REASON-TO-REUSE: A SUSTAINABLE TO-GO FOOD STORAGE CONTAINER SYSTEM FOR RESTAURANTS

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Ryan Christopher LaBuda

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Abstract

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Ryan Christopher LaBuda

A food storage container (FSC), also known as a to-go box, is a very popular way for Americans to pick up food when in a rush and take it with them or store leftovers after dining. Some of the more popular materials that make up FSCs include Styrofoam, paper and plastic. These FSCs are meant for one time use and subsequently the majority end up as waste in their local regions. Reason-To-Reuse is a sustainable business that provides an alternative to the current model of disposable FSCs at restaurants by cutting down on waste. The objective of the Reason-To-Reuse project was to design a system that reduces the need for disposable FSCs at restaurants by implementing reusable and/or compostable materials that are supplied to restaurants and maintained on behalf of the Reason-To-Reuse system. The design was created from knowledge of Industrial Engineering disciplines, specifically supply chain, logistics, quality assurance, resource planning, database management, and operations research.

The design is based on an out of the box solution for towns and cities and is customizable depending on the specific needs of a certain location, similar to that of an out of the box software package with customizable features. San Luis Obispo was looked at as in a case study that was performed analyzing data for an economic justification of implementing Reason-To-Reuse in the region. If implemented in San Luis Obispo, based upon a 3% subscription rate among consumers of the Reason-To-Reuse program it would take two years and 100% participation among local restaurants to break even. Given 100% restaurant participation it is estimated that over 100,000 disposable FSCs would be eliminated from entering into the environment annually.

The business model for Reason-To-Reuse is justifiable given high participation rates among restaurants and individual subscribers. The model would be hard to justify starting out in San Luis Obispo given only a 3% individual subscriber rate to the reusable program. To further the design of this model in San Luis Obispo, a location allocation model could be developed to predict demand for reusable FSCs while incorporating an optimization of scheduling for delivery and pickup of the reusable FSCs. Also, experimenting with cities that have more restaurants and residents than San Luis Obispo will help to determine the optimal amount of people and restaurants for Reason-To-Reuse to achieve financial success.

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Introduction

A new buzzword in business these days is “sustainability”, and for good reason. Sustainability is about more than just preserving the environment and is often represented in terms of the triple bottom line: people, planet, and profits. The definition of sustainability offered by the World Commission on Environment and Development is as follows: “meeting the needs of the present without compromising the ability of future generations to meet their own needs” (Mcdonough & Partners, 1992). In 2011 the Massachusetts Institute of Technology (MIT) Sloan School of Management, in their Sustainability Initiative, measured sustainability innovation by interviewing global executives: 67 percent said that sustainability strategies are necessary to be competitive in today’s marketplace, which was a 12 percent increase over 2010 reports (Brokaw, 2011). Through adopting new paradigms as individuals and businesses and understanding that everyone is responsible for taking action in terms of becoming more sustainable as a whole will allow for sustainable solutions to come to fruition and help alleviate both real and potential problems the planet faces.

People can be designated in many cases as the root cause of these environmental problems due to massive amounts of consumption that takes place everyday on our behalf. Americans are consumers by nature and interact with businesses on a regular basis. In terms of food consumption, the average American eats out around five times per week. A survey conducted by Living Social back in 2011 measuring consumer behavior found that the most popular restaurant meal is lunch, with 2.6 meals eaten on average each week (both carryout and dining in), followed by 1.4 sit-down dinners per week, and

.8 brunch or breakfast meals per week ("Americans eat out," 2011). This is relevant to this project and sustainability because meal's that are carried out and food leftover from dining in requires some sort of takeout container also known as a food storage container (FSC) to be provided to the customer by the restaurant in order for the customer to take the food with them. One of the most common materials that make up FSCs is expanded polystyrene, commonly referred to as Styrofoam, a material that is problematic from inception to disposal. The food service industry remains a root cause of pollution in the environment due to disposable FSCs. A few cities have banned polystyrene packaging altogether from being used in products due to the harmful pollutants that are released into local ecosystems. A few cities that have implemented Styrofoam bans include Seattle WA, Portland OR, Westchester NY, Berkeley CA, and Malibu CA. In addition Laguna Beach, CA and Santa Monica, CA have banned all polystyrene (#6) FSCs ("Global Alliance," 2009). This has raised issues with restaurants over higher costs being incurred due to more expensive materials, which goes to show there is a definite tradeoff over planet and profit. These issues will be discussed in greater detail in the *Background* section of the report.

The work of this project falls within the category of sustainability. Reason-To-Reuse is the all-encompassing business name for the business and system that is being designed for this project. A system is defined as a set of interacting entities that have a purpose or goal and Reason-To-Reuse's purpose and goal came from a desire to eliminate harmful materials and reduce waste through a reusable program, in essence one reason to reuse.

This project's objectives are to:

(1) Create a sustainable FSC system that reduces waste created through disposable FSCs by instituting a reusable program for individuals and businesses

(2) Determine applicability of the system in San Luis Obispo and other cities based on different restaurant styles, excluding fast food chains

(3) Produce a cost-benefit analysis for restaurants, including sustainable benefits

(4) Provide an economic analysis and discuss the feasibility of implementing Reason-To-Reuse

The design of the system is focused on creating an out of the box model that is loosely based on San Luis Obispo and maintains relevancy for implementation elsewhere. It is necessary to focus on one city at a time for the application of this system because each city is unique and requires further customization upon the out of the box model; for this project San Luis Obispo is the subject of a case study to provide further insight into system implementation due to the fact this project is being performed at Cal Poly San Luis Obispo.

The paper is organized as follows. The *Background* and section provides in depth analysis of the literature of the existing FSC materials including current businesses and existing solutions in place. In the *Design* section, the model for implementing an out of the box solution to replace disposable FSC usage at restaurants is proposed and applicable Industrial Engineering concepts are discussed in relation to this newly designed system. In the *Methodology* section, the methods used to determine feedback on

the system and to gain a deeper understanding into the applicability of the system in San Luis Obispo are discussed. The *Results* section provides analysis for both restaurants and Reason-To-Reuse in relation to implementation in San Luis Obispo, along with sustainable benefits that could be realized. In the *Conclusions* section, the feasibility of the Reason-To-Reuse system is discussed. Lastly, the *Appendix* contains an in depth economic analysis that was performed based on the data gathered, as well as miscellaneous materials.

Background and Literature Review

An example of a material that is in use today across many industries is polystyrene. A short list of material uses include packaging "peanuts", cafeteria trays, egg cartons, model cars, hair combs, and the list goes on. According to the Centre for Synthesis and Chemical Biology, 99% of polystyrene ends up in landfills or dumps. While there are many uses for the material, there is currently little infrastructure in place to recycle all of the waste it creates. To recycle polystyrene costs $3,320 per ton, which is twenty times greater than other materials and is a major reason why there is so little infrastructure in place to handle the process ("Polystyrene guide", 2012). It is no surprise that polystyrene is used in FSCs as well and the following sections provide background on different FSC materials used in restaurants.

Current State of Disposable Food Storage Containers

Almost all restaurants in existence today utilize some form of disposable FSCs to provide for their customers. Whether in the form of Styrofoam or as a biodegradable alternative, business owners in the restaurant space are expected to purchase and carry these items. From a financial standpoint, most business owners would prefer to spend the least amount on these items because

Food Storage Container (fsc) Material	Fsc Unit Cost ($)
Styrofoam	$ 0.07
Plastic (non- reusable)	$ 0.10
Plastic (reusable)	$ 3.50
Paper	$ 0.15
Biodegradable (paper)	$ 0.18
Biodegradable (plastic)	$ 0.22

Table 1 – Food Storage Container Unit Costs

they are handed out for free. The main reason why Styrofoam has gained widespread popularity in the market today can be attributed to it being the least costly material available with beneficial storage properties for food and beverages. Table 1 provides a breakdown of costs of the most popular forms of FSC materials used by restaurants; these figures are approximate references that were provided by the online wholesaler "The WEBstaurant Store" based on ordering with quantity discounts and may differ to actual prices paid by restaurants. It is most useful for understanding the relative prices of each FSC material, for example Styrofoam is the least expensive of the materials.

Styrofoam Containers

Styrofoam is the Dow Chemical Company's patented name for expanded polystyrene. Styrofoam products are lightweight, water-resistant, and act as good insulators. These containers are characterized by their ability to retain shape and heat, as well as their short service life that is typically a single use. An issue with Styrofoam waste is that it can take centuries to decompose and as a result of this its waste occupies close to 30% of the area in the landfills. Even worse, it has accumulated along coasts and waterways globally, threatening wildlife that mistake the crumbled pieces for food and ingest the material. A 2006 report by Heal the Bay, a Santa Monica nonprofit, said Styrofoam and other plastics kill 2 million seabirds yearly worldwide (Overley, 2007).

As a nation, Americans throw away enough paper and plastic cups, forks, and spoons to circle the equator 300 times every year (Wills, 2010). It is obvious why many concerns have been tied to Styrofoam due to the contribution it has on the growing waste problem. Styrofoam is made from petroleum, a non-renewable resource containing chemicals that

pose a threat to human health (Hung, 2010). Though it is rarely discussed, Styrofoam contains potential cancer causing chemicals in the forms of benzene and styrene, which can contaminate the contents of the FSC if they are hot, fatty, or acidic (Macaluso, 1996). The U.S. Environmental Protection Agency (EPA) claims that acute exposures to styrene can cause eye irritation and have adverse effects on the gastrointestinal system. Long-term exposures can be harmful to the central nervous system, which may increase the risk of developing leukemia and lymphoma, and both benzene and styrene are listed as human carcinogens ("U.S. Environmental Protection Agency," 2009). David Shissler, the water quality director for the city of Laguna, California said in relation to the polystyrene ban mentioned in the *Introduction,* "It's kind of like banning asbestos, it was such an effective product, but it was found to be a problem" (Ehrenberg, 2009).

Biodegradable Containers

Sustainable substitutes are widely available in the forms of non-toxic, biodegradable and affordable materials made from renewable resources such as corn, potato and sugar cane byproducts (Khan 2007). These green alternatives can biodegrade in just a few months when composted. Composting is the process of turning organic material into a rich and fertile substance that conditions soil, and can be done in ones backyard or in an industrial facility (Epstein, 1997). In the areas where polystyrene and Styrofoam products are banned, restaurants and local businesses are being forced to turn to either paper, plastic, or biodegradable / compostable materials for FSCs.

Although these bans are helping to protect local ecosystems from harmful pollutants, some businesses in the industry are questioning the new restrictions validity. Kearsten

Shepherd, a spokeswoman for the California Restaurant Association, said such restrictions ignore the root cause of pollution. "Banning a product does not address the true issue of littering. You're just going to create a new product that's littered," she said (Overley, 2007). If biodegradable FSCs are not composted and are thrown into the trash, they will too end up in landfills. Modern landfills are designed by law to keep out sunlight, air and moisture in order to prevent pollutants from the garbage from getting into the air and drinking water, meaning they are essentially setup so that nothing can compost (Belevi & Baccini, 1989). This makes it fairly clear that even organic materials like biodegradable FSCs take a very long time to break down in landfills and begs the question that if these FSCs are not being composted then how can a business justify the higher costs they require in comparison to Styrofoam and paper products.

The debate over environmental issues is one place where this principle commonly arises. One side is fighting for sustainable solutions to issues caused by human development, and the other side fighting against restrictions that inhibit businesses from maximizing their potential profits. Some restaurant owners in the areas that have implemented bans have voiced concerns over the fact that the price for FSCs is costing double or triple of their current costs. Many restaurants see no other way to deal with the price increase except to pass the burden along to their customers by raising their menu prices (Rodriguez, 2011). While biodegradable materials are clearly better than Styrofoam in terms of their environmental impact, the issue of the products ending up in landfills and generating more waste is still prevalent.

Current State of Waste Disposal

In 2008, the average amount of waste generated by each person in America per day was 4.5 pounds. Of that waste only 24.3% was recycled, 8.9% was composted, and 66.8% was sent to a landfill or incinerated ("U.S. Environmental Protection Agency," 2009). Waste that ends up in landfills or incinerators can be very problematic. In 2009, the EPA concluded that as much as 42 percent of U.S. greenhouse gas emissions could be avoided through strategies like recycling and composting ("Global Alliance," 2009). This is an opportunity to address the issues and bring awareness to Americans who have demonstrated poor recycling habits so that the amount of waste being sent to landfills and incinerators can be reduced.

Much of the waste generated by Americans is disposed of at their place of residences, and is disposed of by waste management companies through curbside pickup. As mentioned above there are three common forms of waste, compostable waste, recycling, and waste intended for landfills and incinerators. A recent study showing the breakdown of curbside recycling programs by regions reported that only 30% of people in the Southern region of the U.S. had collection programs compared to 84% of people in the Northeast ("U.S. Environmental Protection Agency," 2009). While recycling is important, if people do not have access to programs that allow them to properly dispose of their waste than it is the issue cannot be expected to go away. Instead of relying on programs such as curbside recycling, creating sustainable alternatives that produce less waste by utilizing reusable resources will help eliminate the dilemma of disposing of waste properly. In San Luis Obispo, residents have traditional waste and recycling bins and can choose if they would like to compost. The San Luis Obispo County Integrated

Waste Management Authority encourages home composting and their site provides composting information and links to how a resident can get started. There is not a citywide composting program but what they do offer are ways to purchase bins for home composting where things such as food waste can be composted at the resident's convenience (IWMA).

Current State of Reusable Packaging Applications

Like recent restrictions being set on polystyrene and Styrofoam, many towns across the United States have implemented bans on plastic bags. These measures are for good reason as well. Nationwide, Americans use approximately 1 billion of these in the form of shopping bags, creating over 300,000 tons of landfill waste. To go along with this the state of California spends about 25 million dollars sending plastic bags to landfill each year, and another 8.5 million dollars to remove littered bags from streets. As a whole, less than 1 percent of plastic bags get recycled each year and like polystyrene, plastic bags do not biodegrade either. Light breaks them down into smaller and smaller particles that contaminate the soil and water and make it expensive and difficult to remove ("Clean Air," 2009).

The city of San Luis Obispo recently implemented a ban on plastic bags. The ban is in effect at all grocery stores and the only way to buy and store groceries for transport is through bringing in reusable bags, or to pay $0.10 for single recycled paper bags. This drastically reduces waste created from plastic bags and has led a lot of people to switch to reusable bags. In lieu of the staggering mishaps among the general population when it comes to recycling as mentioned above, these bans not only have the power to alleviate

environmental problems but can also help spread awareness among consumers to these sorts of problems that are present but often fly under the radar.

Existing Companies Focused on Reusability and Sustainability

Private Businesses

Communities with a commitment to keeping the environment clean often have a higher quality of living and because of this attract creative and sustainable companies to arise. GO Box is a new service launched by Laura Weiss in July of 2012 at five food carts in downtown Portland, Oregon and has since spread to over fifty food carts. The objective of GO Box is to replace existing disposable containers with reusable containers in order to cut down on waste. The area boasts a booming dining scene with over 500 food carts available on the streets, but with that the waste generated each month is upwards of 60,000 disposable containers. Currently, most of the food ware containers in use are made of compostable materials since Styrofoam is banned in the area, but even with that being so the majority of the containers are not composted and wind up in landfills. Although on a positive note, in a mere six months of being in business Weiss estimates that around 15,000 disposable containers have been saved from ending up in landfills (Sigler, 2013).

The business model is quite simple and allows members to subscribe for $20 per year ("Go box"). Since inception, GO Box has grown to more than 1,200 individual subscribers along with 13 corporations that pay monthly fees to have GO Box in their offices. When an individual is done eating, the container can be dropped off for cleaning at one of five downtown drop sites in exchange for a token that allows them to retrieve a new container the next time out. GO Box's model for describing the business to

individual subscribers can be seen in Figure 1 of Appendix B. There are no exclusive GO Box washing centers, instead multiple restaurants and commercial kitchens wash the boxes for a fee. Once the food ware containers are cleaned, Weiss picks them returns on her bike and returns them in person to the participating food carts (Sigler, 2013).

A very similar business, No Thro: Reusable Containers To-Go was recently launched in Minnesota and was founded and being run by John Bailey. Restaurants also pay a monthly service fee (still to be determined) to be a part of the program, which gives them an endless supply of clean to-go containers according to the company's website. The model based on a yearlong subscription service that costs $20 annually. Instead of using exchangeable tokens like the GO Box service, No Thro has developed a simple mobile application to tracks the containers whereabouts and alert customers and restaurants to the customer's current status. By scanning the QR code provided at participating restaurants customers can take home a reusable No Thro container, given that their screen is green. If the screen happens to be red, it means that the customer needs to return a container to one of the No Thro drop box locations located around the city before checking out another container. When a container is returned to a drop off location the customer scans a QR code to alert the system a container has been returned and ultimately providing analytics for John so that he can determine when to make a pickup on his bicycle (Bailey, 2012).

This model isn't very secure because the business has been built up around QR codes, which by nature are not very secure. Customers can cheat the system by scanning the QR codes at any of the drop off locations without actually returning any containers, fooling

the system into believing they in fact did and making them eligible for checking out more reusable No Thro containers. No price could be found for the cost of No Thro's reusable containers, but if customers are in fact able to game the system this could result in potentially large losses in inventory costing the business money (Pagani, 2012).

Public Institutions

Local places of business aren't the only ones who are making strides to become more sustainable through the elimination of waste. College campuses are joining the cause and rightfully so seeing as a lot of the food consumed on campuses is done on the go. An issue with this is that students often take food to go and then dispose of the containers in the trash, so even if a campus has biodegradable containers they do not serve much purpose if they are not being disposed of properly. A handful of universities have taken it upon themselves to implement services on campus that replace disposable to-go food containers with reusable ones. Examples of schools doing so include University of Florida, University of Southern Florida, and University of Minnesota.

The University of Southern Florida (USF) reported that over 200,000 Styrofoam to-go containers were used and thrown away in 2012, making it a priority to reduce this number through their sustainable initiative on campus. They purchased 7,500 reusable FSCs costing $17,000, or about $2.27 per unit. In order for students to receive a FSC from on campus dining halls they must enroll in this program; all disposable forms of FSCs have been eliminated from the campus. To enroll students must place a $4 deposit on a container, which allows them to take it home with them and receive a new one the next time around as long as they bring the container with them to one of the dining halls. To

make things simple the dining halls on campus double as both the washing and drop off locations. Figure 2 in Appendix B describes the USF model for students to understand. The idea behind this model is powerful because it is forcing young people to be a part of a sustainable solution and raise awareness to the fact that such simple tasks that often go unnoticed can have a large impact on the environmental health of this planet ("Reusable to-go boxes," 2012).

Quality Assurance in the Food Service Industry

Preventing food borne illnesses is a major priority of restaurants as they are in charge of cleaning and sanitizing their equipment and food ware for their customers. The FDA Food Code is an important document that provides enforceable provisions to small businesses and institutions on how to prevent foodborne illness. The Food Code is outlined in the 44 provisions, which are designed to be consistent with federal food laws and regulations (Food Code, 2009). One of the provisions contained in the FDA Food Code is the cleaning and sanitization of equipment. Contaminated equipment in restaurant establishments has been identified as a source of cross- contamination for food during preparation, where diseases from food borne pathogens can stem and be transmitted through improper sanitization procedures. In order to achieve the standards set by the FDA Food Code, restaurants and other food service establishments must clean and sanitize tableware items (e.g. dishes, glassware, and eating utensils) either manually or mechanically (McSwane et al., 2005). The FDA Food Code states that a minimum microbial reduction of 5 logs must be obtained before surface sanitization of such items can be considered effective.

The FDA Food Code of 2009 provides details of acceptable standard for the manual ware-washing operation, but in general a three-compartment sink is required for washing, rinsing and sanitizing. The American National Standard Institute (ANSI) and the National Sanitation Foundation (NSF) International provide the acceptable standards for mechanical ware washing in which automation is employed (ANSI/NSF 3, 2009). In addition it is important to note the sanitation methods should meet the standards and bear the stamp of approval from the (NSF) International to assure that quality materials are used and built according to acceptable standards (McSwane et al., 2005).

Manual versus Machine Food Ware Sanitation

As previously mentioned, there are two main sanitation methods and both have similarities as well as differences. They both have the same objective, to render tableware free of soil and to achieve a minimum microbial reduction of 5 logs and specifically address the reduction of bacterial numbers from food contact surfaces, excluding viruses. Some of the differences found within these two methods are the temperatures employed during the washing procedure and the way soils are removed from surfaces. For instance, the temperature of the washing solution during manual procedure should be at least 43ºC whereas for mechanical dishwashers it should be at least 49ºC. Other contributing factors of the manual washing method include the physical skill of the employee in the removal of soils. Generally employees use a brush or other approved device to assist in this task. In mechanical washing the mechanical action to remove soils is restricted by jets of water emitted from rotating spray arms where the forces on the food ware are much less than what results from the mechanical action of an individual during manual washing.

Therefore, in order to obtain good cleaning result in mechanical washing, the water spray is compensated by the extra chemical action of the detergent, the temperature, and wash time (Tomlinson and Carnali, 2007). Figure 3 summarizes the relative contributions of all factors during the ware washing procedures.

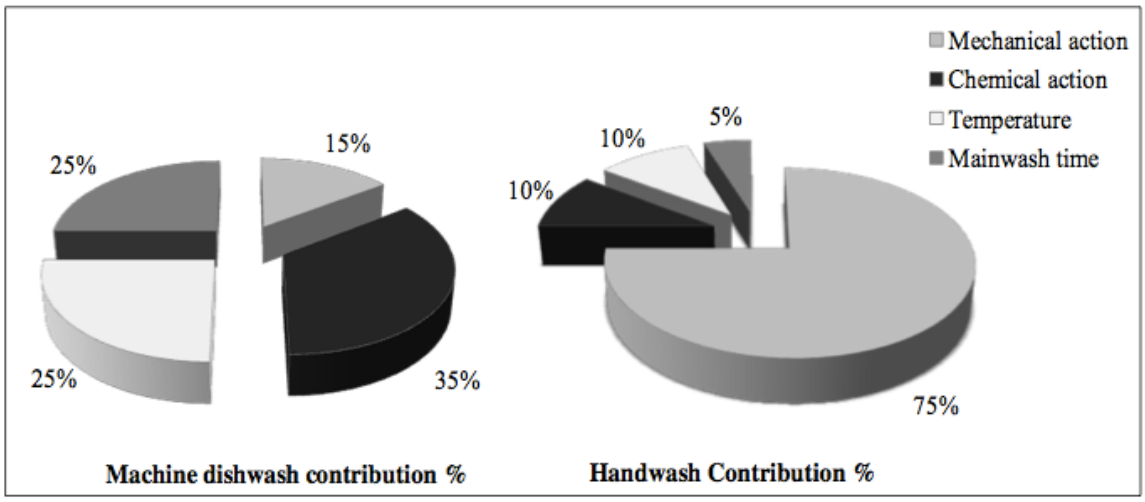

Figure 3 – Contribution Percentages for Machine dishwashing and Hand washing (Tomlinson and Carnali, 2007)

Supply Chain Management for Delivery Service Businesses

Many definitions for supply chain exist today. An applicable definition is "an integrative philosophy to manage the total flow of a distribution channel from the supplier to the ultimate user" (Cooper, 1993). Supply chain management (SCM) involves the development of cross-functional structures and integrated process management to sourcing, production, and logistics operations (Agan, 2005). An example of a small to medium sized business that relies heavily on SCM is a local San Diego water company, Pure Flo. Pure Flo is a pickup and delivery business of fresh water supplies in reusable storage containers that vary in size. They are responsible for managing producing and

maintaining inventories to meet customer demand, and then schedule pickup and deliveries for each individual customer.

Pure Flo offers business-to-business (B2B) and business-to-customer (B2C) solutions. An example of their B2C solutions is shown in Figure 4 of Appendix B. Their plan requires that individual customers do the following: sign a one-year agreement, have delivery/ pickup every 3 weeks, signup for auto pay, and a deposit for reusable containers that can be refunded upon return costing $25 to $50. Reason-To-Reuse shares many similarities with Pure Flo in terms of SCM and the overall business approach. Both are reusable container systems that provide both a B2B and B2C services including pickup and delivery. This model will be elaborated on in the upcoming *Design* section with respect to the implementation of the Reason-To-Reuse project being discussed.

Design

The design of Reason-To-Reuse, herein also referred to as "the system", is focused on towns and cities that encourage sustainable business practices such as San Luis Obispo, CA. It is not specific to San Luis Obispo and instead applies to a multitude of places across the United States. The design is in essence an out of the box solution to be customized for each place. The Reason-To-Reuse system aims to reduce the need for disposable FSCs used at restaurants by providing a system that provides restaurants and consumers a means for reusing FSCs. Biodegradable / compostable FSCs could be implemented as either a supplement or as an alternative to the reusable FSC system and is included in this design but it is not a requirement of the reusable Reason-To-Reuse system; biodegrading / composting FSCs may require a different system entirely then the one being designed for reusable FSCs. This section discusses the out of the box solution of Reason-To-Reuse, with room for customization so that it can be applied to any city in the United States.

Target Audience

The target audience for this system is any city that has placed bans on materials that can be found in FSCs such as polystyrene. Some of the cities that have such bans and are a target for Reason-To-Reuse are provided in Table 2 of Appendix B. While this system is useful in any community, the ones who have begun to address concerns about environmental issues will make for a smaller learning curve in terms of restaurants and customers adopting these ideals for more sustainable living practices. Although San Luis Obispo has not banned polystyrene or Styrofoam FSCs, the city has recently adopted a

ban on plastic bags and forced residents to either bring reusable bags grocery shopping or purchase paper bags at the store. It can be inferred that these cities and communities with bans on harmful materials are aware of the environmental pollutants and harm that they are causing, shown by bans enforcing businesses to be more responsible and comply by ridding banned materials from being used.

When looking into developing this system in new places, there are a few assumptions that can be made in regards to the feasibility of implementing this system. First, the people that make up the town or city are "average" Americans that eat out roughly five times per week, as mentioned in the Living Social study. The survey also found that about two of the five meals are carried out, meaning that some form of FSC is required. A very conservative estimate will assume that at least four of these twenty meals eaten out each month require some form of disposable FSC for the customer to take with them. Currently, most if not all restaurants provide disposable FSCs to customers at no extra charge. This factor plays a key role in developing a fair business model plan for restaurants so that switching to this new system can be justified financially. This is presented in detail in the upcoming section, *Subscription Model* and is reported on in the *Results*.

While it is important to understand the local San Luis Obispo market, considerations for implementation in other cities is equally as important. For instance, the GO Box service based in Portland, Oregon reached 1,200 individual subscribers and more than fifty local businesses in six months of existence after originally launching at just five food carts, as referenced in the *Background*. This provides insight into acceptance rates

that may be realized if implemented in San Luis Obispo. For a more detailed look into how this system being presented succeeds in San Luis Obispo, the economic analysis in the *Results* section presents scenarios for varying levels of participation among local restaurants and consumers.

Limitations

A major part in the process of developing this system is making sure that restaurants and consumers are interested. In order to gain useful feedback, there needs to be compliance among both restaurants and the consumers in the targeted city. To test this, surveys may be administered to obtain feedback and gauge interest and insight into the customers mind. In order for an implementation to begin in a given city there would need to be a lot of market research done before proving feasibility. In terms of this project, gaining market insight into multiple towns cannot be achieved with the given resources and timeframe. Instead, by surveying local business and residents of San Luis Obispo a certain level of market insight is gained. The process of obtaining this insight and interpreting the results are discussed in the *Methodology* and *Results* sections, respectively. Although only sampling from and modeling San Luis Obispo limits knowing if this system will be useful elsewhere, it still is instrumental in developing the system out further in order to create a viable business that can used in an array of cities across the United States.

Out of the Box Solution

The design of the model involves an interconnected network of customers, restaurants, and the proposed business entity working in unison. The current process of disposable FSCs at restaurants remains intact while the system surrounding Reason-To-Reuse is an

innovative alternative to the existing model. Regardless, the choice is left up to the business to decide how they will provide FSCs for their customers and it is their choice if they would like to become a part of this system. For that reason they can be looked at as the direct customer to this system's business model and the more restaurants that join the more chance that consumers will in turn become customers of Reason-To-Reuse as well.

This system is setup for reusable FSCs and is similar to the GO Box and No Thro models, except Industrial Engineering concepts are applied to make it more efficient and scalable. A compostable FSC component was added as an experiment as it has not been done by an existing business and provides an alternative to reusable FSCs. The reason for choosing to allow for compostable containers to be distributed is for the similar reasons grocery stores in San Luis Obispo still carry paper bags, to provide a simple alternative for customers not looking to take on extra responsibility of having a reusable container to return.

System Overview

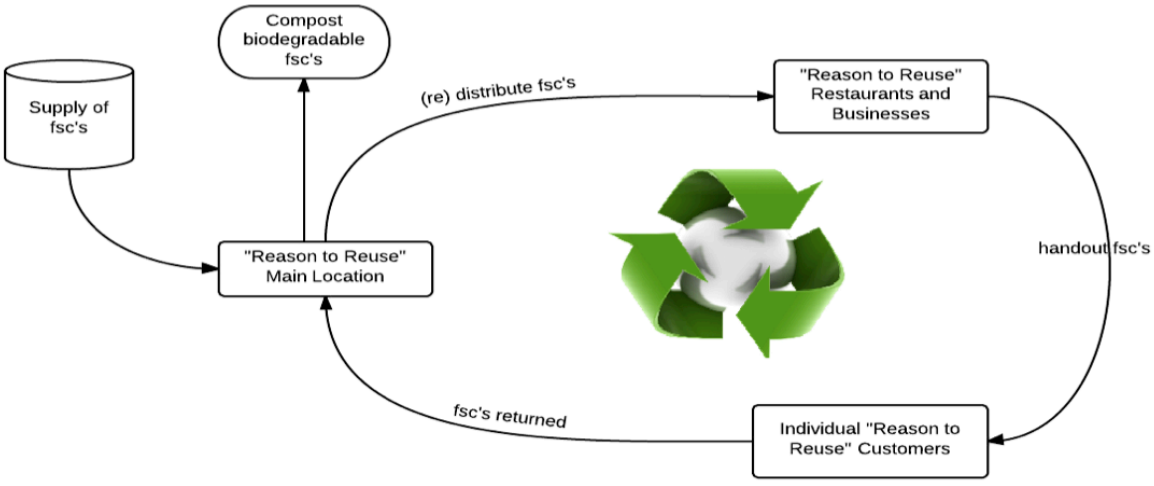

Figure 5 – Reason-To-Reuse Supply Chain

Figure 5 demonstrates the supply chain model of how the system works from a top-level perspective. The figure shows composting on the supply chain because it is option being experimented with too. The focus in this design is giving restaurants the option to supply reusable FSCs to customers in addition to their current model, and not taking into account biodegradable / compostable FSCs because it can be assumed that this process is the same process that currently takes place in giving out FSCs. For this reason the model specifically targets a reusable FSC solution, and the design of composting FSCs is considered as an alternative to the reusable design and is discussed in the *Conclusion*. Overall Reason-To-Reuse is a business entity that interacts with both the restaurants and individuals, the next section discusses the resources necessary for these interactions to take place.

Resources

(1) Reusable FSCs

(2) Biodegradable/ compostable FSCs

(3) Reusable Reason-To-Reuse bags

(4) Reason-To-Reuse Website

(5) Database Management Software

(6) Sanitation Equipment

(7) Compostable Bins

(8) Reason-To-Reuse facility

(9) Company Van(s)

Business Model

For the Reason-To-Reuse system to come to fruition, it needs to be incorporated as a business so that it can act on behalf of itself while interacting with the restaurants and individuals in the communities. This company is focused on sustainability and could be setup in a few ways. Non-Profit businesses usually are charitable organizations that raise funds through outside donations. The reason this model will not be implemented as a non-profit is because if for some reason donations stopped flowing in and the business was not able to meet its basic needs to stay afloat, communities and ultimately the environment would pay the price and suffer by being forced to revert back to using disposable food ware without simple way of allowing the masses to compost. Due to this risk, the most beneficial form of business model for this system would be a modeled after a traditional for-profit business. This is a very good thing because through the process of centering the core mission and values of the company around sustainability and helping the environment, it will set an example for more businesses to follow suit and show existing businesses the power behind sustainable initiatives in this day and age and the ability to join people, planet, and profit as one.

Distribution Model

The business exists to serve the restaurants that in turn serve their customers, creating the loop that was shown in Figure 5. The Reason-To-Reuse system can be broken down into five distinct stages:

Stage 1: Reason-To-Reuse begins by obtaining a supply of FSCs. The University Of Southern Florida was able to obtain reusable FSCs for $2.27 a unit, and it will be

assumed that this is the price per reusable FSC. These FSCs are stored as inventory until demand from restaurants triggers in order.

Stage 2: Depending on restaurant demand FSCs are distributed accordingly to restaurants. This can be done on a daily, weekly, or monthly basis, although a scheduling system will be created to maximize efficiency. This stage is heavily reliant on the database management system, which in connection with the website that is linked to restaurant accounts can trigger an order to go out. A flowchart of stages 1 and 2 is provided in Figure 6.

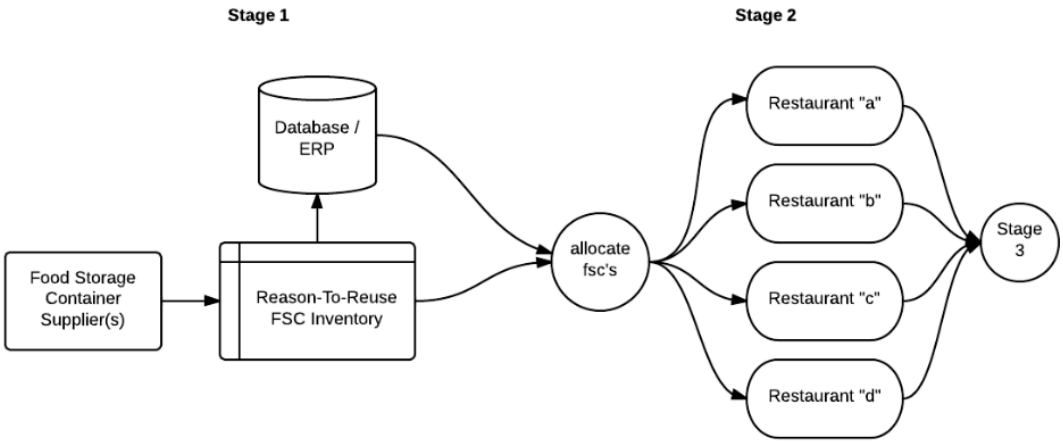

Figure 6 – Process flow for Stage 1 and Stage 2 of the Design

Stage 3: Once the FSCs are at the restaurants, they are ready to be distributed to the consumers. It is necessary for a restaurant's customer to be a member of Reason-To-Reuse in order to receive a reusable FSC, if they are not then they will be provided with the standard disposable FSC the restaurant carries. It could be a Reason-To-Reuse biodegradable FSC if the restaurant carries those as well. The restaurants are in business to provide a pleasant experience for their customers so that they want to keep coming

back and forcing restaurants to make their customers use reusable FSCs is not necessary, although they are encouraged to advertise the reusable system.

> Barcode Vouchers: Barcoded tickets, similar to those used for sporting events and concerts will be used for tracking reusable FSCs from restaurant to customer, and then eventually back to be washed. Once the FSC is back at the Reason-To-Reuse facility the FSC will be checked in and accounted for and the previous barcode used for tracking will be obsoleted. The barcodes can be obtained by subscribers through their website account, and the tracking is done through the accounting database system.

For a subscriber to check out a reusable FSC, they must bring in their barcoded voucher on paper or on their smartphone. This is linked to the website where customers with subscriptions can receive their vouchers for a reusable FSC. The voucher is redeemed for a reusable FSC when needed at the restaurant and the subscribers account tracks that a FSC has been checked out.

Stage 4: The FSCs can be stored by the subscriber and used for personal use until their pickup date. Every four weeks the FSCs are picked up from the subscriber's place of residence. The member places their used FSCs in their reusable Reason-To-Reuse bag that has paperwork containing account information, and during the pickup the bag with used FSCs is exchanged for a new bag to be used for the following period. Figure 7 shows the processes that take place in stage 3 and 4 in a flowchart.

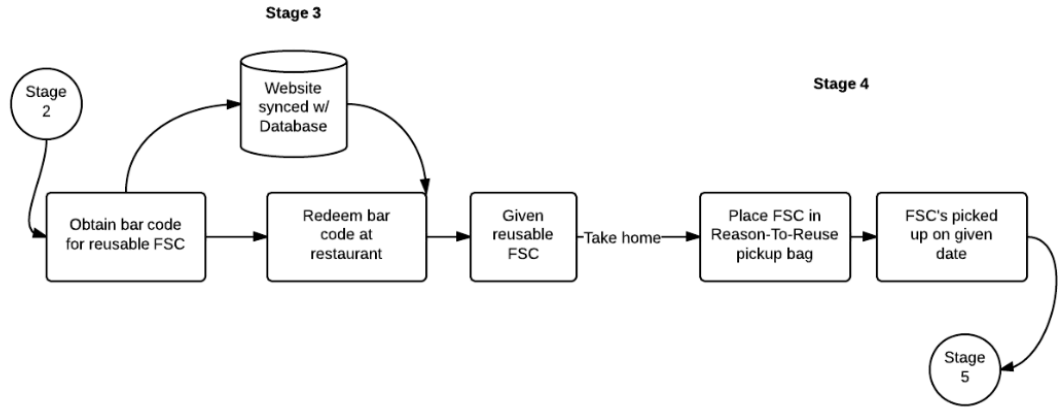

Figure 7 – Process flow for Stage 3 and Stage 4 of the Design

Stage 5: The final stage, the reusable FSCs are returned to the Reason-To-Reuse facility. Before any washing or composting begins, all bags must be accounted for and entered into the database to keep track of containers and individual member accounts. If the member has included all of their FSCs from the previous period and they are all accounted for in good condition then they are not charged. If they fail to return an FSC or return one damaged then they are charged $4 for the FSC on their account. The reusable FSCs are washed and sanitized according to the FDA Food Code and them stored until they need to be used again in which stage 1 repeats, this is shown in Figure 8 below.

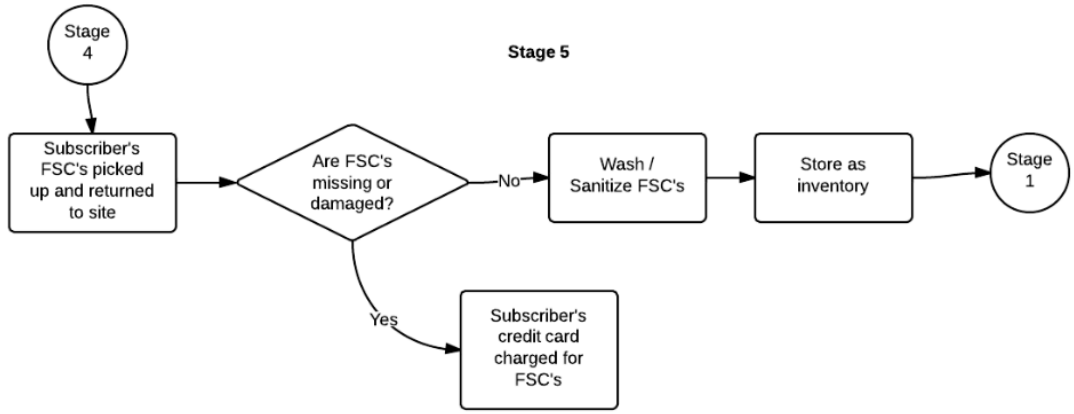

Figure 8 – Process flow for Stage 5 of the Design

Subscription Model

The general outline for the subscription model provided is very similar to the model of the Pure Flo's water company mentioned in the end of the *Background* section of the report. Both restaurants and their customers require subscriptions in order to become part of the Reason-To-Reuse ecosystem.

Restaurants: The out of the box model for restaurants is flexible. Assuming that they continue purchasing and using their current model for disposable FSCs, they will only add a small amount of reusable FSCs to begin. Based on consumer demand for reusable FSCs, restaurants can place orders as they see fit. In order to acquire as many restaurants as possible, they will only be accountable for the reusable FSCs but will not be charged unless the FSC is lost. This is because the consumer is the subscriber who generates revenue and the more restaurants participating the better chance for acquiring subscribers. Restaurants are only responsible for paying for biodegradable FSCs, if they choose to do so.

Individual Subscribers: The out of the box model for individual customers is as follows: Four (4) reusable FSCs per four-week period. The experimental cost of this is $20 per year, based off of the GO Box system. This subscribes one to four (4) vouchers per period for reusable FSCs which can be obtained through their website account and printed or downloaded to their smartphone to be redeemed at participating restaurants. If a subscriber uses all four vouchers and needs more before the four-week period is over, they can be purchased through their account online. While GO Box uses tokens to

exchange for containers, this utilizes technology that can be scaled to accommodate more people at very little cost or effort to the Reason-To-Reuse business.

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Methodology

To test this newly designed system would require a lot more time and money, which were both constrained for this project. The subscription model is based upon existing research and will be evaluated in the *Results*. For simplicity in this model and for positioning Reason-To-Reuse to capitalize of acquiring as many subscribers as possible, restaurants will not be used in the financial analysis in terms of cost. Instead restaurants will be used to account for subscriber rates based on a percentage of customers to individual restaurants. Instead of physical implementation, testing the concept is still possible by considering restaurants in San Luis Obispo, CA with different service and dining styles. Fast food chains have been excluded from this system due to the fact that they employ special logo packaging and the focus of this system is on generic FSCs.

Case Study

The first restaurant that was chosen was Company X, located at 1210 Higuera Street, San Luis Obispo, CA. Company X offers a wide variety of Mediterranean dishes and recently expanded their restaurant giving them a new look, feel, and more seating. They were chosen because of their laid back dining style typical to many food carts, in which a customer orders at the cash register and then picks up their food when called from another counter. In addition it was known previously that Company X uses Styrofoam and plastic FSCs.

The second restaurant that was chosen was Company Y, located at 1020 Railroad Ave., San Luis Obispo, CA. Company XYoffers fine Italian cuisine with a casual to upscale dining experience. This is a more traditional restaurant in which customers are

seated and are waited upon by servers. They use paper FSCs.

Both restaurants were studied for the same purpose. To estimate the daily number of FSC units given out to customers. In addition it was of interest to find out if they have an interest in switching to more sustainable FSC alternatives over their current materials, or take part in a reusable FSC system.

Economic Justification

In order to provide an economic justification for implementing the Reason-To-Reuse business model in the city of San Luis Obispo, research on the amount of restaurants within the area needs to be considered for analysis. This will help calculate the subscriber base, which most likely will depend on the number of participating restaurants. The overall feasibility of the system in San Luis Obispo based on the current model that has been designed will be analyzed.

Results

Assumptions that can be made about the success of Reason-To-Reuse from the get go can be interpolated from the research gathered thus far. Starbucks Coffee's reusable model has established a 3% consumer base for the reusable containers. GO Box has acquired approximately 50 restaurants/ businesses and 1,200 subscribers in its first six months. These two metrics can be used to quantify typical expected results for implementation among San Luis Obispo restaurants and consumers. In addition, results taken from the Company X and Company Y can be incorporated into the analysis for an even better prediction of expected results. Company X claims to go through about 200 FSCs per day, or 6,000 FSCs per month based on a 30-day month. This is due to their high volume of take out orders, as well as the majority of their dine in orders requiring a take out FSC. They usually give out Styrofoam FSCs to take out orders while the leftovers are usually provided in either Styrofoam or throw away plastic. Company Y claims to go through about 50 FSCs per day, or 2,100 FSCs per month based on a 30-day month and uses paper FSCs.

The financial returns for Reason-To-Reuse based on 3%, 5%, 10%, and 25% subscriber rates are the subject for the economic analysis and justifications in Appendix A. Business expenses such as leasing a facility, purchasing a van, gas for van, sanitizing equipment, website/database, and cost for FSCs are taken into account (payroll excluded). Based on a 3% subscriber rate and 50 restaurants, in the first year Reason-To-Reuse would lose approximately $44,747 after paying up front costs and ongoing costs. In year two, it would lose $26,971 through ongoing costs. To become profitable in San

Luis Obispo based off of the general assumptions Reason-To-Reuse would need all 195 restaurants with a 3% subscriber rate to break even in year two, year on is a total loss. The minimum break-even point based off the current assumptions is if all 195 restaurants participated and the subscriber rate was 10%. Appendix A Table 3 outlines the revenue generated before paying any expenses. Table 4 shows approximate up front and on going costs. Table 5 provides economic analysis as well as justification for the different participation rates among both restaurants and individual subscribers.

The option of biodegradable FSCs was talked about in the report, and Table 6 in Appendix A shows the cost increase restaurants can expect to pay over current FSC materials. Tables 7 and 8 show the increases based on switching to biodegradable containers for Company X and Company Y while also having a 3% customer base subscribed to the reusable model, which helps detract from their FSC costs linearly by the percentage of reusable subscribers they have. For example, if 3% of Company X's customers are subscribers to the Reason-To-Reuse reusable model then they can expect to pay 3% less for FSC's because 3% less customers need them in theory. Going along with a 3% customer base on reusable FSCs, Company X would see a price increase of FSCs of 118% per month over their existing plan while Company Y would only see a price increase of about 16.4% per month over their existing plan.

Roughly 3.5 million disposable FSCs are used each year in San Luis Obispo, based on 195 restaurants using 50 per day. This is a large amount of waste, and reduction by 3% means more than 100,000 FSCs would be saved, not to mention how many more with higher subscription rates and/or implementing biodegradable FSCs as well.

Conclusions

Based upon the GO Box reusable business model that has been created in Portland, a few conclusions can be drawn. Most importantly is that the reusable container system is feasible and has proven to work in this area, and because of this GO Box is a source for gathering assumptions in relation to this system being proposed here. While the results clearly show it is very difficult to break even with the current model, prices to the subscribers could be raised, and in addition restaurants could be charged a flat fee to recuperate potential profits lost to expenses. Depending on how restaurants go about sharing Reason-To-Reuse with customers, the subscriber rate may soar well above 3%. An alternative at this point may be to borrow restaurant equipment and pay them to sanitize the FSCs like GO Box and No Thro. The biodegradable FSC option is not a complete wash either. While Company X and Café Roma's costs increased when switching to biodegradable in the case study, Company X did add that they were looking to switch to a more sustainable alternative FSC.

Lastly, it is important to remember that this project was born out of the desire to reduce waste and embrace the people and planet and not so much the profit portion of the triple bottom line. By taking these small steps to begin cutting back on waste, like everything eventually a tipping point is reached and participation rates soar. This is when hundreds of thousands of FSCs are eliminated from entering the environment, and hundreds of thousands are made in profit. The tipping point is what Reason-To-Reuse is after.

To further the design of this model in San Luis Obispo, a location allocation model could be developed to predict demand for reusable FSCs while incorporating an optimization of scheduling for delivery and pickup of the reusable FSCs. Also, experimenting with cities that have more restaurants and residents than San Luis Obispo will help to determine the optimal amount of people and restaurants for Reason-To-Reuse to achieve financial success.

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Appendix A – Economic Analysis and Justifications

Table 3 – Reason-To-Reuse Revenue based off of Individual Subscriptions

	Reason-To-Reuse Subscription Rate					
Restaurants Particpating	3%	3% Revenue	5%	5% Revenue	10%	10% Revenue
5	53	$ 1,052.88	88	$ 1,754.81	175	$ 3,509.62
25	263	$ 5,264.42	439	$ 8,774.04	877	$ 17,548.08
50	526	$ 10,528.85	877	$ 17,548.08	1755	$ 35,096.15
100	1053	$ 21,057.69	1755	$ 35,096.15	3510	$ 70,192.31
195	2053	$ 41,062.50	3422	$ 68,437.50	6844	$ 136,875.00

Restaurants Particpating	25%	25% Revenue	50%	50% Revenue	75%	75% Revenue	100%	100% Revenue
5	439	$ 8,774.04	877	$ 17,548.08	1316	$ 15,793.27	1755	$ 21,057.69
25	2194	$ 43,870.19	4387	$ 87,740.38	6581	$ 78,966.35	8774	$ 105,288.46
50	4387	$ 87,740.38	8774	$ 175,480.77	13161	$ 157,932.69	17548	$ 210,576.92
100	8774	$ 175,480.77	17548	$ 350,961.54	26322	$ 315,865.38	35096	$ 421,153.85
195	17109	$ 342,187.50	34219	$ 684,375.00	51328	$ 615,937.50	68438	$ 821,250.00

Table 4 – Approximated Up Front and Ongoing costs for Reason-To-Reuse

Up Front Costs	Year 1	
Van	$	10,000.00
Sanitizing equipment	$	3,000.00
SUM	$	13,000.00
Ongoing Costs	Annually	
Building lease	$	36,000.00
Gas for van	$	1,000.00
Website / Database	$	500.00
SUM	$	37,500.00

Table 5 – Economic analysis for Reason-To-Reuse including Up Front and Ongoing costs for Year 1 and Year 2

3% Subscriber Rate							
					One time costs	Revenue (w/ container costs)	
Participating Restaurants	unit cost	subscribers	containers	container cost		Year 1	Year 2
5 Restaurants	$ 2.27	53	212	$ 481.24		$ (49,928.36)	$ (36,447.12)
25 Restaurants	$ 2.27	263	1052	$ 2,388.04		$ (47,623.62)	$ (32,235.58)
50 Restaurants	$ 2.27	526	2104	$ 4,776.08		$ (44,747.23)	$ (26,971.15)
100 Restaurants	$ 2.27	1053	4212	$ 9,561.24		$ (39,003.55)	$ (16,442.31)
195 Restaurants	$ 2.27	2053	8212	$ 18,641.24		$ (28,078.74)	$ 3,562.50
5% Subscriber Rate							
						Revenue (w/ container costs)	
Participating Restaurants	unit cost	subscribers	containers	cost		Year 1	Year 2
5 Restaurants	$ 2.27	88	352	$ 799.04		$ (49,544.23)	$ (35,745.19)
25 Restaurants	$ 2.27	439	1756	$ 3,986.12		$ (45,712.08)	$ (28,725.96)
50 Restaurants	$ 2.27	877	3508	$ 7,963.16		$ (40,915.08)	$ (19,951.92)
100 Restaurants	$ 2.27	1755	7020	$ 15,935.40		$ (31,339.25)	$ (2,403.85)
195 Restaurants	$ 2.27	3422	13688	$ 31,071.76		$ (13,134.26)	$ 30,937.50
10% Subscriber Rate							
						Revenue (w/ container costs)	
Participating Restaurants	unit cost	subscribers	containers	cost		Year 1	Year 2
5 Restaurants	$ 2.27	175	700	$ 1,589.00		$ (48,579.38)	$ (33,990.38)
25 Restaurants	$ 2.27	877	3508	$ 7,963.16		$ (40,915.08)	$ (19,951.92)
50 Restaurants	$ 2.27	1755	7020	$ 15,935.40		$ (31,339.25)	$ (2,403.85)
100 Restaurants	$ 2.27	3510	14040	$ 31,870.80		$ (12,178.49)	$ 32,692.31
195 Restaurants	$ 2.27	6844	27376	$ 62,143.52		$ 24,231.48	$ 99,375.00
25% Subscriber Rate							
						Revenue (w/ container costs)	
Participating Restaurants	unit cost	subscribers	containers	cost		Year 1	Year 2
5 Restaurants	$ 2.27	439	1755	$ 3,983.41		$ (45,709.38)	$ (28,725.96)
25 Restaurants	$ 2.27	2194	8774	$ 19,917.07		$ (26,546.88)	$ 6,370.19
50 Restaurants	$ 2.27	4387	17548	$ 39,834.13		$ (2,593.75)	$ 50,240.38
100 Restaurants	$ 2.27	8774	35096	$ 79,668.27		$ 45,312.50	$ 137,980.77
195 Restaurants	$ 2.27	17109	68438	$ 155,353.13		$ 136,334.38	$ 304,687.50

Table 6 – Cost comparison of FSC materials using biodegradable FSCs as the baseline

Food Storage Container (fsc) Material	Fsc Unit Cost ($)	Cost Increase (based on $0.18 biodegradable paper)	RtoR 3% subscription rate cost increase	RtoR 5% subscription rate cost increase	RtoR 10% subscription rate cost increase
Styrofoam	$0.07	157%	149%	144%	131%
Plastic (non- reusable)	$0.10	80%	75%	71%	62%
Paper	$0.15	20%	16%	14%	8%
Biodegradable (paper)	$0.18	0%	-3%	-5%	-10%

Table 7 – Company X monthly costs vs. monthly costs with biodegradable FSCs and 3% subscriber rate to Reason-To-Reuse

• Petra	Current Model	"Reason to Reuse" model
Material of fsc	Styrofoam and plastic (non-reusable)	Reusable and biodegradable
Disposable fsc used per month (#, $)	6,000 units, $480	5,820 units, $1040
Reusable fsc used / month*	N/A	180 units, $630
Total Cost / month	$480	$1670
Total Cost / month (without reusable)	$480	$1040

Table 8 – Company Y monthly costs vs. monthly costs with biodegradable FSCs and 3% subscriber rate to Reason-To-Reuse

• Café Roma	Current Model	"Reason to Reuse" model
Material of fsc	Paper	Reusable and biodegradable
Disposable fsc used per month (#, $)	2,100 units, $315	2,037 units, $366.67
Reusable fsc used / month*	N/A	63 units, $220.50
Total Cost / month	$315	$587.16
Total Cost / month (without reusable)	$315	$366.67

Appendix B – Miscellaneous

Figure 1 – GO Box model for individual subscribers ("Go box")

Figure 2 – University of Southern Florida model for students ("Reusable to-go boxes," 2012)

Figure 4 – Pure Flo Water subscription service model

Table 2 – List of cities and towns that have implemented polystyrene bans ("Cities that have,")

Berkeley, CA
San Francisco, CA
Malibu, CA
Alameda, CA
Emeryville, CA
Fairfax, CA
Hercules, CA
Laguna Beach, CA
Los Angeles City, CA
Millbrae, CA
Monterey, CA
Newport Beach, CA
Huntington Beach, CA
Oakland, CA
Santa Cruz, CA
Pittsburg, CA
Palo Alto, CA
Pacific Grove, CA
San Bruno, CA
Santa Monica, CA
Orange County CA. (containing approx. 34 cities and towns)
Seattle, WA
Portland, OR
San Mateo County, CA (containing approx. 20 cities and towns)
Santa Cruz County, CA (containing approx. 53 cities and towns)
Ventura County, CA (containing approx. 73 cities and towns)
Glen Cove, NY
Suffolk County, NY (containing approx. 263 cities and towns)