UBC Social Ecological Economic Development Studies (SEEDS) Student Report

An Investigation Into Bring Your Own Container Food Outlet Concept

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ABSTRACT

The following report outlines the evaluation of feasibility of Bring Your Own Container (BYOC) in the new SUB of UBC using a triple-bottom-line analysis approach and concludes whether or not the new SUB should proceed with BYOC. The triple-bottom-line analysis includes three aspects: environmental assessment, economical assessment, and social assessment. All sources in this report are from peer-reviewed articles, on-line articles, and surveys.

The economical assessment is based on the research of two indicators: cost of disposable containers (like paper and Styrofoam) versus reusable containers (plastic, glass) and the impact of BYOC program on vendors. The environmental assessment makes a comparison between disposable and reusable containers. Each part of disposable containers or reusable containers also illustrated several types of containers with different materials. Recommendations among the various containers are made for environmental sustainability. The social research is focused on students. Firstly, a survey was carried out. It shows that most students worry about potential health problems caused by BYOC. Also, some researches point out that some chemicals from plastic food containers might lead to health problems. Lastly, another survey shows that BYOC would allow students to have some positive habits.

In conclusion, based on these three aspects of sustainability assessment, this report suggests that BYOC can significantly benefit the new SUB's sustainability, leading to a green and eco-friendly SUB in UBC.

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GLOSSARY

Bisphenol A: An organic compound $(CH_3)_2C(C_6H_4OH)_2$ which is an endocrine disruptor.

Endocrine: Disrupting Chemical: Chemical which interferes with hormone system in humans. The disruptions can cause cancerous tumors, birth defects, and other health problems.

Hazard Index: The sum of more than one hazard quotient for multiple substances. If it is less than one, then the effect of the chemical is not of concern; if it is greater than 1, then the chemical should be of concern.

Phthalates: Esters of phthalic acid, which are mainly used as plasticizers. In the United States and Canada, many researches have shown the health concerns of phthalates.

Polycarbonate: A particular group of thermoplastic polymers. Because they are easily worked, molded, and thermoformed, they can be used in many applications including plastic food containers.

Polypropylene: Also known as polypropene, is a thermoplastic polymer used in a wide variety of applications including packaging and labeling.

Polystyrene: An aromatic polymer made from the monomer styrene, a liquid petrochemical. Polystyrene is one of the most widely used plastics, the scale of its production being several billion kilograms per year.

1.0 INTRODUCTION

The idea of growing campus sustainability is becoming increasingly important worldwide. One significant movement is to better container management. Over the years, UBC's student society, the AMS, has taken up many sustainable initiatives such as discounts for reusable containers and Bring Your Own Container (BYOC) program.

In this report, we analyze the feasibility of BYOC based on the three essential aspects for sustainability – economical, environmental, and social aspects – which is the core aim of APSC261: Technology and Society. Peer surveys among students in the SUB, scholar journals, online articles, etc. are assessed or implemented for our report.

Base on the investigation, we will have a conclusion about BYOC program and recommendations toward BYOC for the new SUB building in UBC.

2.0 ECONOMIC ASPECT

Economic elements always first come to your mind when compare two goods. When we decide whether to implement BYOC program and choose which container to be used, the total cost of the options will be majorly considered. The chosen two indicators of economic aspects are cost of disposable containers (paper and Styrofoam) versus reusable containers (plastic, glass) and the impact of bring your own container program on vendors.

2.1.0 COST OF DISPOSABLE CONTAINERS VERSUS REUSABLE CONTAINERS

Costs of the two kinds of containers are mainly investigated from maintenance cost of reusable containers (like water/electricity consumption for washing and how often it needs to be replaced) and the cost on recycling the disposable containers. Also we discuss it from the producer's perspective besides the consumer's side.

2.1.1 Reusable Containers

Two main kinds of reusable containers are plastic and glass. The majority of plastic containers in the market are made from polypropylene, which is a durable, recyclable and safe material. According to Kenneth Marsh (2007), the high melting point (160 °C) makes it suitable for hot-filling and microwaving; also polypropylene is flexible, strong, tough and resistant to moisture. A typical polyethylene container in the market, such as, 1.1 Liter Lock & Lock container (see Figure1 below), is about 8 dollars, and typically it can be used for 3 to 5 years, even longer.

Figure 1: Lock & Lock Polypropylene Container

Glass has extremely long history as food container. It is impermeable, provides good insulation and maintains food freshness for a long time. But the disadvantage of glass is also outstanding, the heavy weight of glass makes it costly to transport, the major concern is "its brittleness and susceptibility to breakage from internal pressure, impact, or thermal shock" (Marsh, 2007, R41).

2.1.2 Disposable Containers

When we talk about disposable containers, we mainly mean paper container now. Styrofoam does harm to environment severely and is rarely used in Canada now. But paper is widely used at present.

The major advantage of paper container is it is renewable. It is hard to get the exact price of per paper container. According to online research, it is about 0.02 to 0.2 dollars per piece.

2.1.3 Comparison between the two kinds of containers

The comparison is between paper and plastic (polypropylene). From economic aspect, my suggestion is your own plastic container is much better than paper container.

From the vendor's side, if customer brings their own container, it is more convenient for no more purchasing those containers. Also, this will cut down the capitalized cost and then reduce the price, which may attract more customers.

From the customer's side, as mentioned above, customers themselves actually pay for the disposable (paper) containers. A regular polypropylene container is about 8 dollars, which can be used for more than 3 years. A paper container is no less than 0.02 per day to consume. Assume you eat at school for lunch 20 days per month, than the cost of paper container per month is about 0.4 dollars. And 8 dollars can only be used up to 20 months, less than two years.

Of course, paper container is renewable. But actually the interesting thing is "Recycling waste uses double the energy consumption and causes twice the pollution from factories, trucks, byproducts etc."(Larry, 2007, introduction) Although the

number is not exact, preparing and maintenance of recycle bin, special truck to pick up the waste, trucks that delivered the waste, and the process to transport those material to goods, all these processes need to consume lots of energy.

The conclusion is obvious: use the reusable containers and try to use it as long as possible.

2.2.0 IMPACT OF BRING YOUR OWN CONTAINER ON VENDORS

According to the survey of 93 students who are always eating in the SUB (see Figure 2 below), if BYOC program is implemented, 7.5 percent of them indicate they will not go to the SUB anymore and 38.7 percent indicate they will bring their own container and still go to the SUB, others remains unknown yet.

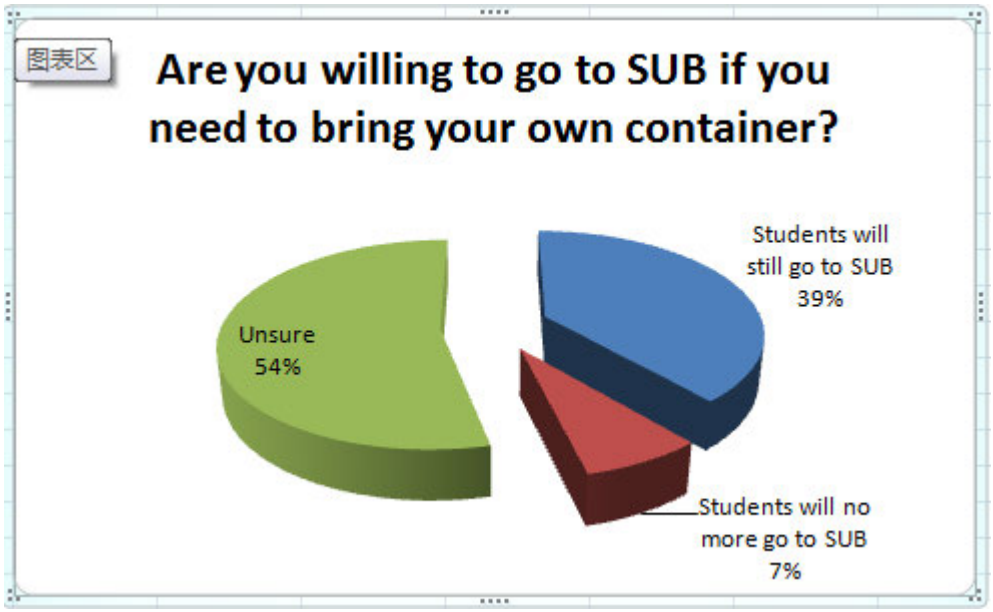

Figure 2: Survey Regarding Impact of BYOC Program on Students

It seems the BYOC program will cause a huge customer loss rate. According to Fredix's(2007) research, people now like disposable containers more, and consider less about the long run cost of containers. The same condition is among the students.

From my perspective, there are two ways to reduce the customer loss rate. One is a program like to-go program first used in Eckerd College. Students just need to pay 5 dollars for a durable and dishwasher-safe plastic container. When they place a to-go order in school cafeteria they get a plastic container and later they check it back in and

the container is washed and will be used again (“To-Go Containers Keep Going”, 2008). The disadvantage of the program is considering long run cost, 5 dollars may not be enough to the washing and maintenance fee. My suggestion is to change the charge to 5 dollars per semester. It will still be acceptable.

Another suggestion is giving a transition period. The SUB can offer food both with and without paper containers. For those students bring their own containers, the price will be a bit cheaper, such as, 25 cents (should be related to the cost on paper containers). For those people who do not want bring their container, they can still eat in the SUB but accept a little bit higher price; and for those students who bring their container, they can eat with a cheaper price.

3.0 ENVIRONMENTAL ASPECT

Environmental aspect of our research takes up a significant part. Our destination is to analyze the benefits and drawbacks of different disposable and reusable containers and find out the “green” ones. In the following paragraphs, we will compare various types of reusable containers with disposable ones and have recommendations between them. To begin with, it is very useful to take a look on the dark and bright side of disposable containers.

3.1.0 DISPOSABLE CONTAINERS

The need for disposable containers has hardly been reduced worldwide even though a number of countries have implemented laws or economic methods trying to protect our environment. Many restaurants or kiosks prefer using disposable containers mainly because they are very convenient for the customers. However, the harm accompanying significantly overweighs the benefits they bring to us.

3.1.1 Polystyrene Containers

Polystyrene is a widely used polymer material for manufacturing of disposable containers. Some factors of polystyrene, e.g. having high melting point and good plasticity, being easy for mass production, and containing little toxic below 60°C, led this material to become the top choice for the manufacturing of disposable containers over the past decades. In comparison, the material is a chronic killer to the environment. Polystyrene is resistant to acids and bases because it is very chemically resistant. The degradation period of polystyrene is extremely long – approximately 200 years in normal conditions. Shall we bury the discarded polystyrene containers? No. Burying of the containers needs many additives, which, together with polystyrene itself, can do much harm to the soil and water with time. Can we burn them then? No, either. Combustion of polystyrene will release more than 10 toxic gases, e.g.

polycyclic aromatic hydrocarbons, which are a threat to the atmosphere. With the fact that mounting number of people are becoming aware of the great damage polystyrene containers will bring to our earth (commonly known as “white pollution”), the use of this type of containers has been decreased drastically, leading to many new types of containers that are comparatively more eco-friendly.

3.1.2 Paper Containers

Paper appears in every little corner of our daily life. It is degradable, can be easily recycled, and contains no toxic. Since paper seems to considerably surpass polystyrene, will replacing plastic containers with paper containers be a favorable choice? No. Water pollution during production of paper containers can be as harmful as, if not outstripping, that of plastic containers. Moreover, substantially, it will result in a large consumption of wood resource.

3.1.3 Biodegradable Vegetal Containers

Biodegradable vegetal containers are mainly made from starch. With necessary non-toxic additives, the containers can be produced through some physical and chemical processes. They are comparatively very eco-friendly since starch is abundant in nature (can be obtained from rice, corns, potatoes etc.) and this type of containers can easily be degraded and are non-toxic. Nonetheless, biodegradable vegetal containers can be regarded as a waste of food and have the problem of mustiness over time. (Minor, 1972)

3.2.0 REUSABLE CONTAINERS

Reusable containers also play a significant role in our daily life. Among the many materials that are commonly used for reusable containers, glass and plastic are the most popular.

3.2.1 Glass Containers

Many physical and chemical properties of glass make glass containers advantageous in food packaging. First of all, because glass is very solid and behaves chemically inert in normal conditions, glass containers are resistive to acids or bases, and do not react with inside food, providing good insulation. Glass can stand high temperature, which contributes a lot to the considerable need of fast heating of food nowadays (e.g. heating food in microwave ovens at very high temperature). Also, since glass is transparent, users can look through the container and see the content conveniently without opening the container. (Marsh & Bugusu, 2007) Surely, glass containers are not perfect. Glass containers can be very costly for them to be very thin and light. In addition, as shown in Figure 3, production of glass containers is a huge process and high sequence dependent setup times are involved in product property changes such as color changeovers. For example, it takes up to 120 hours for the color changeover from cobalt blue to emerald green, which leads to very limited freedom for output changes and waste of energy. (Almada-Lobo, Oliveira & Carravilla, 2008)

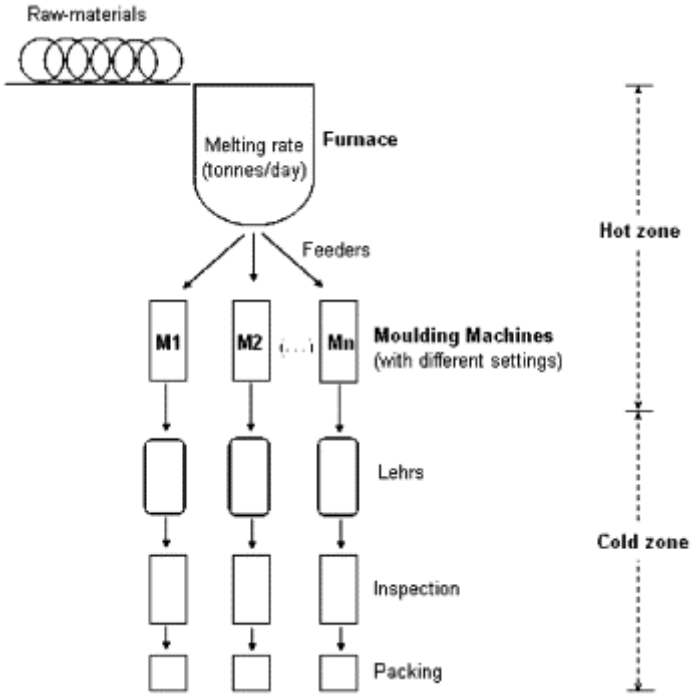

Figure 3: Glass container production process layout (Almada-Lobo, Oliveira & Carravilla, 2008)

3.2.2 Aluminum Containers

Cans and foil are commonly made of aluminum due to its light weight. In addition, aluminum containers are very resistive to numerous types of corrosion, e.g. air, water, smell, weak acids and based. Owing to aluminum's excellent ductility, aluminum containers are very easy to recycle. However, welding aluminum can be very hard, resulting in a drawback that broken piece of aluminum cannot easily be reproduced without first melting it thoroughly. (Marsh & Bugusu, 2007)

3.2.3 Plastic Containers

Thanks to flexibility and light weight of plastics, plastic containers can be of many different shapes with good portability. Since plastics are cheap and chemically inert, plastic containers provide good resistance to various forms of contamination or corrosion without costing much. The major drawbacks of this type of containers are their variable permeability to gases, light, vapors, and the long period of degradation. Figure 4 shows the recycling of plastic in the US in 2006. (Marsh & Bugusu, 2007)

Resin	Code	Amount generated (thousand tons)	Amount recycled (thousand tons)
Polyethylene terephthalate	1	2860	540
High-density polyethylene	2	5890	520
Polyvinyl chloride	3	1640	
Low-density polyethylene	4	6450	190[a]
Polypropylene	5	4000	10
Polystyrene	6	2590	
Other resins	7	5480	390

Source: American Plastics Council (2006b) and EPA (2006a).
[a]Includes linear low-density polyethylene.

Figure 4: Recycling of plastic containers in the US in 2006 (Marsh & Bugusu, 2007)

3.3.0 RECOMMENDATION BETWEEN DISPOSABLE AND REUSABLE CONTAINERS

Based on investigations above, reusable containers are highly recommended for environmental sustainability. Among various materials for reusable containers, aluminum cans of drinks, meat, etc. are recommended since their great resistivity to various corrosions, excellent portability and recyclability. Meanwhile, glass containers such as glass lunch boxes are highly recommended because they are highly resistant, transparent, recyclable, and very convenient for heating inside food. In cases that reusable containers are not feasible, we recommend using disposable biodegradable vegetal containers since they are outstanding in being eco-friendly among various types of disposable containers.

4.0 SOCIAL ASPECT

After the evaluations of environmental aspects and economical costs, social aspects should be considered, too. As an important aspect in triple-bottom-line assessment, the social assessment is more complex and more difficult to evaluate because usually a survey is necessary and the information on social issues of Bring Your Own Containers is lacking. In this report, the social assessment is more focused on students: How does BYOC effects students' health? What is the educational purpose of BYOC for students? Also, after each analysis, some pieces of advice will be provided for the new SUB.

4.1.0 HEALTH ISSUES

According to the survey, 57 out of 93 students will not or might not go to the new SUB if BYOC will be proceeded there. And about 60% of these 57 students believe that one of the most important worries of BYOC for them is that whether or not BYOC would bring negative outcome for their health. Some say that they used to bring their own containers but after eating, without cleanser essence they cannot wash their containers clean. Then when they are back home, they possibly forget to wash their containers with cleanser essence. According to a research, "bacterial removal during cleaning or their transfer via liquids flowing over colonized surfaces, is likely to vary with the surface composition and the bacterial species colonizing the surfaces"(Fletchere,1988,p. 229). It suggests that rinsing food container will leave bacteria in the surface of food containers. Therefore, students' concern is reasonable. A solution suggests that the new SUB should provide more washing sinks with cleanser essence.

In addition, there are some researches which show that Bring Your Own Container might lead to some health problems, so the material of the food containers should be considered. Most food containers are made of plastics. And "..... polycarbonate(PC) are used as major ingredients for the manufacture of plastic bottles, food containers, food packaging, ..."(Bang et al., 2012,p. 453). The use of plastic

additives has been suggested to have some risk to environment and human health(Bang et al., 2012). “Some phthalates(for example, DEHP, DBP), styrene, or bisphenol have been suspected to have endocrine disrupting effects,.....(Bang et al., 2012,p. 453). However, the migration of endocrine disrupting chemicals in plastic food containers is low enough to be ignored. As “a main component of manufacture of PC plastic”, BPA[bisphenol A] has been examined extensively(Bang et al., 2012, p.456). Based on a recent study on BPA migration, migration levels of BPA into food is extremely low. Also, based on hazard index(HI) calculation, “plastic ingredients such as BBP, DEHA, DEP, DEHP, DBP, and BPA are far less than 1”(Bang et al., 2012,p. 464)(see Table 1 below). It concludes that these chemicals from plastic food containers are consumed at a safe amount.

Table 1. –Estimated daily intake (EDI) and hazard index (HI) for bisphenol A in different age groups.(Bang et al., 2012)

Compound (TDI μg/kg/day)	Medium	Population	HI
BPA (50)	Packaged pork (PC)	Adults (60 kg)	ND−0.007
	Food contact materials	Infant	0.048
		Adult	0.004
	Breast milk only	Infant (3 mo)	0.004
	Infant formula fed with glass or nonpolycarbonate (PC) bottle	Infant (3 mo)	0.046
	Infant formula (PC bottle)	Infant (3 mo)	0.220
	Infant formula (PC) and commercial foods/beverages	Infant (6 mo)	0.260

	2 kg commercial foods/beverages	1.5 year-old child	0.106
	3 kg commercial foods/beverages	Adult	0.030
	Urinary excretion of bisphenol A	General population	0.003
	metabolites	General population	0.008–0.016
	4 food groups/ Korea	20–29 y	0.007
	(canned foods (n = 14); carbonated	30–49 y	0.004
	drink, coffee, beer, corn)	50–64 y	0.002
		> 65 y	0.0004
	6 food groups/ Korea	1–2 y	0.0002
	(canned foods (n = 50); cola, cider,	3–6 y	0.0006
	coffee, tuna, spam corn)	7–12 y	0.001
		13–19 y	0.002
		20–29 y	0.002
		30–49 y	0.001
		50–64 y	0.0002
		> 65 y	0.0002

4.2.0 EDUCATIONAL PURPOSE

BYOC will also allow students to form some good habits. According to the other survey on 20 students who already bring their own food containers to the SUB every day, fourteen of them mentioned that after bring their own food containers, they are less likely to waste leftovers. They prefer to eat the leftovers later or bring them back home. It shows that BYOC can somehow educate students not to waste food. Moreover, all of them have been bring their own food containers for more than one semester. Thirteen of them showed that they are accustomed to washing their containers after eating. Among these 13 students, eight of them say they were suffer from washing food containers in the first month when they brought their own containers. Some of them also developed a habit of cleaning dishes for their families when at home or bring their bags to super markets. It points out that BYOC could be a good chance for students to start the sustainability.

5.0 CONCLUSION AND RECOMMENDATION

This report evaluates the possibility of BYOC in the new SUB using a triple-bottom-line analysis which included environmental, economical, and social assessments.

In the aspect of economy, the new SUB should implement BYOC program. From customer's side, bring their own container can save more for them; from vendor's side, BYOC may cause customer loss, but the SUB can provide some plan to reduce the customer loss. For example, they can adopt to-go program or set a transition period to offer food both with and without containers and give a discount for those students who bring their own container.

In the aspect of environmental sustainability, the new SUB should implement BYOC program. Generally, in comparison to disposable containers, reusable containers are much more recyclable, reusable, less toxic, and eco-friendly by having less pollution. In cases that reusable containers are not feasible, e.g. failure of dish-washing machines in the new SUB, we recommend disposable biodegradable vegetal containers be used since they are pollution-free.

In social assessment, some researches show the worry of harmful chemicals from food containers; however, recent studies pointed out that those chemicals cannot be migrated into food in dangerous amount. The other problem is that rinsing might not clean food containers enough, but if the new SUB can provide more sinks and cleanser essence, this problem can be solved easily. Also, based on the survey, BYOC helps students to develop good habits.

In general, BYOC program is recommended with consideration in all economic, environmental and social aspects. In addition, the new SUB may consider implementing some program, e.g. to-go program, to help operating BYOC program.

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