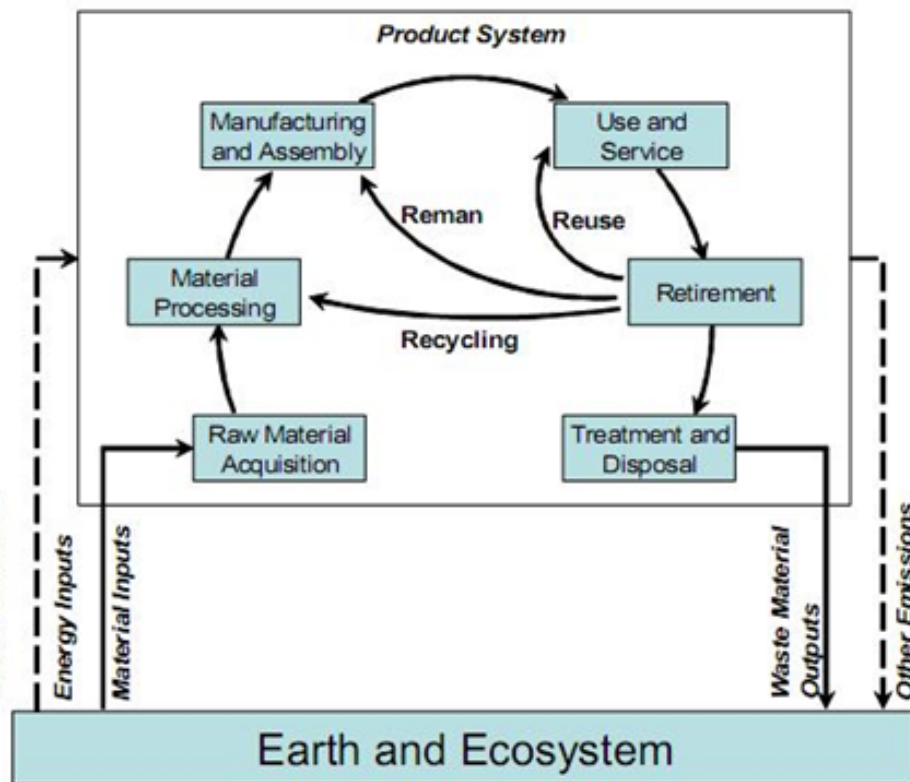


Figure 5: Closed Loop Product Life Cycle [Gallo, Romano, & Santillo (2012). A Perspective on Remanufacturing Business: Issues and Opportunities, International Trade from Economic and Policy Perspective, Prof. Vito Bobek (Ed.).]

Re-use of the mini-refrigerators in a rental setup increases the total life. Presently, most of the students who buy mini-refrigerators for their dorm rooms typically own in for a period of 2-4 years. During this period the mini-refrigerator is not actively used at all times (summer vacation, moving away for a co-op work term, etc. are periods of passive use). The students end up either throwing out the mini-refrigerators when they graduate or move to a different place or they carry it back to their home, where it ends up lying unused

in a garage for a few more years before it is thrown out. By having a rental setup we would be able to actively use the mini-refrigerator for an extended period of time.

With the life cycle analysis, we observe that there are no environmental gains in the use phase with the rental program. By renting out energy star mini-refrigerators we are able to save a small amount of electricity compared to students ending up buying cheap non-energy star mini-refrigerators. But we would in fact be using more electricity as more students would now be encouraged to have a personal mini-refrigerator in their rooms in addition to the common unit refrigerator provided in all UBC student housing residences. The real savings come from the production and manufacturing of the mini-refrigerators. With the rental program, the life of the refrigerators would be significantly increased. Therefore, a fewer number of refrigerators would need to be produced for the same demand. Each unit of mini-refrigerator requires about 5,000 MJ of energy for manufacturing and assembly (Rüdenauer and Gensh, 2007). This amount of energy can be used to power five average Canadian households for a day (Statistics Canada, 2007). In addition to this, Rüdenauer and Gensh highlight in their research that production of each mini-refrigerator unit creates a global warming potential of 150 kg of carbon dioxide - this is double the amount of carbon dioxide emitted by a Boeing 737 in a flight from Vancouver to Calgary. In addition to the total energy consumption and the greenhouse effect, the refrigerants used in these refrigerators cause depletion of the ozone layer. By reducing the number of the refrigerator units produced, we can reduce the rate of the depletion of the ozone layer. Based on the market reach described in the section above, even if UBC Bookstore rents 500-1000 mini refrigerator units, it will create a significant impact in terms of environmental savings. After the mini-refrigerators are disposed off, the cost of recycling the refrigerators is higher than the initial production cost, with insignificant environmental advantage, that it is not feasible to recycle them (Boustani, Sahni, Graves, & Gutowski, n.d.). Therefore, re-use through the rental program would extend the life of these mini-refrigerators reducing the environmental impacts associated with disposing the refrigerators.

5. CONCLUSION AND RECOMMENDATIONS

From this investigation it was determined that mini-refrigerators are a viable option for expanding the UBC Bookstore's rental service. Students have expressed a need for this service and it would assist students in their life in UBC residence and thus providing a positive social effect. The service will provide an alternative to purchasing new units and thus help reduce the number of refrigerators thrown out annually. However it was found that if the rental service would promote an increase in the number of refrigerators used in residences, then there would be a slight negative environmental effect. Furthermore it was found that the concept is economically sustainable as well, with an estimated annual profit of \$36.10 per unit. So with regards to the Triple Bottom Line, this investigation has determined mini-refrigerators to be a sustainable option for expanding the UBC Bookstore's rental service. The recommendation is for the UBC Bookstore to apply the existing student identification and billing infrastructure used in book rentals to rent out mini-refrigerators at \$50 per school year (8 months) or \$25 dollars per school term (4 months).

6. REFERENCES

1. Boustani, A., Sahni, S., Graves, S., & Gutowski, T. (n.d.). Appliance remanufacturing and life cycle energy and economic savings. Retrieved from http://www.reman.org/articles/appliance_reman.pdf
2. Best Buy (2014). Mini refrigerators. Retrieved from [http://www.bestbuy.com/site/searchpage.jsp?nrp=15&cp=3&seeAll=&id=pcat17071&_dyncharset=UTF-8&ks=960&sc=Global&list=y&usc=All%20Categories&type=page&iht=n&browsedCategory=abcat0901002&st=categoryid\\$abcat0901002&qp=currentprice_facet%3DPrice~%2450%20-%20%2499.99%5Ecurrentprice_facet%3DPrice~%24100%20-%20%24149.99](http://www.bestbuy.com/site/searchpage.jsp?nrp=15&cp=3&seeAll=&id=pcat17071&_dyncharset=UTF-8&ks=960&sc=Global&list=y&usc=All%20Categories&type=page&iht=n&browsedCategory=abcat0901002&st=categoryid$abcat0901002&qp=currentprice_facet%3DPrice~%2450%20-%20%2499.99%5Ecurrentprice_facet%3DPrice~%24100%20-%20%24149.99)
3. Energy BC (n.d.). An overview of how Canadians and especially British Columbians use energy. Retrieved from <http://www.energybc.ca/usage/usage.html>
4. Gallo, M., Romano, E., & Santillo, L. (2012). A Perspective on remanufacturing business: Issues and opportunities, international trade from economic and policy perspective, Prof. Vito Bobek (Ed.), Retrieved from: <http://www.intechopen.com/books/international-trade-from-economic-and-policy-perspective/a-perspective-on-remanufacturing-business-issues-and-opportunities>
5. Khumboon, R., Kara, S., Manmek, S., & Kayis, B. (2009). Environmental impacts of rental service with reconditioning – A case study. Proceedings of 1st CIRP Industrial-

Product Service Systems (IPS2) Conference, Cranfield University. Retrieved from https://dspace.lib.cranfield.ac.uk/bitstream/1826/3864/3/Environmental_Impacts_of_Rental_Service_with_Reconditioning-A_case_study.pdf

6. n.a. (2007). Carbon independent: Aviation sources. Retrieved from http://carbonindependent.org/sources_aviation.htm
7. Rüdener, I. & Gensh, C. (2007). Environmental and economic evaluation of the accelerated replacement of domestic appliances. Retrieved from <http://www.oeko.de/oekodoc/271/2007-016-en.pdf>
8. Seiders, D., Ahluwalia, G., Melman, S., Quint, R., Chaluvadi, A., Liang, M., ... Bechler, C. (2007). Study of life expectancy of home components. National Association of Home Builders/Bank of America Home Equity. Retrieved from https://www.nahb.org/fileUpload_details.aspx?contentID=99359
9. Slaper, T. F. & Hall, T. J. (2011). The triple bottom line: What is it and how does it work? *Indiana Business Review*, 86(1), 4-8. Retrieved from <http://search.proquest.com.ezproxy.library.ubc.ca/docview/861497991?accountid=14656>
10. UBC Bookstore (2014). Rental Books FAQ. Retrieved from <http://bookstore.ubc.ca/books/course-materials-students/find-choose/faqs/rental-books-faq#lostdamagedstolen>

11. UBC Sustainability Initiative (2014). UBC sustainability initiative: Commit, integrate, demonstrate, inspire. Retrieved from <http://sustain.ubc.ca/our-commitment/ubc-sustainability-initiative>

12. The University of British Columbia (2014). Living in residence. Retrieved from <http://you.ubc.ca/ubc-life/vancouver/residence/>

13. Walmart (2014). Mini refrigerator. Retrieved from http://www.walmart.com/search/search-ng.do?query=mini%20refrigerator&cat_id=0&facet=capacity:3.2%20cu%20ft