Marketainer: Closed-Loop Packaging Solutions

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Our signatures on the document signify our joint responsibility to fulfill the archiving standards set by the Bren School of Environmental Science & Management.

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The mission of the Bren School of Environmental Science & Management is to produce professionals with unrivaled training in environmental science and management who will devote their unique skills to the diagnosis, assessment, mitigation, prevention, and remedy of the environmental problems of today and the future. A guiding principal of the School is that the analysis of environmental problems requires quantitative training in more than one discipline and an awareness of the physical, biological, social, political, and economic consequences that arise from scientific or technological decisions.

The Group Project is required of all students in the Master's of Environmental Science and Management (MESM) Program. It is a three-quarter activity in which small groups of students conduct focused, interdisciplinary research on the scientific, management, and policy dimensions of a specific environmental issue. This Final Group Project Report is authored by MESM students and has been reviewed and approved by:

_____ Roland Geyer, PhD

Abstract

The goal of Marketainer is to phase out single-use packaging by creating a reusable distribution infrastructure. Conventional disposable packaging is characterized by resource-intensive production, supply chain inefficiencies, and extensive end-of-life management issues. These factors combine to create a substantial environmental burden and unnecessarily high economic costs. Marketainer aims to eliminate sources of waste throughout the supply chain for a wide range of flowable liquid and solid products. Building upon the existing bulk distribution infrastructure, the Marketainer system is designed to satisfy the product distribution needs of manufacturers, retailers, and consumers. The reduced environmental footprint of the Marketainer system was verified through a comprehensive life-cycle assessment, comparing its impact to that of both typical disposable packaging and current bulk distribution. A detailed economic analysis confirmed the financial gains achievable with this new system. Additionally, extensive market research was conducted to formulate an effective marketing strategy, design a functional prototype, and shape the Marketainer business model. The result is a highly efficient, sustainable, state-of-the-art system that the Marketainer team believes is the future of product packaging.

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Executive Summary

Single-use, disposable packaging has become the most common medium for product distribution in use today.[1] A third of all municipal waste in the United States is composed of this packaging, most of which is not recyclable.[2] On an annual basis, product manufacturers spend billions of dollars on packaging production,[3] while taxpayers spend billions more to dispose of it.[1] Although the environmental and economic impacts of disposable packaging are considerable, a well-designed and convenient alternative does not exist. The current form of bulk buying (e.g. where the shopper purchases products from a large, unpackaged supply) can effectively cut down on packaging waste and food costs. However, the mainstream consumer has not embraced this practice, despite decades in the marketplace.[4] Most shoppers are unaware of the environmental and economic benefits of buying products in bulk,[5] and many perceive bulk systems to be unhygienic and inconvenient (Appendix I).

Marketainer is an eco-entrepreneurial business venture that attempts to mitigate the detrimental environmental and economic impacts of conventional disposable packaging by reinventing the bulk distribution process. Working with the Isla Vista Food Cooperative and Wal-Mart, along with numerous other retailers, manufacturers and distributors, our team analyzed existing product distribution systems, identified key problems, and directly addressed barriers to change. The result of our research is an integrated, closed-loop system that phases out disposable packaging by replacing it with a reusable product distribution infrastructure. The Marketainer system is comprised of three main components: reusable bulk bins that convey products from the point of manufacture to the point of sale, smart-technology dispensing units that are maintained by the retailer, and reusable containers used by shoppers to transport and store products at home.

To ensure that the Marketainer system does indeed have a smaller environmental impact than the status quo, we conducted a comparative life-cycle assessment (Appendix A). The Marketainer system outperformed both current bulk systems and conventional disposable packaging in every environmental impact category. In the most likely scenario, impacts were reduced by over 30% compared to bulk, and over 78% compared to disposable packaging. We carried out a thorough economic analysis as well, comparing the costs of the three systems (Appendix B). Our findings indicate that Marketainer's overall cost is nearly 75% less than the current bulk system, and nearly 85% less than disposable packaging.

Our team formulated a comprehensive, multi-tiered marketing strategy by conducting market research interviews with retailers, manufacturers, and distributors (Appendix I). We will initially market bulk bins directly to

manufacturers of bulk flowable liquids and solids that are sold at health food, natural, or organic retailers. Many are concentrated in California, allowing us to adopt a regional focus during the early stages of our venture. After the bulk bins are phased in, we will introduce dispensing units and personal containers to eco-conscious retailers and consumers, a growing market which will appreciate the reduced environmental impact of our system in addition to the cost savings. As we establish a foothold in the bulk food market, we plan to drive growth by expanding into additional product categories, ranging from cleaning products to nuts and bolts. This approach will allow us to steadily integrate our system into the mainstream, catalyzing the sustainable packaging revolution, with Marketainer in the vanguard.

We are seeking seed funding of $50 thousand to refine product design and pay for patent-related legal fees. A second round of funding will raise $200 thousand, necessary for the initial proof-of-concept production run. Current financial projections indicate that break-even will occur midway through Year 2, with total sales exceeding $1 million during Year 3. By the end of Year 5, Marketainer will achieve an operating profit margin of 43%, and have over $1.8 million in total assets, making it appealing to potential buyers in the packaging and retail sectors.

The Problem

One-time-use disposable packaging accounts for a third of all municipal waste in the United States.[2] Each year, American taxpayers spend billions of dollars sending single-use packaging to landfills and recycling centers.[1] Consumers are not just paying for the end-of-life management of packaging waste however, they also pay to obtain packaging in the first place. Disposable packaging makes up on average 15-35% of the direct cost that consumers pay for food products.[6] The food industry alone spent $50 billion on one-time-use packaging in 2000 -- an increase of over $30 billion since 1980.[3]

When calculating the full cost of the disposable packaging life-cycle, we must consider not just the economic but also the environmental costs of its manufacturing and disposal. Excess waste and large landfills negatively impact local environmental quality, harming wildlife and increasing toxicity in the soil, rivers, and oceans.[2] However, 95% of the environmental footprint of disposable packaging actually lies in its production.[7] The manufacture of disposable packaging relies on consumption of nonrenewable fossil fuels, and the extraction of raw materials -- both significant contributors to global climate change.

There have been attempts to solve this packaging problem but, despite decades in the marketplace, they have yet to go mainstream. The most effective method to date has been the sale of products through gravity-fed bulk dispensers. However, many consumers have an aversion to buying in bulk due to perceptions of it being unsanitary or inconvenient.[5] Retailers complain about the difficulty of filling these dispensers, and the potential for “shrink” and "grazing" -- product lost through spillage or consumption without paying.[5] Furthermore, the current bulk system still requires the use of disposable packaging, as the product is typically transported in a large plastic bag contained in a corrugated cardboard box, and consumers use paper or plastic bags available in the retailer's bulk section to transport their goods home. Although the current bulk system is an improvement over typical "grab-and-go" packaging, it still falls short of being the optimal packaging system.

The Opportunity

Marketainer intends to phase out single-use packaging by creating a reusable packaging solution for flowable liquids and solids. By leveraging the potential for economic and environmental gains, Marketainer will profitably convert the current wasteful supply chain into a closed-loop, sustainable system. Research conducted by our team over the past year has indicated that there is a significant demand for a better bulk system, with improved sanitation, freshness, and a more convenient stocking and dispensing method (Appendix

I). Marketainer has developed such a system, where all components are seamlessly integrated and closed-loop by design.

Manufacturers will place their products into large, heavy-duty, reusable bulk bins, customized with poster-sized marketing material. At the retailer, these containers will plug directly into computerized dispensing units, reducing stocking costs and offering greater hygiene and freshness than any current bulk bin stocking methods. Consumers can bring their own Marketainer personal containers to the store, locking them into the base of the dispenser and interacting with its graphical user interface to dispense the desired amount of product. The Marketainer card, used during the transaction at the retail store, will record all the purchase information and conveniently facilitate the check-out process. Manufacturers can gain additional brand exposure by subsidizing the cost of Marketainer personal containers branded with their own logos. By adopting the Marketainer system, manufacturers and retailers will realize cost savings large enough to pass on to customers while still improving margins.

A thorough life-cycle assessment (Appendix A) and economic analysis (Appendix B) confirm that Marketainer's introduction of reusable containers into the supply chain would substantially reduce the environmental and economic costs of product distribution. The Marketainer system reduces polluting emissions, damage to ecosystems, and contributions to climate change that are inherent in current disposable packaging systems (Appendix A). Marketainer intends to create a convenient transition away from single-use disposable packaging, and as such, its system has been designed to phase into current manufacturing operations and retail facilities smoothly and efficiently (Appendix E). As its reputation and influence grow, Marketainer will continually innovate its product line in a way that matches the needs of both small, local markets and multinational retailers and manufacturers. The end result would be cost-savings for all parties involved, and the elimination of disposable packaging in a way that has never been attempted before.

Mission, Vision, and Value Proposition

Our Mission

Marketainer rethinks packaging solutions with the goal of making sustainable product distribution the industry standard. By developing a reusable, integrated product distribution system that links consumers, retailers, distributors, and manufacturers, Marketainer aims to conserve natural resources and minimize environmental impacts while creating a convenient and cost saving experience for all user groups.

Our Vision

Marketainer will catalyze the sustainable product distribution revolution in order to realize a world free of one-time-use disposable packaging.

Value Proposition

The Marketainer solution will enable a closed-loop, reusable supply chain for a variety of flowable liquid and solid products, reducing costs while increasing environmental performance. Through innovative technology and design, Marketainer will streamline the bulk shopping experience to create value for a mainstream audience.

The Marketainer Experience

The following provides an overview of how each party interacts with the Marketainer system and the relevant benefits. See Appendix G for a more detailed version of the Marketainer experience.

The Manufacturer Experience

Manufacturers purchase heavy-duty reusable bulk bins from Marketainer and use them to package their products. These containers are shipped to retailers for product resale and then returned to the manufacturers to be refilled and reused. By adopting the Marketainer system, manufacturers will be able to:

- Save on packaging costs -- our economic analysis (using cereal as a baseline product) indicates that our bulk bins pay for themselves in only 20 cycles when compared to an equivalent amount of disposable packaging (Appendix B)
- Reduce their environmental footprint and reliance on disposable packaging suppliers
- Ship products with greater confidence that they will arrive at retailers undamaged, fresh, and sanitary
- Customize bulk bins with poster-sized advertisements, strengthening their brand image in retail outlets
- Easily communicate product information (nutritional content, ingredients, recalls, etc.) to consumers via a Marketainer online interface
- Seamlessly integrate bulk bins with retailers using Marketainer dispensers, or simply use them as a reusable alternative to conventional disposable packaging that can be poured into retailers' existing bulk dispensers

Figure 1: The Marketainer bulk bin

The Retailer Experience

Retailers purchase gravity-fed Marketainer dispensing units, which each include a computer interface that relays all sales information to a centralized computer system. Retailers can also make Marketainer personal containers available for resale to shoppers, providing an additional revenue stream. Finally, retailers offer customers swipe cards to be used with the dispensing units. The Marketainer system will allow retailers to:

- Efficiently stock full bulk bins by plugging them into dispensing units (less labor-intensive and unsanitary pouring required)
- Improve the integrity of products offered through enhanced protection, superior freshness, and an unbreached dispensing system
- Automatically monitor the level of each product on the shelves through a centralized computer system
- Reduce product spillage, grazing, and theft by requiring the card (with a unique customer ID) to be inserted before dispensing

- Streamline the check-out process -- weighing and product codes will be automatically accounted for by the dispensers and communicated to the point of sale
- Save on labor costs from more efficient check-out and stocking processes
- Collapse empty bulk containers for efficient storage and transportation

Figure 2: The Marketainer dispensing unit

The Consumer Experience

Consumers activate Marketainer dispensers by using either their Marketainer swipe card or their existing retailer rewards card. When shopping, consumers will be able to choose between dispensing their desired products into disposable bags provided by the retailer or into their own reusable personal containers. Marketainer will enable consumers to:

- Pay less at check-out by avoiding the cost of disposable packaging -- shoppers who purchase a reusable container and switch to bulk buying may find that the cost of the container is recouped in a single shopping trip (Appendix B)
- Purchase as much or as little of a product as they need

- Shop quickly and conveniently in the bulk section without needing to weigh purchases or record product codes
- Use their swipe card at the register to instantly account for all purchases made using the Marketainer system, instead of unloading, weighing, entering product codes, and reloading each item into their cart
- Gain access to an up-to-date account of their purchases via a web interface that offers information such as nutrition, ingredients, expiration dates, product recalls, as well as recipes and coupons

Figure 3: Marketainer personal containers

Environmental Impact Assessment

As Marketainer is an eco-entrepreneurial venture, one of its defining goals is to reduce society's environmental impact. We conducted a life-cycle assessment (LCA) for two reasons: to help design our products in the most environmentally-friendly way possible, and to ensure that the Marketainer system does indeed have a smaller environmental impact than the status quo. Unlike disposable packaging and current bulk systems, the Marketainer system requires reverse logistics and industrial sanitization,

so it is not immediately apparent that it has a smaller impact from a complete supply chain perspective.

Fortunately, the results of the LCA were overwhelmingly in Marketainer's favor. Measuring environmental impacts in ten common categories (including eutrophication, human toxicity, and global warming potential), the Marketainer system outperformed both conventional disposable packaging and bulk systems across the board. In fact, in our best-estimate case, Marketainer's impact reductions across the ten categories ranged from 78.0% to 99.5% compared to disposable packaging, and from 30.1% to 98.5% compared to current bulk.

The LCA confirmed that a tremendous amount of the impact of disposable packaging lies in its initial production and eventual disposal. Even considering the reverse logistics, sanitization, and electricity consumption of the Marketainer system, its reusable nature more than makes up for these impacts by vastly reducing production and end-of-life impacts. Furthermore, we determined that manufacturing the bulk bins and personal containers from 100% polypropylene has the smallest impact of all potential production materials (including bioplastic). See Appendix A for the complete life-cycle assessment.

Economic Analysis

We carried out a thorough economic analysis comparing the Marketainer system to conventional single-use packaging and the current bulk system. The analysis incorporates the same model that was used for the Environmental Impact Assessment, comparing the estimated cost of using each of the three systems to convey a given product (cereal) from a specific manufacturer (Golden Temple of Oregon, LLC) to a specific retailer (Isla Vista Food Cooperative). The scope of the analysis includes the costs of manufacturing packaging materials, fuel used for shipping, stocking labor at the retailer, sanitization (for current bulk and Marketainer systems), and packaging end-of-life management per kilogram of Golden Temple cereal delivered to the end-use consumer.

Our findings indicate that Marketainer's overall life-cycle cost (i.e. the sum of all these costs) is nearly 75% less when compared to the current bulk system. These savings climb to nearly 85% when compared to boxed cereal. Indeed, Table B-11 (Appendix B) shows that for every 5,000 kilograms of Golden Temple cereal sold by the Isla Vista Food Cooperative, the sum of all costs analyzed would be $1,287 using the boxed cereal system, $825 using the bulk system, and $214 using the Marketainer system.

Additionally, the payback periods for each component of the Marketainer system are quite reasonable. Every bulk bin purchased by Golden Temple

to replace the production of boxed cereal would pay for itself within 20 shipments to the Isla Vista Food Cooperative, and every bin purchased to replace the production of current bulk would pay for itself within 97 shipments. Each Marketainer dispensing unit purchased by the Isla Vista Food Cooperative, instead of purchasing a new conventional bulk dispenser, would make up the price difference in around half a year due to labor savings alone. Finally, consumers who switch from buying conventional boxed cereal to bulk cereal using a Marketainer personal container can recoup the cost of the container after only a single visit to the store.

Even considering sanitization and reverse logistics, Marketainer is the clear winner among the three systems in economic terms. The complete economic analysis, including all data and assumptions, is available in Appendix B.

Competitive Analysis

Industry at a Glance

The bulk distribution industry currently has a large number of reusable bulk bin and dispenser manufacturers with no clear industry leader, and little synergy between these two products. Some competing firms include Trade Fixtures, BestBins, and Orbis Corporation (Appendix D). The existing market for bulk bins is adequately served, but a key part of Marketainer's mission is to expand demand for bulk distribution to new market segments. Challenges to entering the market include: developing an affordable manufacturing process, adopting our bins to existing factory lines, and coordinating enhanced business relationships among manufacturers, distributors, and retailers to facilitate reverse logistics.

Manufacturers may be resistant to the initial capital cost of adopting the Marketainer system but should be attracted to our more efficient, less resource intensive system. This will result in cost savings from reduced packaging and increase profits over the long term (see Appendix B for more information on payback periods). Additionally, these companies should be able to increase demand by capitalizing on the environmentally-friendly nature of our products. Similarly, retailers might be resistant to the initial capital cost and installation necessary to incorporate our dispensing units, but should be interested in the space savings (which translates to more product on the floor), reduced time requirements, and green image provided by Marketainer.

The personal container industry is better-organized than the bulk bin and dispenser industries, with much stronger competition overall. As such, our strategy is to license out the right to manufacture personal containers

(with our patented interlocking mechanism) to potential competitors such as Tupperware, Ziploc, or Lock & Lock. By licensing personal containers, Marketainer will save on the cost of production and marketing, as well as turn potential competitors into partners.

A major source of competition may come from conventional packaging printing companies such as Smurfit-Stone (which supplies General Mills and Kellogg, among others) and Georgia-Pacific. Both companies are major industry players that have an extensive portfolio of disposable packaging products. If effective, the Marketainer system would be taking away a major revenue stream from these companies. However, there may be opportunities to partner with these firms if they show interest in manufacturing bulk bins or personal containers that work with our system. See Appendix D for the complete competitive landscape analysis.

Competitive Advantage

Our Company

Our team's common foundation in environmental science and management, combined with the interdisciplinary nature of our individual backgrounds, is the foremost element that sets our firm apart from our competitors (Appendix L). In addition to our education, we have established a large network of industry, academic, legal, and media contacts over the past year, offering a plenitude of opportunities and giving us an important competitive advantage as we enter the marketplace. Through our affiliation with the UCSB Technology Management Program, we have been able to utilize the school's on-campus assets and interact with specialists to strengthen our business and marketing plans, and help with the initial construction of our prototype (Appendix F).

Marketainer is the first firm to design, patent, and license a closed-loop packaging solution. Once we breach the market, this will give Marketainer a solid first-mover advantage. Marketainer will work to maintain this initial lead through continual innovation. By developing our products with both small and large-scale manufacturers and retailers in mind, we will create a solution that addresses the needs of the spectrum of flowable liquid and solid product suppliers. Finally, Marketainer will mirror the environmentally responsible nature of our products in our own operations, reducing risk and attracting investors and customers who are interesting in becoming part of the new green economy.

Product Differentiation

Marketainer's primary competitive advantage lies in creating an efficient product distribution system that offers improved economic and

environmental performance over the status quo. To date, no firm has designed and brought to market a completely integrated, closed-loop packaging solution that addresses the entire product supply chain. Our vision to revolutionize the shopping experience, from manufacturer to consumer, makes Marketainer truly unique. See Appendix H for a detailed system comparison.

Our detailed LCA (Appendix A) compares conventional disposable packaging, existing bulk packaging, and the proposed Marketainer system. The LCA has been crucial in demonstrating the environmental benefits of the Marketainer bulk system, and serves as a scientifically-verifiable competitive advantage. In addition to the LCA, our economic analysis (Appendix B) highlights the financial benefits of the Marketainer system. The findings of this analysis indicate that the cost savings provided by Marketainer, when compared to the other two system, can far surpass the initial capital costs, saving consumers money and contributing to long-term profitability for manufacturers and retailers.

Waste Elimination and Improved Logistics

Current bulk systems rely heavily on disposable packaging to deliver products from manufacturers to retailers.[8] Using the Marketainer system, manufacturers' can decrease their disposable packaging demand by employing our reusable bulk bins. The shape and size of the bins is designed to maximize transportation efficiency. Furthermore, they will be airtight and compactly filled, minimizing the inefficient transport of empty air space commonly associated with disposable packaging. Once at the retailer, the Marketainer bulk bins will plug directly into the dispensing units, eliminating the need for employees to remove the entire assembly from the shelf and fill it by hand. This has the potential to reduce labor-hours and decrease product loss due to spillage.

Sanitation and Freshness

Sanitation is one of the main reasons that disposable packaging products have become the industry standard.[5] When dealing with food products in particular, sanitation is critical for protecting both the health of consumers, and the reputation of retailers and manufacturers. Our airtight bulk bins and integrated plug-in dispenser loading system guarantees that products will not be exposed to the outside environment from the time they are sealed at the manufacturing facility to the point when they are dispensed into the consumer's personal container. This gives the Marketainer system an advantage with both sanitation and freshness compared to current bulk systems, which typically involve product exposure during stocking.

Convenience through Innovative Technology

Current bulk buying is often viewed as an inconvenient way to shop, due to the time it takes to dispense and label products.[5] Check-out efficiency is reduced as well, as store employees must manually enter product codes and weigh the product to price the purchase.[8] In general, customers are not aware of the price of their purchase until it is finally calculated at the register. Eco-conscious customers are further inconvenienced if they bring their own containers, because they must first weigh each empty container before filling it up.[8]

The Marketainer dispensing unit will enable customers to use a computerized interface to fill their container to the desired quantity or price point. Advanced weight sensing technology will ensure accuracy, and customers will instantly be able to see the exact cost of their purchase as it is dispensed. At the register, they only have to scan their Marketainer or frequent shopper card to check out -- no manual weighing or labeling is necessary. These factors converge to create a novel and convenient shopping experience that is both cost saving and environmentally beneficial. Additionally, the patenting and licensing of our smart technology will enable Marketainer to construct barriers to competitors attempting to enter the market.

Branding and Customizability

The Marketainer bulk bins and personal containers will allow product manufacturers to maintain, and even expand, brand identity in ways that current bulk systems do not allow. Current bulk bins displays have a minimum of product information and brand identification, and provide little visual stimulation.[8] Marketainer's large bulk bins can be covered in poster-sized displays that have the potential to grab the attention of shoppers even more than current disposable packaging does. In addition, consumers will have the option to purchase personal containers that are decorated by their favorite brand logos. Even if consumers fill the container with alternate products, the brand identity will still be exposed in homes and store aisles. The personal containers will also be customizable, offering a variety of sizes, visual options, and advanced features such as collapsibility. The Marketainer website will allow users to create their own personalized containers and will continually offer new features and accessories, such as the Marketainer Personal Container Carrying Kit, to further improve the shopping experience.

SWOT Analysis

Strengths

- Economic incentives

- Reduction of environmental impact -- appeals to the burgeoning green movement
- Expands on bulk system and reusable packaging infrastructure already in place
- Unique entire supply chain approach
- Computerized dispensing system for consumers
- New branding opportunities
- Marketainer team & Bren School education
- Contacts established through the Bren School network

Weaknesses

- Lack of engineering knowledge
- Must adapt products to manufacturers' existing factory lines
- Few sales relationships in industry initially
- First movers -- no existing reputation, and must bear entire burden of marketing costs
- Additional reverse logistics and sanitization required
- Costly initial investment
- Trying to change consumer, retailer, and manufacturer mindset

Opportunities

- Significant cost savings associated with reduced packaging
- Directly addresses resistance to adopting bulk systems
- Competition is currently scattered, without a unified front
- Increasing environmental awareness of general population
- “Eco-friendly” product market is expanding
- Can capture significant market share as first movers, and build customer loyalty early on
- Chance to develop stronger relationship between retailers and manufacturers
- Can partner with potential competitors by licensing out designs
- Halo effect of “green image” extends to partner firms
- Allows manufacturers to add environmental credibility to their brands
- Ability to develop add-ons and accessories for products

Threats

- Competition from a variety of sources: disposable packaging, reusable container, and bulk dispenser manufacturers
- Primary competition is well-funded and well-established
- May meet resistance from companies within the supply chain that are successful doing “business as usual”
- Competition may use established relationships to leverage suppliers and retailers against us

- Political lobbying against reusable containers by well-established competition (e.g. disposable packaging manufacturers)
- Market may become attractive to second-movers, who can learn from our mistakes

Risk Analysis

Consumer Acceptance

Consumers are accustomed to prepackaged products and have a “grab and go” mentality about shopping.[5] Our system requires a behavioral shift on the part of consumers.

Retailer Acceptance

Retailers may be skeptical of consumer's willingness to adopt this new system. Additionally, the upfront investment associated with the change may be a barrier to adoption.

Manufacturer Acceptance

Manufacturers, much like retailers, may be resistant to change due to the large initial investment and operation shift required. Food product manufacturers in particular may have additional hesitation due to US Food and Drug Administration (FDA) regulations.

Hygienic Challenges

It is imperative that the Marketainer system is designed to easily conform with all FDA regulations concerning food packaging and safety. The system should be designed to exceed all hygienic requirements.

Engineering Challenges

The current Marketainer prototype design is predicated on four environmental scientists’ vision. Greater engineering expertise is needed to further advance the design of the system.

Existing and Future Competitors

While there is currently no major market leader in bulk distribution (Appendix D), competitors may attempt to copy our system when they observe its success. Our system will be protected by utility and design patents, trade secrets, and business relationships. Foreign competitors, with little regard for intellectual property, may pose a problem in large potential markets such as China and India.

Environmental Impact

While the Marketainer system is expected to reduce waste and environmental impact, there is an upfront investment of materials and resources required, which do have an environmental impact. The system must operate successfully for a certain period of time in order to offset this initial environmental burden. Additionally, continual sanitization of the components and reverse logistics, although accounted for in the LCA, will create an ongoing environmental impact.

Five Competitive Forces

Threat of Substitutes

- Substitutes include: conventional disposable packaging, other gravity-fed bulk bins, and disposable bags or personal containers manufactured by competitors
- Our combination of economic incentives, environmental benefits, and convenience is unrealized by substitutes
- Our focus on altering the supply chain, and the integrated nature of our system is unique
- Once suppliers, retailers, and consumers have bought into our system, the cost of switching becomes relatively high

Threat of New Competitors

- Our smart technology and patented locking design can be used to prevent non-Marketainer bulk bins and personal containers from interfacing with dispensers
- By investing in our system, manufacturers and retailers may incur sunk costs that would make switching to a competitor undesirable
- Our first-mover reputation will give us greater credibility if new competitors enter the market
- We will continually innovate our product line, improving our design and working to differentiate ourselves from any new competition

Rivalry Among Existing Competitors

- Due to our all-encompassing approach, our competitors are split among a variety of different industries
- The bulk bin industry is relatively diluted, which gives us an advantage as a differentiated newcomer
- The personal container sector is more concentrated and diversified, but our partnership strategy will give us a key advantage
- Competitors will likely avoid competing on price, which will allow us to optimize our profit margins

Buyer Bargaining Power

- We will initially target higher-income, eco-conscious consumers who are less sensitive to price
- Switching costs will likely be high for manufacturers and retailers, but low for consumers
- We will service a high volume of customers on the personal container side, making us less vulnerable to individual consumer decisions
- The uniqueness of our system will make substitutes for the bulk bin side difficult to find, decreasing price sensitivity
- Once our reputation is established, retailers may compete for our business, lessening their bargaining power
- We will work to understand manufacturer, retailer, and consumer needs from the start, allowing us to cultivate lasting, two-way relationships

Supplier Bargaining Power

- We will work to source competitive local suppliers to keep costs low
- However, our focus on maintaining a green supply chain may allow suppliers to cut into our margins
- Dispenser components will be sourced separately and assembled in-house, allowing us to switch suppliers relatively easily if necessary
- The basic materials and technologies required to manufacture our products are plentiful and unspecialized

Value Chain

Service

Marketainer intends to establish long-term relationships with the initial target manufacturers and retailers, and eventually consumers. We plan on being successful at this by having a responsive customer support system, and educating our internal staff on the importance of customer relations. Manufacturers and retailers should appreciate the receptiveness of our staff and our willingness to adapt to the needs of both sectors in order to facilitate the success of the our system.

Technology Development

An essential part of the Marketainer system is the development and patenting of smart dispensing technology, including the graphical user interface used by consumers. This will serve a dual purpose, ensuring shopping convenience and efficiency, and allowing Marketainer to create barriers to entry against competitors who would seek to make their own

containers that interact with our dispensers. Customers will additionally be able to use our innovative website to track their purchases, access nutritional information, recipes, and coupons, receive expiration and product recall alerts, and order customized personal containers and accessories. Marketainer also plans to eventually integrate with smart phone technology, allowing for dispensing unit interaction without needing a card, and providing a means of directly accessing the website while shopping in the store.

Human Resource Management

As Marketainer grows, it plans to recruit only the best staff and have a short but intensive training that allows for Marketainer to impart the importance of the goals, the environmental aspects of the product, and the overall benefits that can be achieved. Marketainer understands that employees are prone to work harder if they believe in the mission of the company they work for, and we plan to cultivate that mindset to reduce turnover and improve employee satisfaction. We hope that our employees' enthusiasm for Marketainer's products will clearly be visible in their interactions with customers.

Firm Infrastructure

Marketainer will begin as a small 1-2 person operation, outsourcing R&D and relying on contract labor for quality assurance and light assembly operations. As the business grows, we plan to eventually bring on experienced, qualified management, legal, PR, and quality control experts to maintain the high levels of satisfaction throughout our customer base. These new additions will add value to our products and enhance relationships with our target markets.

Willingness To Pay & Credibility

The Marketainer system will require an initial investment on the part of manufacturers, retailers, and consumers. Over time, partial if not full cost savings should be realized through resource conservation and improved efficiency to all parties. We must educate our customers, making them aware of the long-term return on their initial investment, in order to elicit the necessary willingness to pay. Our complete life-cycle approach, as well as our backgrounds in environmental science should help to establish Marketainer as a credible, innovative, efficient, and environmentally-friendly firm.

Operations Plan

Marketainer's operations will be lean and efficient, relying mostly on contract labor for on-site light assembly. We will aim for "just-in-time"

inventory management, having no more than a month's supply of dispensers and bulk bins in stock at a time. Our bulk bins will be injection molded by a third-party manufacturer and sent to Marketainer for quality assurance and further customization before delivery to customers. Electronics and hardware for the dispensing units will be ordered separately and assembled at Marketainer's facilities, allowing us to ensure that they meet our high quality standards before being shipped to retailers. Finally, we will license out personal container production to a partner firm with strong core competencies in container manufacturing, such as Tupperware. This will enable us to generate an additional revenue stream without making any changes to our existing operations.

The Market

Market Research

To better understand the pain points and preferences of our target markets, we gathered information on the drivers and barriers for consumer bulk adoption in the US. We conducted numerous interviews with retailers, distributors and manufacturers over the past year (Appendix I). By providing insight into their experience with bulk distribution, these companies gave us a detailed look at the perceived advantages and disadvantages of using bulk systems. We were also able to gather feedback on design, which we incorporated into the development of the Marketainer system. Some of the most common suggestions included creating a convenient, user-friendly system that easily integrates into the existing infrastructure, keeping the technology simple, putting a high priority on maintaining product integrity, and providing an array of accessories.

Manufacturers were particularly integral in determining the design of the Marketainer system. Through interviews with product manufacturers, we gained an understanding of the logistics involved in packaging and transporting consumable products. This input helped us determine that minimizing storage space is an ongoing concern, and thus the collapsibility of Marketainer bulk bin became a design priority. Simplified reverse logistics and maintaining a high level of sanitation were also important issues. Our team also learned that reusable bins used to transport goods from manufacturers to retailers are already in place in some supply chains.

Interviews with retailers enabled us to gain insight into existing bulk retail operations, as well information on how consumers interact with current bulk systems. These interviews revealed that there is already a strong contingency of consumers who prefer shopping in bulk sections. Retailer concerns included reducing man-hours spent maintaining bulk sections and streamlining the bagging and check-out process (also beneficial to

consumers). They also noted that the best integration might be done with in-house brands, where retailers have more control over the supply chain. We were also able to determine which products are most effectively sold in bulk, and which ones can be improved upon. Many retailers noted that the Marketainer system has the potential to offer improvements in all of these areas. Finally, we spoke with retailers who do not offer bulk items to better understand their reluctance.

In addition to market interviews, we conducted a literature review verifying the basic assumptions behind the Marketainer venture (Appendix J). The information collected through these sources was also incorporated into the design of the Marketainer system. Once Marketainer is placed in stores, further manufacturer, distributor, retailer and consumer feedback will be sought in order to determine the best course of future product innovation.

Target Market

We realize that, although the cost savings associated with decreased packaging are a big selling point, there is a higher likelihood of initial adoption in the eco-minded market. Understanding that this is a smaller base of manufacturers, retailers, and consumers, we predict the growing environmental consciousness of consumers and businesses will determine growth in our sales and market size as the Marketainer system is adopted.

The initial target market for our bulk bins are industrial manufacturers of bulk flowable liquids and solids that are sold at health food, natural, or organic retailers and do not require refrigeration (e.g. granola, grains, nuts, honey). Most of these manufacturers run small to medium-scale operations, and are eager to gain market share by greening their image. Many have a previous record of exploring alternative packaging options, so they are receptive to modifying their packaging strategy. However, most still rely on single-use plastic bags and corrugated cardboard boxes to ship their products. We have identified over 6,000 companies that fall into this category in the US.[9] Furthermore, over 1,100 of these manufacturers operate from California alone, 80 of which we already have immediate access to as a result of our relationship with UNFI, a leading bulk distributor.

This customer concentration will allow us to adopt a regional marketing strategy in the early stages of our venture. Additionally, these manufacturers sell primarily to eco-conscious retailers and consumers, a growing market which will appreciate the reduced environmental impact of our system in addition to the cost savings. We will market our labor-saving dispensing units to retailers that are supplied by our target manufacturers, and therefore already have competency in selling bulk products. They are particularly interested in innovating the bulk shopping

experience to increase demand and enhance their environmental credibility. Target personal container consumers are loyal to these retailers, and tend to be more conscientious of the products they buy, desiring goods with lower environmental impacts.

As we establish a foothold in the bulk food market, we plan to expand into additional product categories (e.g. ranging from cleaning products to nuts and bolts). To give an idea of the potential market size for our bulk bins and dispensers, Trade Fixtures (a major competitor) estimates that they have over 1 million bulk dispensing units in the market today, revealing that their market size alone exceeds $200 million.[6] Since Marketainer's goal is to expand the market demand for bulk systems into new demographics by addressing common reasons for consumer aversion to such systems, we believe our potential market to be in the billion dollar range. This is particularly feasible considering that our system can eventually be used for all flowable liquids and solids, appealing to retailers ranging from Wal-Mart to Home Depot, whereas Trade Fixtures currently deals almost exclusively with health food stores.

Sales and Marketing Plan

Marketainer plans to launch a comprehensive, multi-tiered marketing campaign to reach manufacturers, retailers, and consumers. Interviews with retailers, manufacturers, and distributors (Appendix I) helped us craft an effective marketing strategy. To reach its target market, Marketainer will commit to educating manufacturers, retailers, and consumers about the economic and environmental impacts of disposable packaging waste, and steps they can take to reduce their footprints, presenting Marketainer as a solution. This educational component would be delivered directly via in-store display kiosks, and through an aggressive online marketing campaign. Marketainer will additionally rely upon the marketing power of retailers who have chosen to adopt our system, as they stand to profit from the sales of our personal containers and encouraging customers to purchase items from our bulk bins. If we choose to license out the production of our personal containers, the licensee (e.g. Tupperware) would have a large stake in moving units, and would also be expected to put marketing dollars behind our system.

The Marketainer team believes that the most reasonable way to approach the implementation of our system is to pursue a direct marketing strategy that targets bulk product manufacturers first. This is due to the fact that many manufacturers have already shown a desire to pursue alternative packaging options, our bulk bins can be used with or without the implementation of Marketainer dispensers at the retail outlet, and it is easy to demonstrate how much money can be saved by avoiding the use of disposable packaging. Our marketing mix decisions are outlined below.

Price

List Price

List price for the bulk bins is expected to be $75 per unit. This is in line with our competitors' reusable plastic containers, which range from $50-100.[8] To give another reference point, an equivalent amount of disposable cereal packaging would cost an estimated $1.21 for a bulk version of the product, and $4.44 for a boxed version.[10] Even including the cost of sanitization and additional fuel required for reverse logistics, our bulk bins are more cost-effective than the current bulk cereal packaging after 97 uses, and they are more cost-effective than boxed cereal after only 20 uses (Appendix B). Given their warranty period of 250 uses or 5 years, our reusable bulk bin is an extremely smart investment for manufacturers.

Our dispensing units will be priced at $200 per unit, slightly more expensive than current bulk dispensers, which run for $150 per unit. This is largely due to the weight and volume sensors, LCD screen, and other electronics, which do not exist in most current dispensing units. Despite the higher price, our unit offers an estimated 3 minutes per stocking cycle labor savings over current bulk dispensers which, over the course of the 5 year dispenser lifetime adds up to approximately $500 in labor savings per unit.[8] Accounting for the cost of electricity to power our dispenser, its purchase can result in a net gain of around $280 over its lifetime when compared to current bulk, whereas a conventional dispenser would result in a net loss of $150 in the same timeframe (see Appendix B for specific labor and electricity figures).

Personal containers will be sold at a target price of approximately $3 per unit. As noted above and in Appendix B, consumers who switch from buying conventional boxed cereal to bulk cereal using a Marketainer personal container can actually recoup the cost of the container after only a single visit to the store.

Discounts and Bundling

Manufacturers ordering bulk bins will receive a small discount for every 100 units they order. Retailers will receive discounts (including reduction or waiving of installation fees) for every 15 dispensing units they order. Sizable discounts on bins may be offered to manufacturers for each retail vendor they convince to adopt our dispensing units. Similarly, retailers who convince their suppliers to convert to our reusable bulk bins will receive discounts on dispensing units.

Special incentives can be offered to retailers who manufacture their own in-house brands. If such a retailer were to order a large number of

dispensing units, for example, they may receive a number of bulk bins free of charge.

Personal containers will be offered individually, or as part of "kits." These kits will include a durable, customized, carrying bag with pockets specially sized for a variety of different Marketainer personal containers. Consumers who choose to buy personal container kits will pay less than those who buy each container individually.

Distribution

We will market and sell bulk bins directly to product manufacturers. Sales will rely heavily on the relationships we establish with manufacturers, and on our networking ability. As manufacturers are pleased with our products and their relationship with us, we hope that they will recommend Marketainer to the retailers they supply. By cultivating direct sales relationships and providing personal service, Marketainer will not only gain sales revenue directly, but will build its reputation to secure future sales opportunities.

The special discounts mentioned above can be used to motivate sales, but other than that, the direct marketing strategy does not require conventional distribution channel management. Marketainer will not need to expend any resources evaluating distributors or maintaining show rooms. However, it will need to manage sales logistics. In line with its core values, Marketainer will aim to be efficient, balancing a "just-in-time" supply chain management strategy with keeping a strict order-fulfillment schedule.

Once our reputation has been established and retailers have begun to request dispensing units, we will work directly with them as well to create successful manufacturer-retailer pairings. As customers are exposed to Marketainer dispensing units in stores, demand for personal containers will develop. At this point, Marketainer will introduce its personal container kits, selling them via retailers (positioned in the bulk section, near the dispensers) and online through its website, offering a variety of customizable models.

Promotion

Promotion will require presence in several areas to get the Marketainer message out to potential customers. Within the packaging industry, there are several trade shows at which we can exhibit. Such shows include the annual Sustainability in Packaging Expo and the Credit Suisse Global Paper and Packaging Conference. Other shows include restaurant and food service expos where we can directly market to and make contact with potential customers. We will be able to advertise directly to potential

retailers by using full-page advertisements in trade journals, industry newsletters, and other publications, such as the Cooperative Grocer Magazine which is distributed to food cooperatives throughout the US.

In order to relieve pressure on our advertising funds, we hope to gain publicity via media outlets such as NPR and CNBC, as they both frequently run spots on new, eco-conscious businesses. As Marketainer grows, and the personal containers are brought to market, we will explore paid radio and television advertising options. Marketainer will also pursue a focused online marketing campaign using targeted advertisements on environmental, food, and health websites in order to create consumer awareness. Finally, Marketainer will gain further visibility by joining trade associations, such as the Reusable Packaging Association and the Sustainable Packaging Coalition.

Key Marketing Strategies

Education

Most people are unaware of the amount of resources consumed throughout the life-cycle of disposable packaging, and its subsequent economic and environmental footprint.[5] We believe that by empowering consumers, retailers, and manufacturers with this knowledge, the demand for closed-loop bulk systems will increase. The main points that we will work to convey include the cost savings, environmental benefits, and additional advantages (e.g. sanitation, freshness, and convenience) of using the Marketainer system. This will allow consumers to not only feel good about the money they save by using our products, but that they are doing their part to save the earth as well. The educational component will be available via in-store displays, online, in magazines, and at trade shows.

Harnessing Client Marketing Power

As the Marketainer system is adopted and gains credibility, it will create a marketing chain reaction throughout the supply line, allowing us to utilize compliant manufacturers to reach initially hesitant manufacturers and retailers. Manufacturers who utilize our bulk bins will encourage retailers to adopt the dispensing units, as it saves on labor costs and allows the manufacturers to increase their brand presence. Conversely, powerful retailers (such as Wal-Mart) who are interested in the Marketainer system possess the ability to leverage both suppliers and consumers, encouraging them to buy into Marketainer as well. Retailers who sell our personal containers have a dual stake in encouraging customers to use our system: it maximizes the convenience and labor-saving benefits that the Marketainer system offers, and it generates profits for them directly. By

taking advantage of the marketing infrastructure that's already in place, Marketainer will capture a larger amount of market share with less effort.

Networking

The relationships that we establish with other organizations during each phase of our business plan development will serve as excellent points of contact for future sales. Since we are designing the Marketainer system with the input of specific retailers and manufacturers, they would likely be our first wave of customers, as our product will perfectly suit their needs. We will also explore green business, packaging, and other trade associations, and forge connections by attending trade shows. We will pursue a direct sales strategy, working with manufacturers and retailers on a personal level to ensure that we are indeed reducing their costs and improving their environmental credibility over the long term. As our system is successfully adopted, our reputation will generate the momentum we need to make future sales and strengthen our position in the marketplace.

Online Campaign

Marketainer will maintain a high-profile online presence through targeted advertisements on environmental, food, and health websites in order to reach every level of customer. In addition, our website will boast a variety of features to maximize transparency of our processes, educational value, and customer involvement. The site will be split into two areas: one geared towards manufacturers and retailers that highlights the ways in which Marketainer can help them realize their triple bottom line, and the other designed to get consumers excited and allow them to design and order their own customized personal containers. We will also offer samples of our complete interactive website, so potential consumers can experience the enhanced product information and pantry inventory capabilities they will have access to once they buy into the Marketainer system.

Business Model

The Marketainer business model is based upon the patenting of our innovative system and the profitability of licensing rights. Our dispensing unit will be protected by an internationally prosecuted utility patent, while we plan to file for design patents on our bulk bins and personal containers -- particularly on the way that they lock into our dispensing unit. We will initially outsource the production of the bulk bins and dispensers, and limit operations at our primary facility to quality-assurance and light assembly, allowing us to save money on land, labor, and capital.

Bulk bins will be marketed and sold directly to product manufacturers. Dispensers will be offered to retailers with the option to either buy or lease. Marketainer will be responsible for providing training on how to maintain the dispensers, and issue a 100% guarantee on the product. As mentioned above, we hope to license out the personal container production to a partner firm with core competencies in this area. Tupperware, for example, already has a strong presence in the market and a proven ability to mass-produce similar items. The benefits of licensing our product to an established company are twofold: we gain a revenue stream from the licensing deal, and we capitalize on the existing marketing power of a business of this magnitude.

Marketainer understands that there is a unique opportunity to create a behavioral shift that truly reduces our impact on the environment while offering economic incentive to do so. Realizing that this shift will take time, Marketainer aims to phase its system in one step of the supply chain at a time. As manufacturers enjoy the benefits of Marketainer bulk bins and are able to attest to the benefits of the new system, our dispensing units will be offered to the retailers that they supply. In turn, retailers will begin to demand that other products in their catalog be offered in Marketainer bins. Once the shift has begun on the back-end of the supply chain, more mainstream consumers can be introduced to the system, creating demand for personal containers. This approach will allow us to steadily integrate our system into the market, catalyzing the sustainable packaging revolution, with Marketainer in the vanguard.

Exit Strategy

Plan A: Acquisition

The most likely exit would be through sale to a major retailer or packaging company.

Plan B: IPO

Going public guarantees the company’s continued commitment to environmental protection. However, current economic and regulatory conditions may make this option difficult.

Financials

Basic Timeline

- Year 1: Heavy R&D, intellectual property (IP) filing, proof-of-concept test run with a single manufacturer and retailer -- 1 employee working from home office with limited contract labor

- Years 2-3: Selling to 5-8 manufacturers and numerous retailers, personal containers introduced to market -- 2 employees and contract labor working from medium-sized office
- Years 4-5: Expand bulk bin sales to 30+ manufacturers in a variety of product categories, dispensers widely adopted by retailers -- 5 employees and contract labor running light assembly operation in large building

Basic Assumptions

- Bulk bins: sold directly to manufacturers for $75 / unit after Year 1 prototype run
- Dispensers: sold directly to retailers for $200 / unit after Year 1 prototype run
- Personal container: production licensed out, with 4% of gross revenue (sale price $3 / unit) collected as licensing fees
- Employees paid $50 thousand / yr. salary, contract labor paid $15 / hr. wage
- Labor, variable manufacturing overhead, product liability insurance 10%, 2%, 1% of sales, respectively
- Marketing and transportation 3% of sales
- Total IP costs over 5 years: $38.5 thousand (3 patents, prosecuted internationally)
- Total R&D costs over 5 years: $172.5 thousand

Financial Summary

Given the above assumptions, our current financial model indicates that break-even will occur midway through Year 2. Total sales are expected to exceed $1 million towards the start of Year 3. By the end of Year 5, Marketainer will achieve an operating profit margin of 43%, with operating expenses as a percent of sales at an efficient 16%. See Appendix C for the complete financial analysis, including 5-year proforma income statements, cash flow statements, and balance sheets.

5-Year Revenues	$7,624,000
5-Year Costs	$4,890,840
5-Year EBIT	$2,733,160
5-Year Net Profit	$1,502,930
Venture Funding	$250,000
Potential ROI	501%

Table 1: 5-Year financial summary

Funding

Marketainer is initially seeking $50 thousand to refine the design of its products and pay for patent-related legal fees. After this, Marketainer

hopes to secure an additional $200 thousand (either through partnership with a manufacturer or retailer, or through angel investment) to fund the initial proof-of-concept bulk bin and dispensing unit production run. Marketainer will avoid debt financing, relying exclusively on initial equity and profits to fund its expansion. Once its system has been successfully implemented, Marketainer may consider a third round of funding (either from additional partnerships or venture capital) to accelerate growth.

Appendix A: Life-Cycle Assessment

Goal and Scope Definition

Through an attributional life-cycle assessment (LCA), we analyzed and compared the cradle-to-grave environmental impacts of single-use disposable packaging, current bulk packaging, and the proposed Marketainer reusable packaging system. We additionally compared different materials for the Marketainer system in order to help us design a viable product with minimal environmental impact. The results of this study will be used to educate flowable solid and liquid product manufacturers, distributors, retailers, and consumers on the environmental impact of different packaging systems.

The scope of the attributional LCA was limited to cereal packaging systems, and in particular those used by Golden Temple of Oregon, LLC (GT), located in Eugene, OR. Our study compared the environmental impacts of GT using the three different packaging systems to ship their cereal to the Isla Vista Food Cooperative (IVFC) in Isla Vista, CA, and then on to the end-use consumer. Additionally, we compared the impact of manufacturing the Marketainer bulk bins and personal containers out of four different materials: high-density polyethylene (HDPE), polyethylene terephthalate (PET), polypropylene (PP), and polylactide (PLA), also known as “bioplastic.”

Function and Functional Unit

The function of the three packaging systems is the safe delivery of 1 kg of cereal from the manufacture (GT) to the retailer (IVFC) to the consumer. The functional unit for this study is to contain, protect, and convey 1 kg of cereal through the supply chain.

(Continued on next page.)

Reference Flows

The relevant reference flows for each of the three systems are broken down in Table A-1 below:

System	Per Packaging Unit Mass (kg)	Cereal Conveyed Per Unit (kg)	kg Packaging / kg Cereal *	Durability (# of Cycles)	kg Mat. Prod. and EoL Processing / kg Cereal **
Disposable (Case)	0.4	4.992	0.0801	1	0.0801
Disposable (Carton)	0.055	0.416	0.1322	1	0.1322
Disposable (Inner Bag)	0.008	0.416	0.0192	1	0.0192
Disposable Total	N/A	N/A	0.2316	N/A	0.2316
Current Bulk (Case)	0.56	11.34	0.0494	1	0.0494
Current Bulk (Large bag)	0.08	11.34	0.0071	1	0.0071
Current Bulk (In-Store bag)	0.01	0.5	0.0200	1	0.0200
Current Bulk Total	N/A	N/A	0.0764	N/A	0.0764
Marketainer (Bulk Bin)	3.356	13.44	0.2497	250	0.0010
Marketainer (Personal Container)	0.245	0.94	0.2606	250	0.0010
Marketainer Total	N/A	N/A	0.5103	N/A	0.0020

Table A-1: Reference Flows

* Relevant for transportation and sanitization processes (when applicable)
** Relevant for material production and end-of-life processes

Note: Calculations assume a cereal density of 0.4177 kg/L, and that the Marketainer bulk bin and personal container are made of 100% PP. These values comprise the “Estimate Case” scenario, with data on disposable and current bulk systems coming from GT. See the Methodology section for more information on the scenarios modeled.

Supply Chain Overview

Our analysis of the three supply chains begins with the manufacture of packaging (either disposable or reusable) and ends with the end-of-life management of the discarded material. The Marketainer system requires additional reverse logistics and sanitization that are not modeled for the other two systems.

GT's cereal is marketed under the brand names Peace Cereal (boxed) and Golden Temple Bulk Granolas (bulk). All products are distributed by United Natural Foods, Inc. (UNFI) to retailers, in this case via truck from Eugene, OR to Isla Vista, CA, by way of their Moreno Valley, CA distribution center. The trucks do not return empty to the manufacturer and the freight logistics are handled by UNFI.

See the process flow diagrams for disposable, current bulk, and Marketainer systems (Figures A-1, A-2, and A-3) for a detailed illustration of how each supply chain was modeled.

Methodology

We conducted an LCA on all three supply chains using PE International's GaBi 4.3 Professional software. We modeled each supply chain using processes from the PE and EcoInvent databases (favoring the latter, as it is typically the most up-to-date), as well as a number of our own processes constructed from data gathered from literature, as well as information collected from GT,[10] UNFI,[11] and IVFC.[8]

We comprehensively parameterized our models to allow for sensitivity analysis. By calculating impacts for a range of different values, we were able to construct and report results for three different scenarios: the "Estimate Case" (which uses the most accurate numbers available), the "Worst Case" (i.e. with values resulting in a relatively high environmental impact), and the "Best Case" (i.e. with values resulting in a relatively low environmental impact). See Table A-2 for a complete list of assumptions, and how they vary between the three scenarios.

Boxed Cereal System

The GaBi process plan for the boxed cereal system is shown in Figure A-4. See Table A-2 for detailed numerical assumptions.

Key data:

- Inner bag is 2/3 HDPE by mass (1/3 actual HDPE, 1/3 EVA peel seal, which is likely HDPE) [GT]
- Inner bag is 1/3 nylon by mass [GT]
- Carton is 0.020 clay-coated newsboard (CCNB) (Recycled) [GT]
- Carton case is single-wall corrugated cardboard [GT]
- Average net weight of cereal per carton is 0.416 kg (this value actually ranges from 0.283 - 0.454 kg, depending on the product type) [GT]
- There are 12 cartons (around 4.99 kg of cereal) per case [GT]

Our assumptions:

- "Whitelined chipboard" is a reasonable approximation of "clay-coated newsboard"
- Gravure printing is used to print the cartons
- The inner bag is produced by plastic film extrusion
- Resources used to initially fill the packaging with cereal are comparable to those required for current bulk and Marketainer systems, and are therefore ignored

Current Bulk System

The GaBi process plan for the current bulk system is shown in Figure A-5. See Table A-2 for detailed numerical assumptions.

Key data:

- Bulk bag is PP [GT]
- Bulk case is single-wall corrugated cardboard [GT]
- Average net weight of cereal per bulk case is 11.340 kg [GT]
- Individual bag is PP [IVFC]

Once the bulk cereal arrives at IVFC, additional packaging is required to transport the cereal from the store to the consumer's home (i.e. use phase). Although the use of reusable containers is on the rise, according to IVFC, most consumers still use small disposable plastic bags for this transport process.

Our assumptions:

- The bulk and individual bags are produced by plastic film extrusion
- Resources used to initially fill the packaging with cereal are comparable to those required for boxed cereal and Marketainer systems, and are therefore ignored

Marketainer System

The GaBi process plan for the Marketainer system is shown in Figure A-6. Manufacturing and sanitization plans are shown in Figures A-7 and A-8. See Table A-2 for detailed numerical assumptions.

Our assumptions:

- The bulk bin and personal container can be manufactured from any combination of HDPE, PET, PP, or PLA, but they're assumed to be 100% PP for the comparison between the three systems
- The bulk bin and personal container are produced by injection molding, regardless of material composition
- Resources used to initially fill the bulk bin with cereal are comparable to those required for boxed cereal and current bulk, and are therefore ignored
- The bulk bin and personal container are filled to capacity
- The dispensing unit consumes electricity at a rate determined by its wattage and the number of hours per day it is in use
- Tap water is sufficient for a sanitization facility, and sterilization requires 0.45 kg of water per kg of container
- Sanitization requires enough thermal energy (assumed to be from natural gas) to heat the water from 295 K to 407 K

Transport

Transportation is modeled in the GaBi process plans for all three systems, shown in Figures A-4, A-5, and A-6. See Table A-2 for detailed numerical assumptions.

Key data:

- Trucks meet Euro 4 emissions standards[12]
- Sulfur content in diesel fuel is 15 parts per million (ppm)[13]
- Trucks can haul a maximum load of around 18,650 kg [GT]
- UNFI keeps its trucks full whenever possible, and optimizes transportation logistics [UNFI]
- Empty pallets each weigh 22.680 kg [GT]
- Boxed cereal: 63 cases per pallet, 30 pallets per truckload (12,295 kg total) [GT]
- Bulk cereal: 50 cases per pallet, 30 pallets per truckload (18,650 kg total) [GT]

Our assumptions:

- The Marketainer bulk bin is densely packed such that, like current bulk, they achieve a 1.00 utilization ratio by mass from GT to IVFC
- Transport from IVFC to the use phase (i.e. via the consumer's car) is assumed to be the same regardless of the system used, and is therefore excluded from the model
- Transport from initial packaging production plant to GT is estimated to be the same for all components of packaging (e.g. Marketainer bulk bin, current bulk cardboard case, boxed cereal inner bag)
- For the current bulk system, impact of transporting waste from IVFC to end-of-life is the same as from consumer (use-phase) to end-of-life
- In the Estimate Case, the reverse logistics distance traveled of the Marketainer bulk bin is 50 km farther than from GT to IVFC to account for the sanitization facility being out of the way
- In the Best Case, the reverse logistics distance traveled of the Marketainer bulk bin is set to zero because it assumes that the truck would have traveled back to GT with or without it
- The Worst Case distance is significantly longer than the Estimate Case because it assumes that the sanitization facility is far out of the way

End-of-Life

End-of-life (EoL) management GaBi process plans are shown in Figures A-9 and A-10. See Table A-2 for detailed numerical assumptions.

Our assumptions:

- Waste packaging is sent to the landfill, incinerated, or recycled

- Transportation logistics during the EoL management phase are assumed to be the same regardless of the system used, and are therefore excluded from the model
- Unlike disposable packaging, the Marketainer system is designed to be recycled easily, so its recycling rate is significantly higher

The impact of recycling was not actually accounted for in this study. See System Boundaries and Limitations for more information.

System Boundaries and Limitations

Creation of production, sanitization, and end-of-life facilities was not modeled, nor were human labor inputs. Our analysis does not include the production or end-of-life impacts of the Marketainer dispenser or the current bulk dispenser. These components are estimated to have a relatively long lifespan, so we felt they would be beyond our cut-off criteria on a per-kg-cereal-dispensed basis. These processes could be modeled in future versions of the study, however. Additionally, it would be beneficial to gather more accurate power consumption data on the Marketainer dispenser, perhaps dividing operation into standby and active power modes.

We did not account for the resources required in the upkeep of the current bulk system (e.g. energy, water, and soap used for sanitization). The sanitization processes modeled for Marketainer did not include any soaps or detergents, and it was modeled primarily based on the water and electricity usage of industrial dishwashers. The study could be improved by acquiring data from an actual sanitization facility capable of sterilizing large bulk bins.

Although cereal requires no refrigeration, the trucks that UNFI uses for distribution are typically refrigerated. We did not account for this in our model, but it would likely increase the impact of all three systems due to additional energy consumption and the use of refrigerants (particularly for boxed cereal, as it has a low packing density). Some potentially important transportation steps were not included in this analysis:

- From raw materials to packaging production for all packaging materials
- From packaging production to IVFC for in-store bulk bags
- From production to use-phase, and use-phase to end-of-life for Marketainer personal container

Due to data limitations, our analysis was conducted up to the production of post-consumer recyclable materials (i.e. it does not model recycling directly, instead diverting recyclable waste into an elementary flow). We made this decision because we were unable to find any processes that

reliably model cardboard recycling. Our goal was to compare the three systems on equivalent standing and, despite building the capability into our models, we felt that it would not be good practice to include the impacts of recycling non-cardboard materials while excluding the recycling of cardboard. The landfilling and incineration aspects of the end-of-life management plan are limited as well, sending all waste to generic processes, rather than splitting it up by material composition.

Finally, the PE and EcoInvent processes used in our models were generally European in origin, as the US has invested very little in the collection of LCA data to date. This introduces additional sources of uncertainty, as environmental standards and regulations differ between the two regions.

Environmental Impact Indicators

We evaluated the environmental impacts of the three systems using the CML 2001 impact assessment criteria (updated December 2007, consistent with ISO 14040). Our assessment calculated impacts in the following ten categories, with the indicated units:

- Abiotic Depletion Potential (ADP) [kg Sb-Equiv.]
- Acidification Potential (AP) [kg SO2-Equiv.]
- Eutrophication Potential (EP) [kg Phosphate-Equiv.]
- Freshwater Aquatic Ecotoxicity Potential (FAETP) [kg DCB-Equiv.]
- Global Warming Potential (GWP) [kg CO2-Equiv.]
- Human Toxicity Potential (HTP) [kg DCB-Equiv.]
- Marine Aquatic Ecotoxicity Potential (MAETP) [kg DCB-Equiv.]
- Ozone Layer Depletion Potential (ODP) [kg R11-Equiv.]
- Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]
- Terrestrial Ecotoxicity Potential (TETP) [kg DCB-Equiv.]

Results

The first part of our analysis compared four different potential material compositions of the Marketainer bulk bin and personal container. Estimate Case values were used, and the impacts were analyzed for 100% composition for each of the four materials. PP had the least impact in every category, followed closely by HDPE. Both PLA (bioplastic) and PET had significantly higher impacts, particularly in EP, HTP, MAETP, and TETP. See Table A-3 and Figure A-11 for details.

It should be noted that these results track closely with the density assumptions for each of the four materials, since height, length, width, and thickness are held constant for all material types (Table A-2). To improve this analysis, thickness in particular should be modified depending on the properties of the material. When comparing the Marketainer system with boxed cereal and current bulk, we decided to use

100% PP as our material of choice, because our research suggested that it is the most commonly used material for products like the bulk bin and personal container.[14]

Among the boxed cereal, current bulk, and Marketainer systems, Marketainer was the clear leader. For the Estimate Case and Best Case, Marketainer had the lowest impact in all ten indicators. For the Worst Case, Marketainer was the lowest in every category except ODP, where it was only slightly outperformed by current bulk. See Table A-4 and Figures A-12, A-13, and A-14 for details.

Breaking down each system's impacts by life-cycle phase -- production, transportation, and end-of-life for boxed cereal and current bulk, and those three categories plus sanitization and use (i.e. power consumed by dispensers) for Marketainer -- provided further insight into how the impacts were distributed for the Estimate Case. For boxed cereal and current bulk, the vast majority of the environmental impacts came from production and end-of-life. The impacts of the Marketainer system were distributed more evenly, but transportation generally proved to be the most significant. See Table A-5 and Figures A-15, A-16, and A-17 for details.

In all three cases, ADP, AP, GWP, and POCP were consistently the indicators with the smallest difference among the systems, ranging from a factor of 1.04 to 4.94 higher for bulk and 2.31 to 15.93 higher for boxed, when compared to Marketainer. According to the phase breakdown, transportation contributed more to these indicators than to any others. Within the models, transportation was relatively consistent between all three systems (unlike production and end-of-life) so it is to be expected that the associated impact categories would be in line with one another.

In the three scenarios, EP, FAETP, HTP, MAETP, and TETP demonstrated the highest variation, ranging from a factor of 3.38 to 208.69 higher for bulk and 9.65 to 759.51 higher for boxed, when compared to Marketainer. For bulk and boxed systems, these impact indicators were by far the most affected by end-of-life activities (with the notable exception of TETP, which was most affected by production). As previously mentioned, recyclable material in this analysis was treated as an elementary flow (i.e. actual recycling was unaccounted for). Recycling rate assumptions for the Marketainer bulk bins and personal containers ranged from 70-90% -- since the Marketainer system is designed for easy recycling -- while rates for bulk and boxed packaging ranged from 0-10%, in accordance with the 2007 EPA Municipal Waste Report.[15] Thus, some amount of the variation in these indicators is likely due to the fact that only 3-15% of the Marketainer products were assumed to be landfilled and 0-5% were assumed to be incinerated, while these ranges were 80-100% and 0-10% respectively for boxed and bulk. However, the most important factor

remains the minuscule size of the Marketainer system’s end-of-life flows, since each bin and container is assumed to be reused 50 to 450 times before disposal.

ODP behaved differently than the other indicators: the bulk value was 0.50 to 4.88 times the Marketainer value across the scenarios, while the boxed value was 5.55 to 49.20 times the Marketainer value. The phase breakdown reveals that packaging production was the activity that contributed most to ODP for all three systems -- over 95% for bulk and boxed, and over 40% for Marketainer. The variations in this indicator are therefore most likely a result of packaging material choices and energy consumed during its production.

Process Flow Diagrams

Note: Processes in parenthesis indicate that they were outside the scope of this analysis.

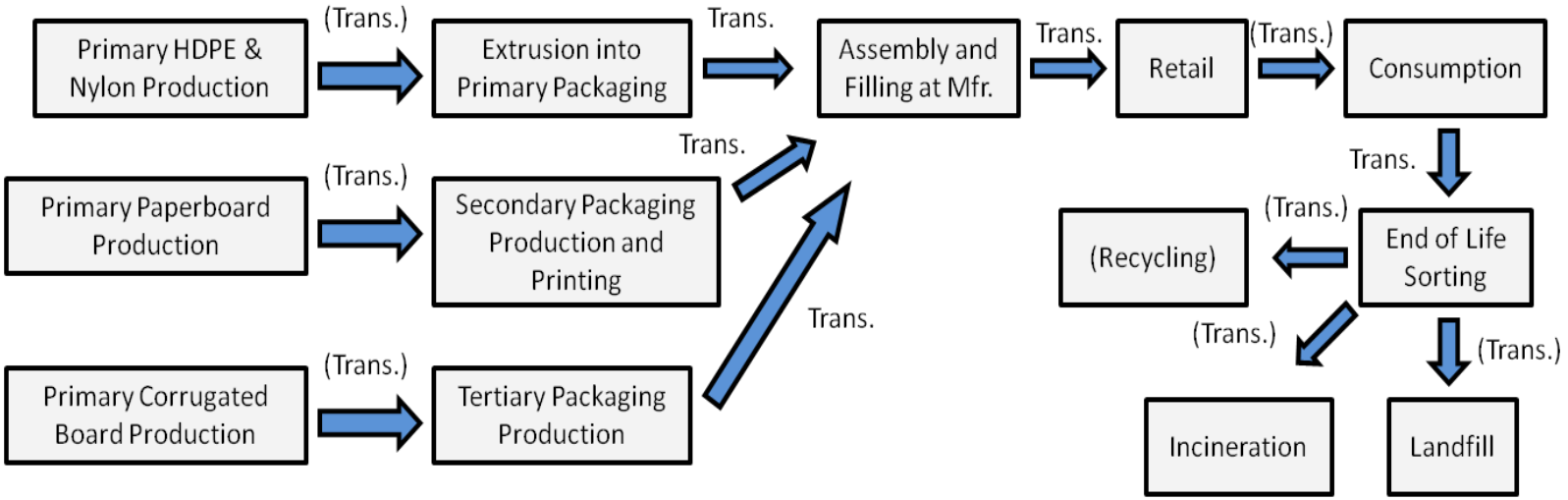

Figure A-1: Boxed cereal system process flow diagram

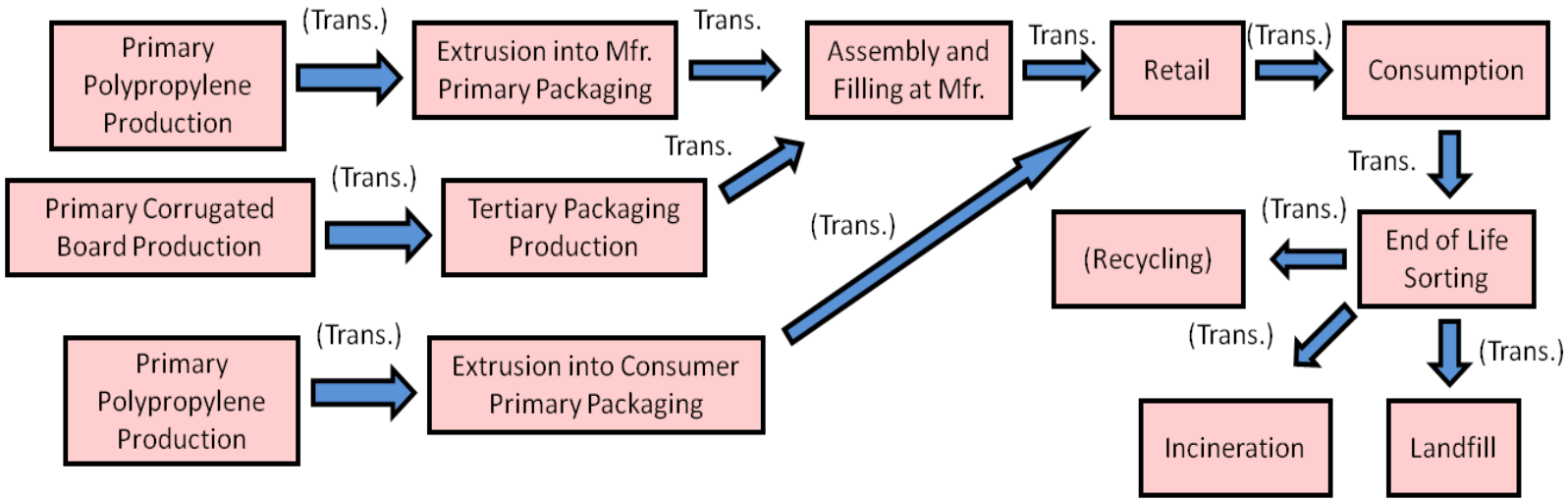

Figure A-2: Bulk cereal system process flow diagram

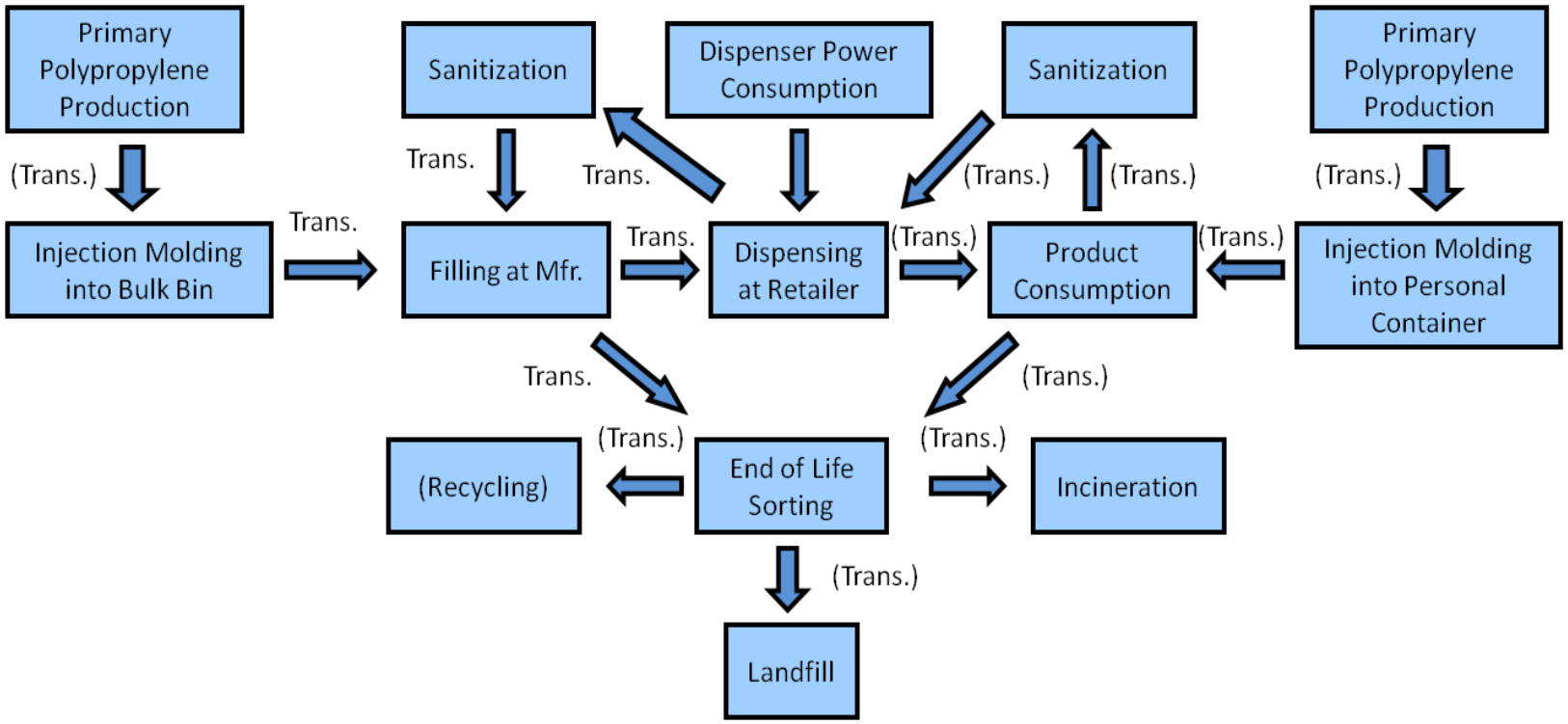

Figure A-3: Marketainer system process flow diagram

GaBi Process Plans

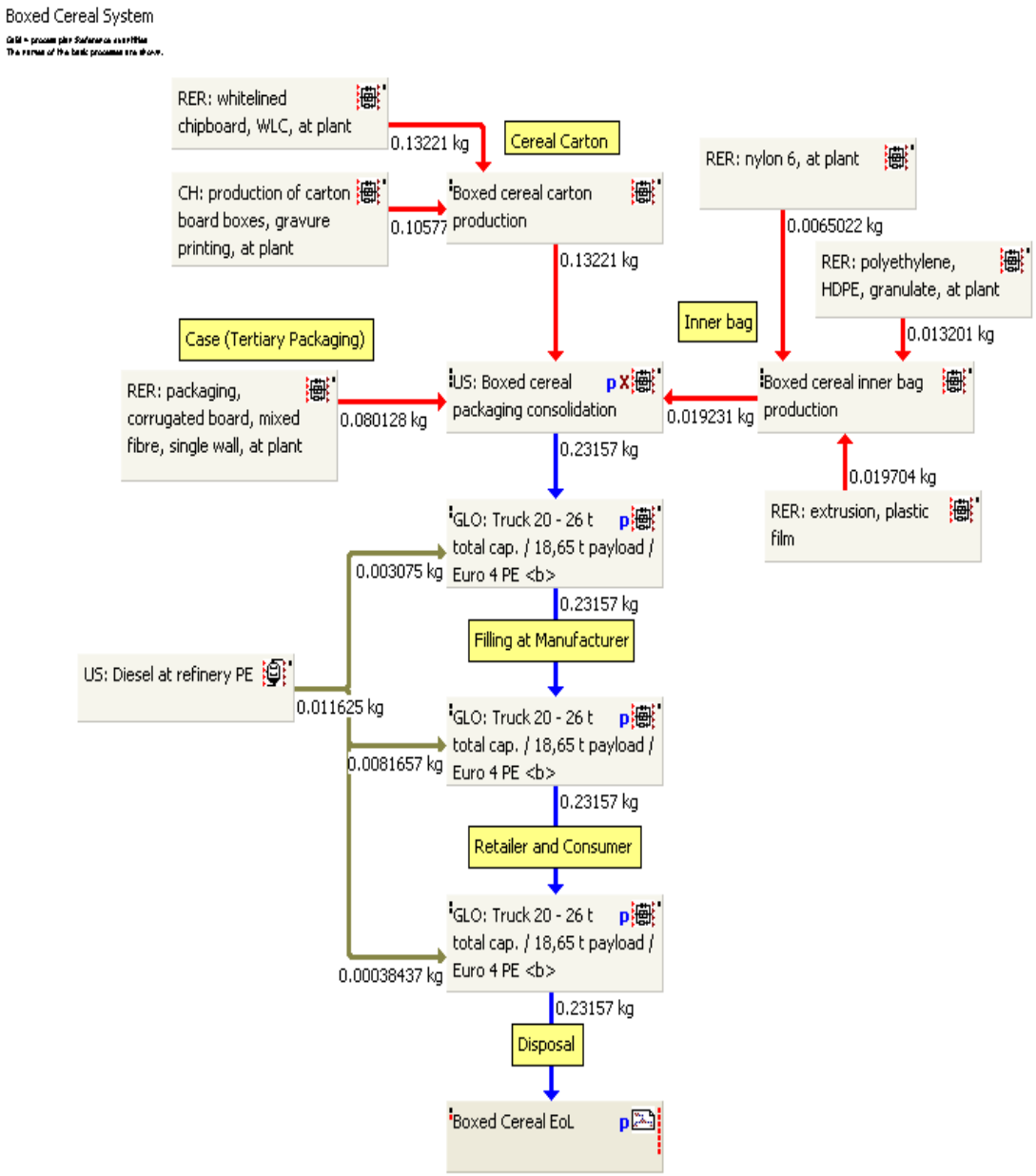

Figure A-4: Boxed cereal system GaBi process plan

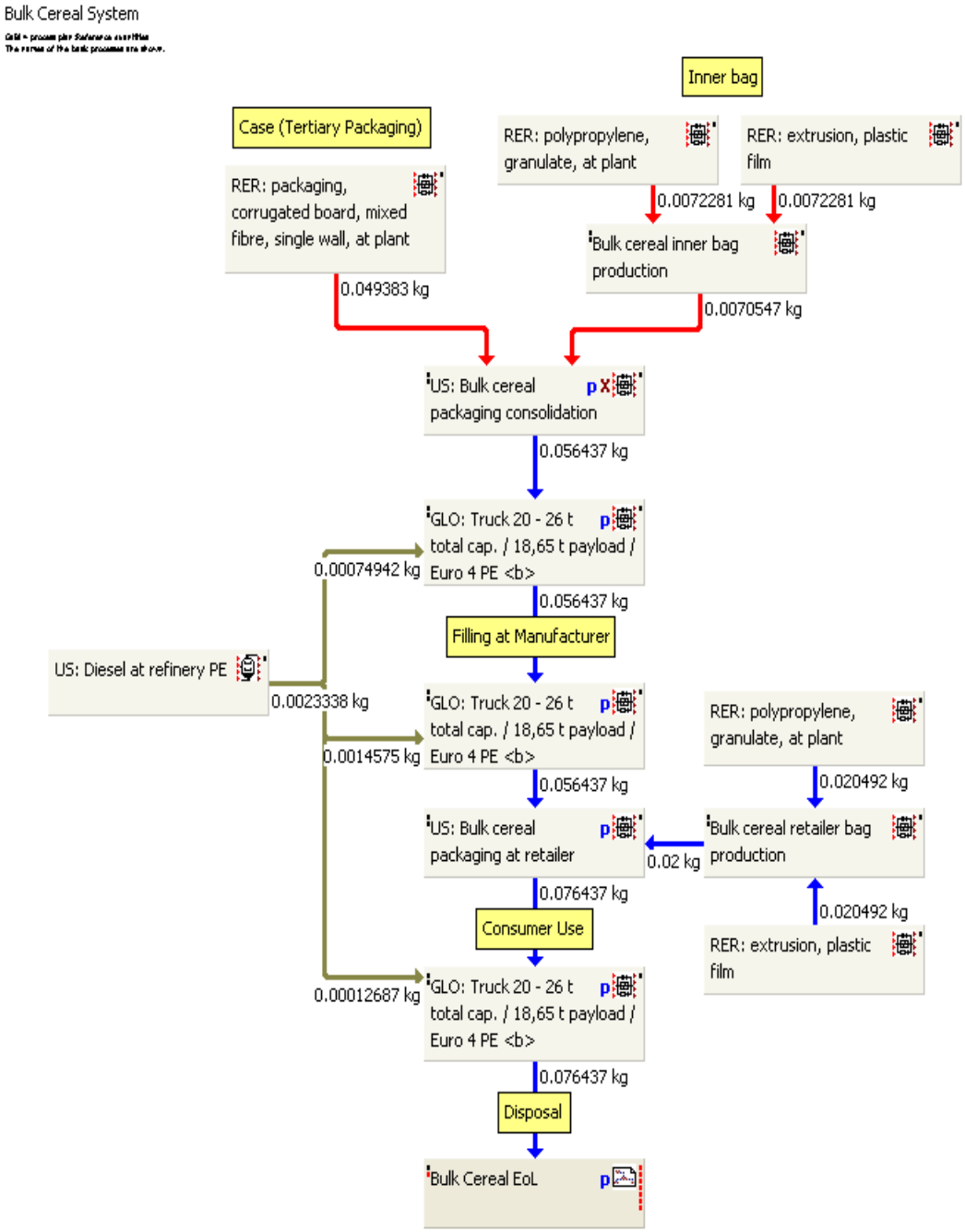

Figure A-5: Current bulk system GaBi process plan

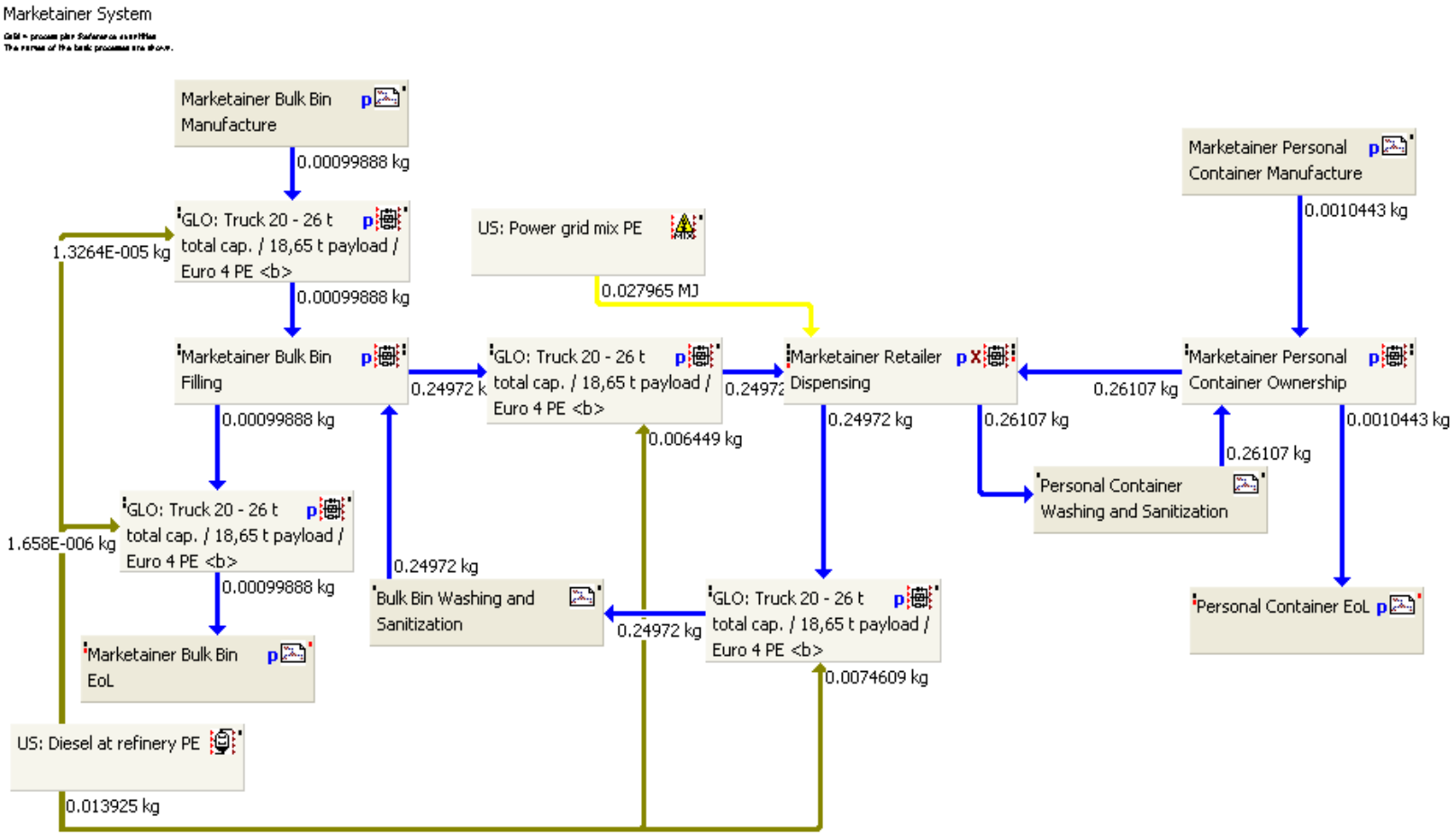

Figure A-6: Marketainer system GaBi process plan

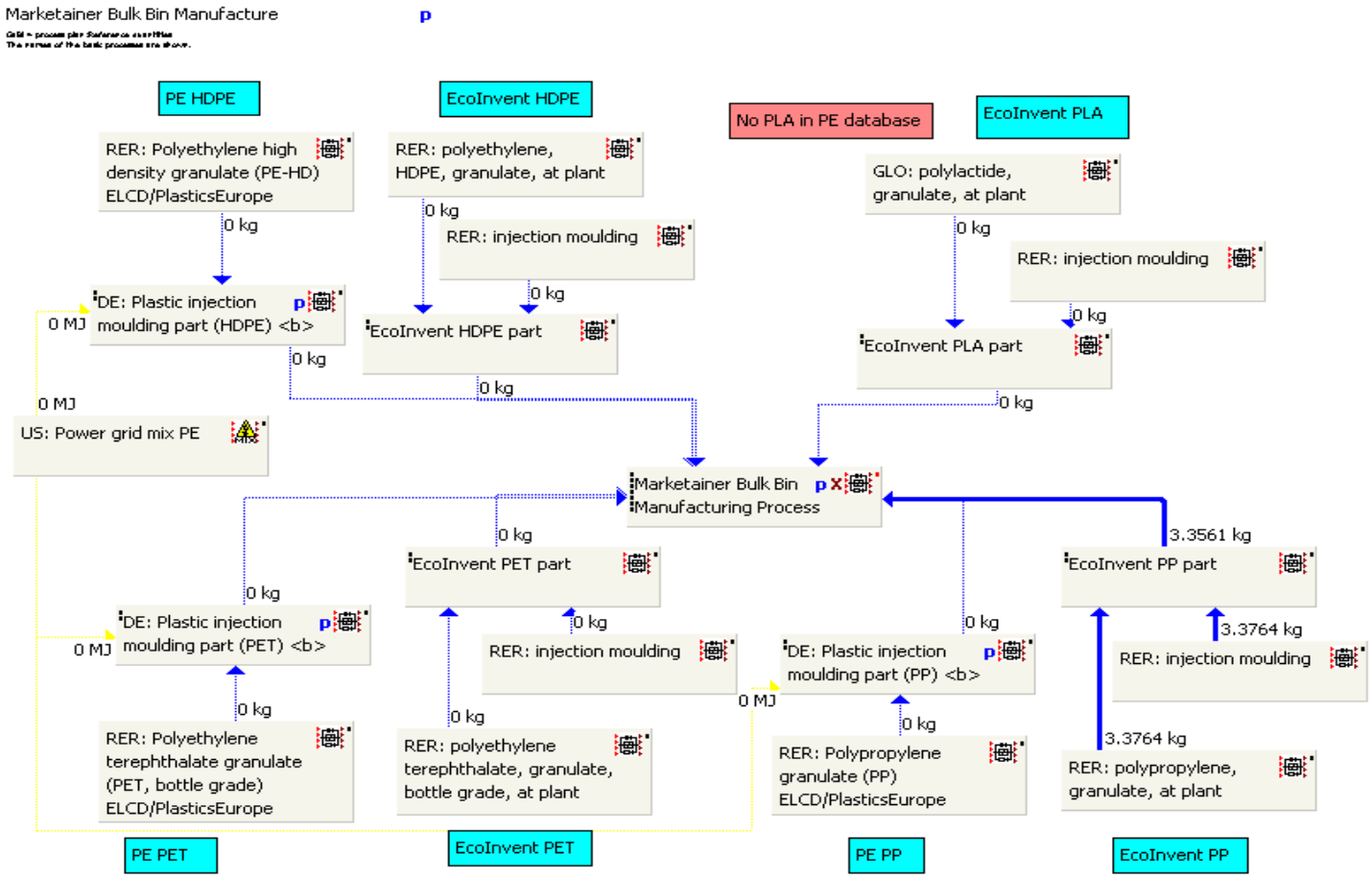

Figure A-7: Marketainer bulk bin manufacture GaBi process plan

Note: The personal container manufacture process is not shown because it is nearly identical to the bulk bin manufacture process.

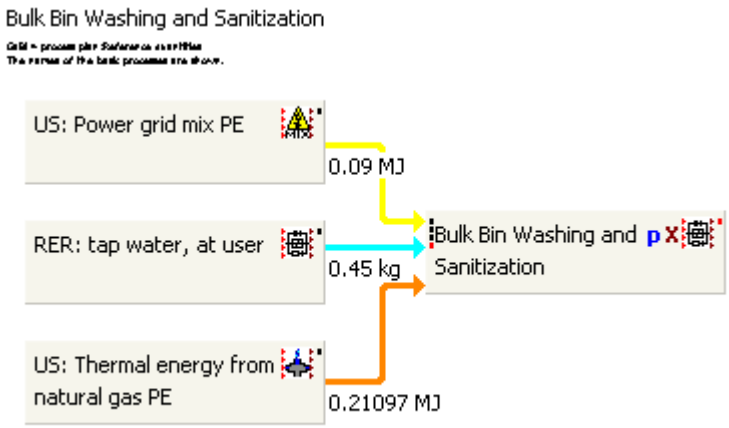

Figure A-8: Marketainer bulk bin sanitization GaBi process plan

Note: The personal container sanitization process is not shown because it is nearly identical to the bulk bin sanitization process.

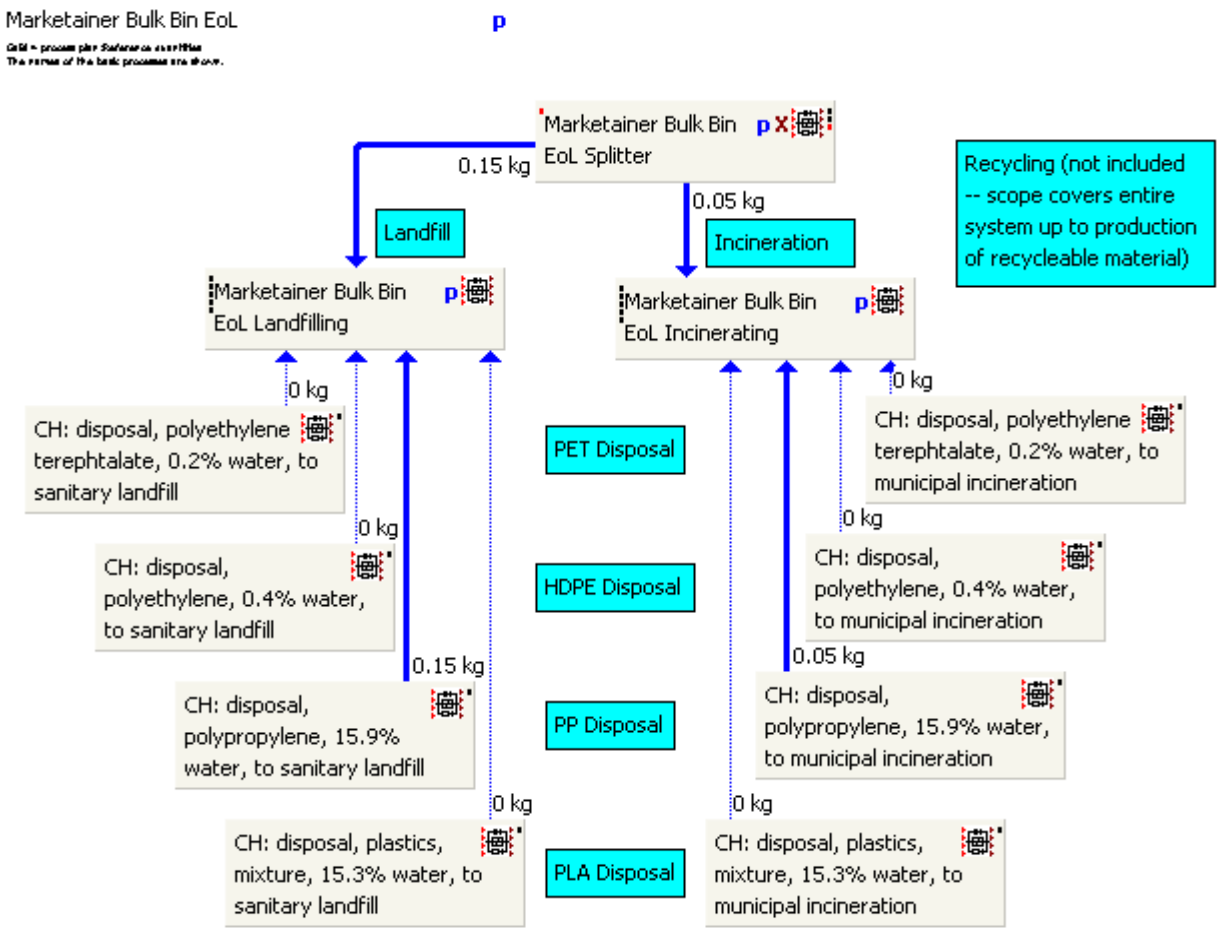

Figure A-9: Marketainer bulk bin end-of-life GaBi process plan

Note: The personal container end-of-life process is not shown because it is nearly identical to the bulk bin end-of-life process.

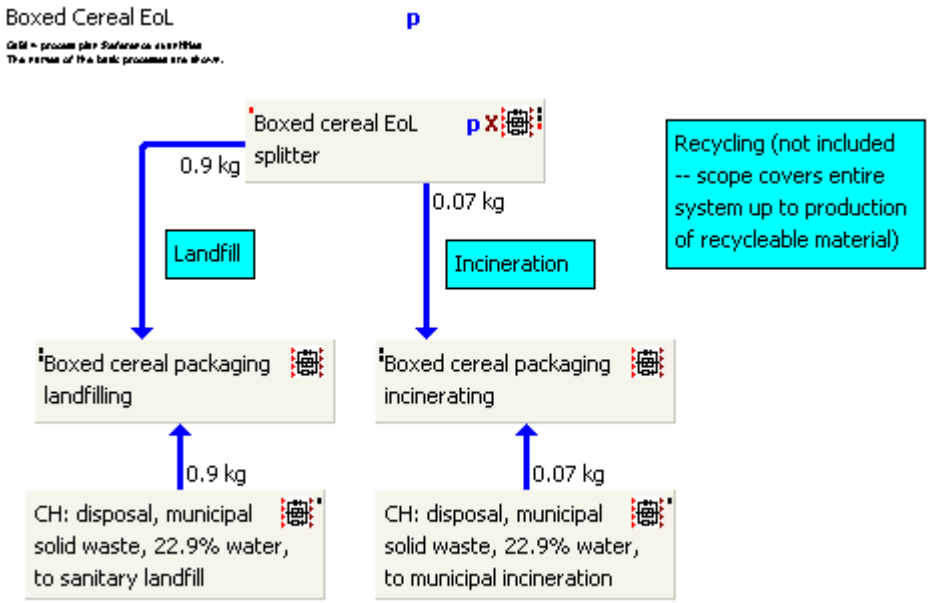

Figure A-10: Boxed cereal packaging end-of-life GaBi process plan

Note: The bulk cereal packaging end-of-life process is not shown because it is nearly identical to the boxed cereal packaging end-of-life process.

Tables

Variable	Esti-mate Case	Worst Case	Best Case	Comment	Estimate Source
Bin_Incinerate	**0.05**	**0**	**0.05**	**[-] Percentage of EoL bin that's incinerated**	**Marketainer**
Bin_Inner_Height	*65*	*65*	*65*	*[cm] Inner height of bulk bin*	*Marketainer*
Bin_Inner_Length	*33*	*33*	*33*	*[cm] Inner length of bulk bin*	*Marketainer*
Bin_Inner_Width	*15*	*15*	*15*	*[cm] Inner width of bulk bin*	*Marketainer*
Bin_Landfill	**0.15**	**0.3**	**0.05**	**[-] Percentage of EoL bin that's landfilled**	**Marketainer**
Bin_Life	**250**	**50**	**450**	**[# cycles] Number of times bulk bin can be used before EoL**	**Marketainer**
Bin_Pct_HDPE	*0*	*0*	*0*	*[-] Percentage of bin by material volume that's HDPE*	*Marketainer*
Bin_Pct_PET	*0*	*0*	*0*	*[-] Percentage of bin by material volume that's PET*	*Marketainer*
Bin_Pct_PLA	*0*	*0*	*0*	*[-] Percentage of bin by material volume that's PLA*	*Marketainer*
Bin_Pct_PP	*1*	*1*	*1*	*[-] Percentage of bin by material volume that's PP*	*Marketainer*
Bin_Recycle	**0.8**	**0.7**	**0.9**	**[-] Percentage of EoL bin that's recycled**	**Marketainer**
Bin_San_Water	**0.45**	**1**	**0.2**	**[kg] Amount of water for bin sanitization / kg material**	**NCDENR Water Efficiency Manual[16]**
Bin_Thickness	**0.5**	**0.6**	**0.4**	**[cm] Thickness of bulk bin material**	**Marketainer**
Boxed_CartonMass	**0.055**	**0.06**	**0.05**	**[kg] Mass of boxed carton**	**Golden Temple[10]**
Boxed_CartonsPer-Case	*12*	*12*	*12*	*[#] Number of boxed cartons per case*	*Golden Temple[10]*
Boxed_CaseMass	**0.4**	**0.45**	**0.35**	**[kg] Mass of boxed case**	**Golden Temple[10]**
Boxed_CerealMass	**0.416**	**0.283**	**0.454**	**[kg] Mass of cereal / carton (vary from 0.283 to 0.454)**	**Golden Temple[10]**
Boxed_Incinerate	**0.07**	**0**	**0.1**	**[-] Percentage of EoL boxed packaging that's incinerated**	**EPA Municipal Solid Waste Report[15]**

Boxed_InnerBagMass	**0.008**	**0.01**	**0.006**	**[kg] Mass of boxed inner bag**	**Golden Temple[10]**
Boxed_Landfill	**0.9**	**1**	**0.8**	**[-] Percentage of EoL boxed packaging that's landfilled**	**EPA Municipal Solid Waste Report[15]**
Boxed_Recycle	**0.03**	**0**	**0.1**	**[-] Percentage of EoL boxed packaging that's recycled**	**EPA Municipal Solid Waste Report[15]**
Bulk_CaseMass	**0.56**	**0.61**	**0.51**	**[kg] Mass of bulk case**	**Golden Temple[10]**
Bulk_CerealMass	*11.34*	*11.34*	*11.34*	*[kg] Mass of cereal / case*	*Golden Temple[10]*
Bulk_CerealPerBag	**0.5**	**0.25**	**1**	**[kg] Bulk system amount of cereal per in-store bag**	**IVFC[8]**
Bulk_Incinerate	**0.07**	**0**	**0.1**	**[-] Percentage of EoL bulk packaging that's incinerated**	**EPA Municipal Solid Waste Report[15]**
Bulk_InnerBagMass	**0.08**	**0.1**	**0.06**	**[kg] Mass of bulk inner bag**	**Golden Temple[10]**
Bulk_Landfill	**0.9**	**1**	**0.8**	**[-] Percentage of EoL bulk packaging that's landfilled**	**EPA Municipal Solid Waste Report[15]**
Bulk_Recycle	**0.03**	**0**	**0.1**	**[-] Percentage of EoL bulk packaging that's recycled**	**EPA Municipal Solid Waste Report[15]**
Bulk_StoreBagMass	**0.01**	**0.025**	**0.005**	**[kg] Mass of bulk store bag**	**IVFC[8]**
Database_Type	*1*	*1*	*1*	*[binary] PE = 0; EcoInvent = 1*	*Marketainer*
Density_HDPE	*0.941*	*0.941*	*0.941*	*[g/cm3] Density of HDPE*	*IDES[17]*
Density_PET	*1.41*	*1.41*	*1.41*	*[g/cm3] Density of PET (amorphous 1.37, crystalline 1.455)*	*IDES[17]*
Density_PLA	*1.24*	*1.24*	*1.24*	*[g/cm3] Density of PLA*	*IDES[17]*
Density_PP	**0.9**	**0.946**	**0.855**	**[g/cm3] Density of PP (amorphous 0.855, crystalline 0.946)**	**IDES[17]**
Dis_BinsPerDay	**1**	**0.25**	**2**	**[# bins] Avg. number of bulk bins used / dispenser / day**	**Marketainer**

Dis_Daily_Usage	**12**	**24**	**8**	**[hr/day] Avg. number of hours / day dispenser is powered on**	**Marketainer**
Dis_Power	**8.7**	**12**	**5**	**[W] Avg. power consumption of dispenser**	**Prototype LCD Screen Specs**
PC_Incinerate	**0.05**	**0**	**0.05**	**[-] Percentage of EoL personal container that's incinerated**	**Marketainer**
PC_Inner_Height	*15*	*15*	*15*	*[cm] Inner height of personal container*	*Marketainer*
PC_Inner_Length	*15*	*15*	*15*	*[cm] Inner length of personal container*	*Marketainer*
PC_Inner_Width	*10*	*10*	*10*	*[cm] Inner width of personal container*	*Marketainer*
PC_Landfill	**0.15**	**0.3**	**0.05**	**[-] Percentage of EoL personal container that's landfilled**	**Marketainer**
PC_Life	**250**	**50**	**450**	**[# cycles] Number of times personal container can be used before EoL**	**Marketainer**
PC_Pct_HDPE	*0*	*0*	*0*	*[-] Percentage of personal container by material volume that's HDPE*	*Marketainer*
PC_Pct_PET	*0*	*0*	*0*	*[-] Percentage of personal container by material volume that's PET*	*Marketainer*
PC_Pct_PLA	*0*	*0*	*0*	*[-] Percentage of personal container by material volume that's PLA*	*Marketainer*
PC_Pct_PP	*1*	*1*	*1*	*[-] Percentage of personal container by material volume that's PP*	*Marketainer*
PC_Recycle	**0.8**	**0.7**	**0.9**	**[-] Percentage of EoL personal container that's recycled**	**Marketainer**
PC_San_Water	**0.45**	**1**	**0.2**	**[kg] Amount of water for PC sanitization / kg material**	**NCDENR Water Efficiency Manual[16]**
PC_Thickness	**0.25**	**0.3**	**0.2**	**[cm] Thickness of personal container material**	**Marketainer**
Product_Density	*0.4177*	*0.4177*	*0.4177*	*[g/cm3] Density of product conveyed*	*Golden Temple[10]*
Trans_EoL_Dist	**100**	**200**	**20**	**[km] Distance from retailer / consumer to EoL**	**Google Maps[18]**
Trans_EoL_Util	**0.85**	**0.6**	**1**	**[-] Utilization ratio by mass from retailer / consumer to EoL**	**Brandon Kuczenski[19]**
Trans_In_Town	**0.15**	**0.25**	**0.05**	**[-] Percentage within town (average speed 27 km/h)**	**Google Maps[18]**

Trans_Mfr_Dist	**800**	**1600**	**50**	**[km] Distance from packaging plant to mfr. filling plant**	**Google Maps[18]**
Trans_Mfr_Util	**0.85**	**0.6**	**1**	**[-] Utilization ratio by mass from packaging plant to mfr. filling plant**	**Brandon Kuczenski[19]**
Trans_Motorway	**0.7**	**0.5**	**0.9**	**[-] Percentage on motorway (average speed 82 km/h)**	**Google Maps[18]**
Trans_Out_Town	**0.15**	**0.25**	**0.05**	**[-] Percentage outside of town (average speed 70 km/h)**	**Google Maps[18]**
Trans_Payload	*18.65*	*18.65*	*18.65*	*[t] Standard = 17,3 t*	*Golden Temple[10]*
Trans_Rev_Dist	**1800**	**2400**	**0**	**[km] Distance for Marketainer from retailer to sanitization to filling**	**Marketainer**
Trans_Rev_Util	**0.85**	**0.6**	**1**	**[-] Utilization ratio by mass for Marketainer from retailer to sanitization to filling**	**Marketainer**
Trans_Rtl_Dist	*1750*	*1750*	*1750*	*[km] Distance from mfr. filling plant to retailer*	*Google Maps[18]*
Trans_Rtl_Util_Boxed	*0.65927*	*0.65927*	*0.65927*	*[-] Utilization ratio by mass for boxed from mfr. filling plant to retailer*	*Golden Temple[10]*
Trans_Rtl_Util_Bulk	**1**	**0.85**	**1**	**[-] Utilization ratio by mass for bulk from mfr. filling plant to retailer**	**Golden Temple[10]**
Trans_Rtl_Util_Mrktnr	**1**	**0.85**	**1**	**[-] Utilization ratio by mass for Marketainer from mfr. filling plant to retailer**	**Marketainer**
Trans_Sulphur	*15*	*15*	*15*	*[ppm] Proportion of sulphur in diesel*	*USEPA[13]*

Table A-2: LCA assumptions

Note: Bolded assumptions vary between cases, italicized scenarios are held constant.

	PP	HDPE	PLA	PET
ADP [kg Sb-Equiv.]	5.84E-04	6.10E-04	7.60E-04	9.05E-04
AP [kg SO2-Equiv.]	3.43E-04	3.58E-04	4.75E-04	5.31E-04
EP [kg Phosphate-Equiv.]	4.75E-05	5.03E-05	8.62E-05	8.21E-05
FAETP [kg DCB-Equiv.]	2.25E-03	2.71E-03	2.21E-03	3.31E-03
GWP [kg CO2-Equiv.]	8.28E-02	8.63E-02	1.09E-01	1.29E-01
HTP [kg DCB-Equiv.]	4.25E-03	4.59E-03	6.55E-03	1.02E-02
MAETP [kg DCB-Equiv.]	5.95E+00	6.59E+00	8.63E+00	1.11E+01
ODP [kg R11-Equiv.]	3.08E-09	3.19E-09	4.76E-09	4.90E-09
POCP [kg Ethene-Equiv.]	3.23E-05	3.47E-05	4.35E-05	4.89E-05
TETP [kg DCB-Equiv.]	6.66E-05	6.95E-05	1.95E-04	2.20E-04

Table A-3: Marketainer Material Environmental Impact Comparison (Estimate Case)

Note: Assumes 100% material composition for both Marketainer bulk bins and personal containers. See the Environmental Impact Indicators section for explanation of impact criteria abbreviations.

	Estimate Case			Worst Case			Best Case		
	Boxed	Bulk	Marketainer	Boxed	Bulk	Marketainer	Boxed	Bulk	Marketainer
ADP	2.92E-03	1.41E-03	5.84E-04	5.19E-03	4.46E-03	1.91E-03	2.21E-03	7.50E-04	1.96E-04
AP	1.56E-03	4.91E-04	3.43E-04	2.79E-03	1.26E-03	1.21E-03	1.19E-03	3.09E-04	1.06E-04
EP	2.00E-03	6.35E-04	4.75E-05	3.57E-03	1.43E-03	1.78E-04	1.47E-03	4.24E-04	1.40E-05
FAETP	4.93E-01	1.52E-01	2.25E-03	8.36E-01	3.32E-01	2.15E-02	3.73E-01	1.03E-01	4.91E-04
GWP	5.46E-01	1.71E-01	8.28E-02	9.41E-01	4.44E-01	2.62E-01	4.17E-01	1.05E-01	2.72E-02
HTP	1.30E-01	3.74E-02	4.25E-03	2.15E-01	7.54E-02	2.23E-02	1.03E-01	2.72E-02	1.31E-03
MAETP	3.16E+02	9.50E+01	5.95E+00	5.37E+02	2.13E+02	4.02E+01	2.42E+02	6.40E+01	1.75E+00
ODP	6.25E-08	6.13E-09	3.08E-09	1.01E-07	9.15E-09	1.82E-08	5.17E-08	5.12E-09	1.05E-09
POCP	2.21E-04	9.27E-05	3.23E-05	3.96E-04	2.79E-04	1.10E-04	1.65E-04	5.13E-05	1.04E-05
TETP	2.84E-03	7.52E-04	6.66E-05	4.72E-03	1.33E-03	2.45E-04	2.28E-03	5.88E-04	2.30E-05

Table A-4: Environmental Impact Comparison (Estimate, Worst, and Best Cases)

Note: See the Environmental Impact Indicators section for explanation of impact criteria abbreviations and units of measurement.

	Boxed			Bulk			Marketainer				
	Production	Transport	EoL	Production	Transport	EoL	Production	Transport	EoL	Use	Sanitization
ADP	88.81%	10.07%	1.12%	95.07%	4.17%	0.76%	14.75%	60.32%	0.01%	5.58%	19.34%
AP	84.56%	11.03%	4.41%	88.33%	7.04%	4.63%	6.65%	60.11%	0.02%	11.19%	22.03%
EP	18.28%	1.44%	80.29%	15.68%	0.91%	83.41%	5.20%	72.41%	10.58%	3.25%	8.56%
FAETP	12.51%	0.02%	87.47%	6.31%	0.01%	93.68%	9.45%	5.74%	82.73%	0.40%	1.68%
GWP	61.75%	7.89%	30.36%	62.90%	5.06%	32.03%	8.07%	62.26%	0.35%	7.37%	21.96%
HTP	65.01%	1.06%	33.94%	60.31%	0.72%	38.98%	20.24%	37.74%	17.37%	8.25%	16.41%
MAETP	34.51%	0.26%	65.23%	28.20%	0.17%	71.63%	23.91%	16.49%	31.67%	9.64%	18.29%
ODP	98.66%	0.14%	1.20%	95.67%	0.28%	4.05%	41.44%	3.34%	0.04%	20.09%	35.09%
POCP	77.77%	8.12%	14.11%	85.11%	3.77%	11.12%	14.60%	64.82%	0.04%	6.53%	14.00%
TETP	87.20%	1.12%	11.68%	84.58%	0.85%	14.57%	24.99%	57.38%	0.10%	5.72%	11.80%

Table A-5: System % Total Environmental Impact by Phase (Estimate Case)

Note: See the Environmental Impact Indicators section for explanation of impact criteria abbreviations and units of measurement.

Graphs

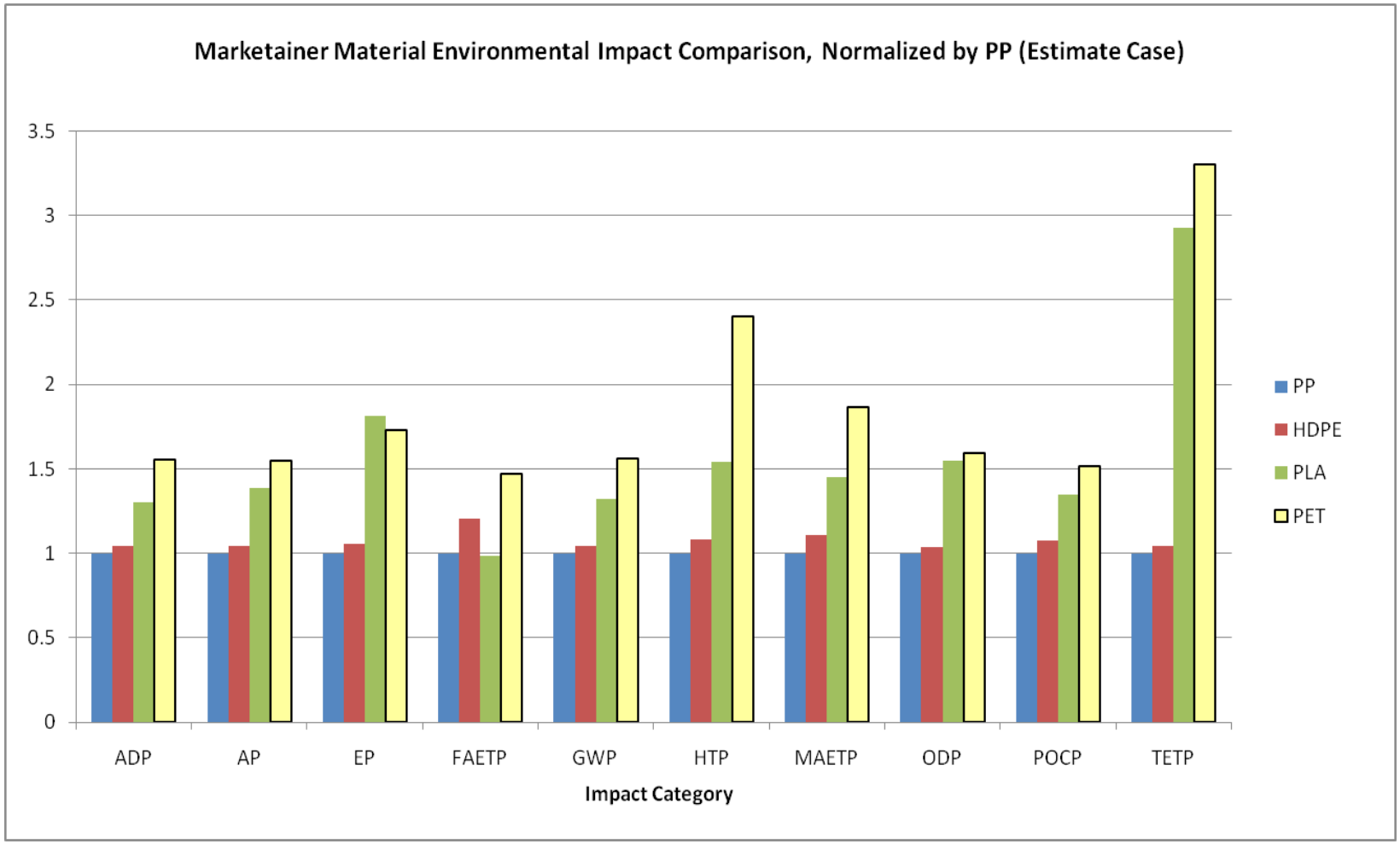

Figure A-11: Marketainer Material Environmental Impact Comparison, Normalized by PP (Estimate Case)

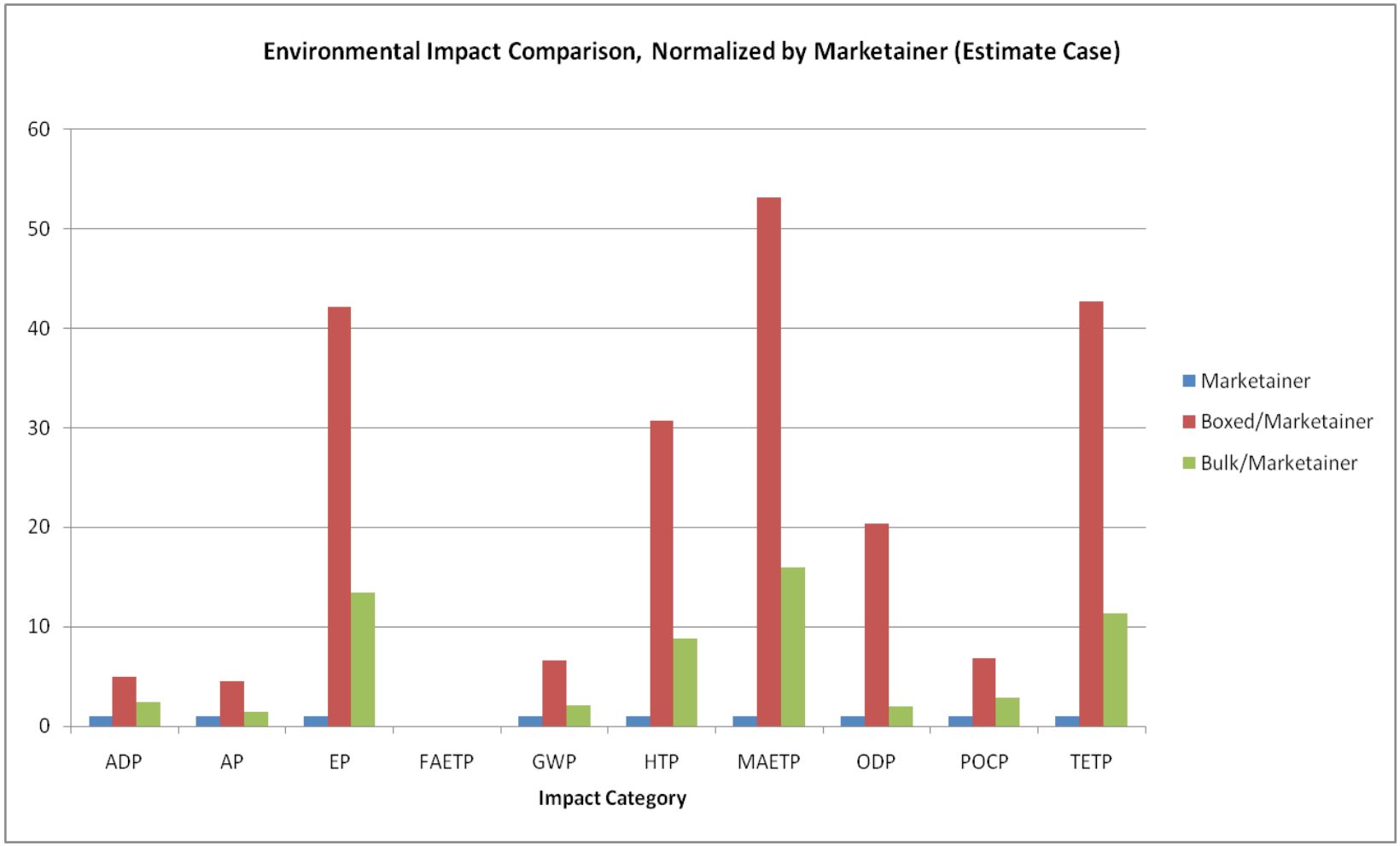

Figure A-12: Environmental Impact Comparison, Normalized by Marketainer (Estimate Case)

Note: FAETP was excluded in this graph -- it was a factor of 219 higher than Marketainer for boxed cereal packaging, and a factor of 67.6 higher for bulk cereal packaging.

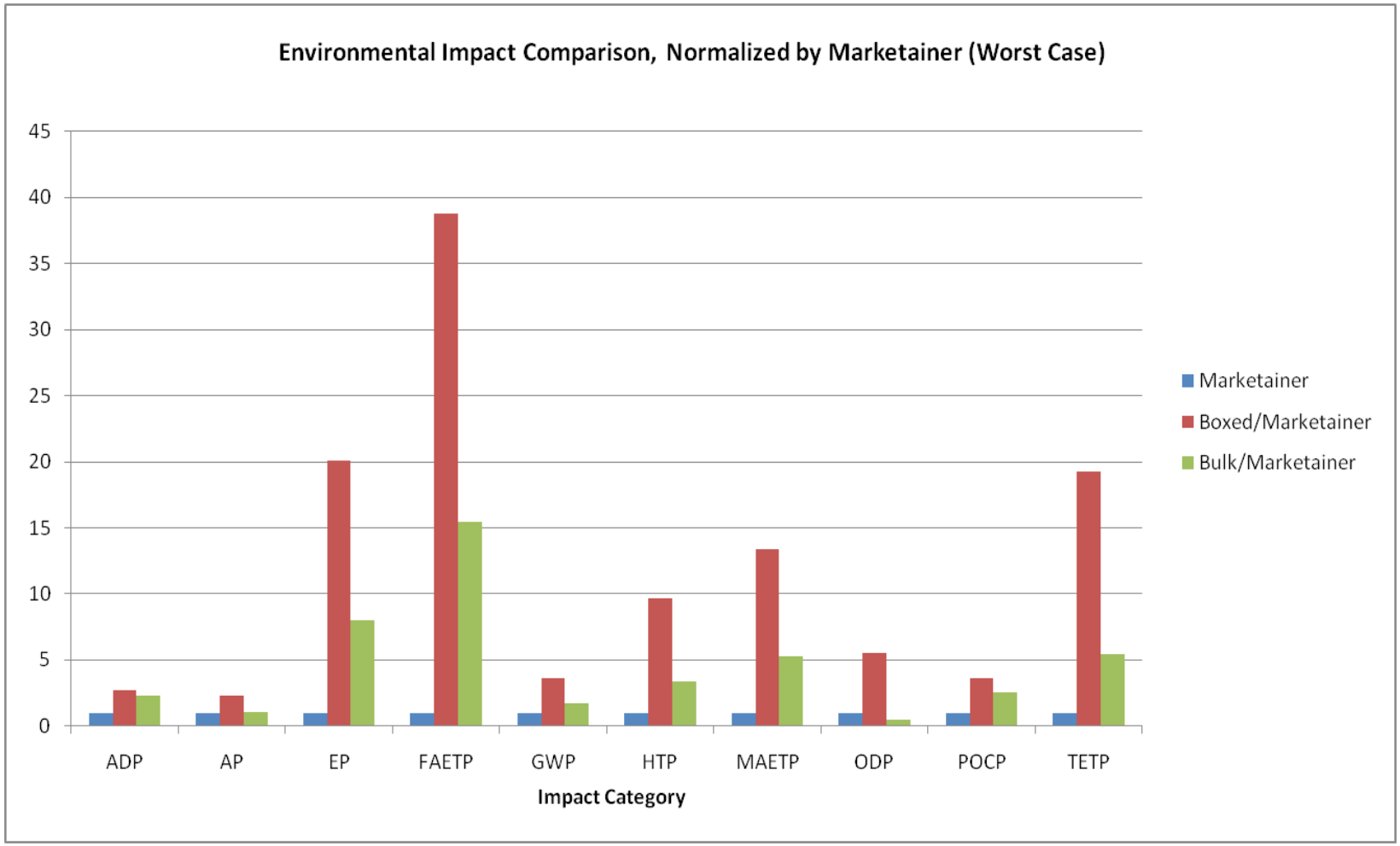

Figure A-13: Environmental Impact Comparison, Normalized by Marketainer (Worst Case)

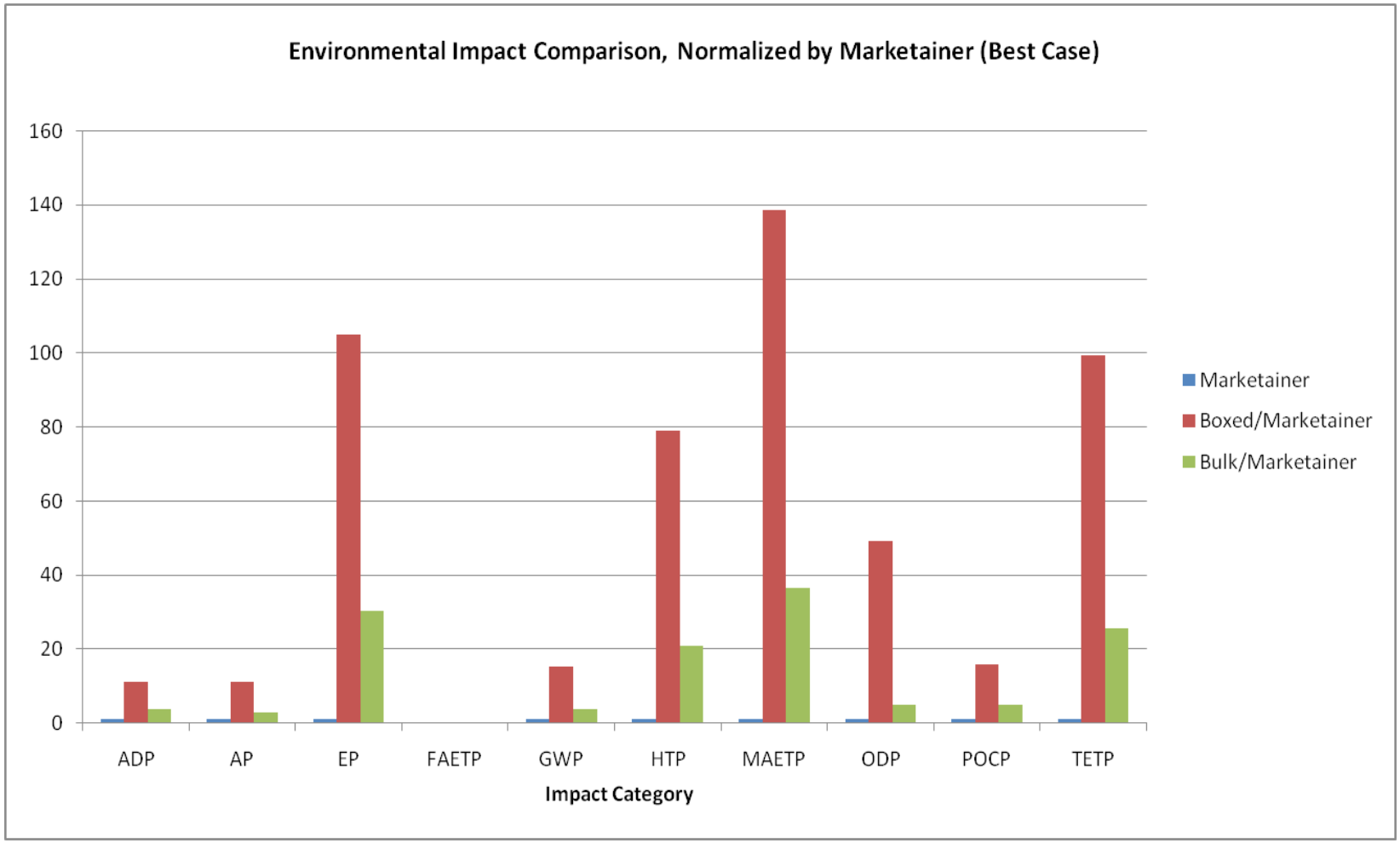

Figure A-14: Environmental Impact Comparison, Normalized by Marketainer (Best Case)

Note: FAETP was excluded in this graph -- it was a factor of 760 higher than Marketainer for boxed cereal packaging, and a factor of 209 higher for bulk cereal packaging.

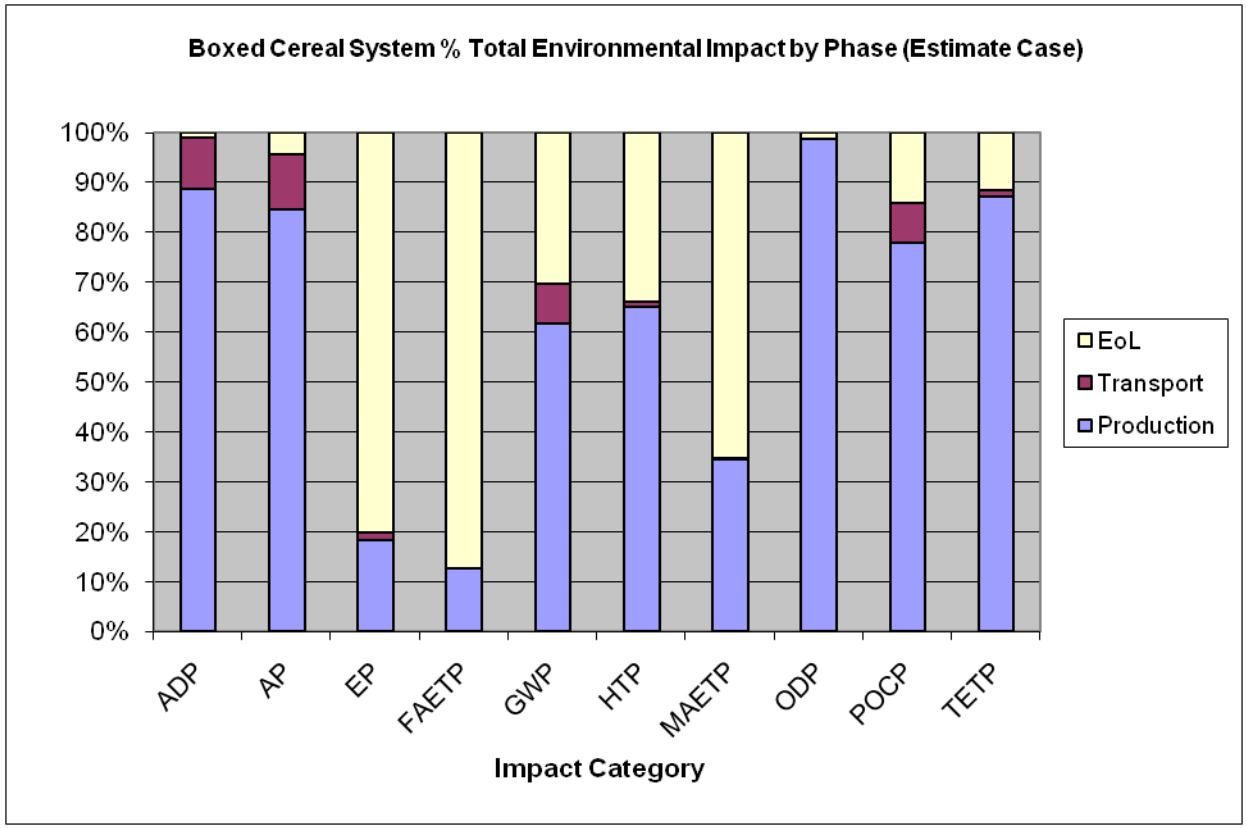

Figure A-15: Boxed Cereal System % Total Environmental Impact by Phase (Estimate Case)

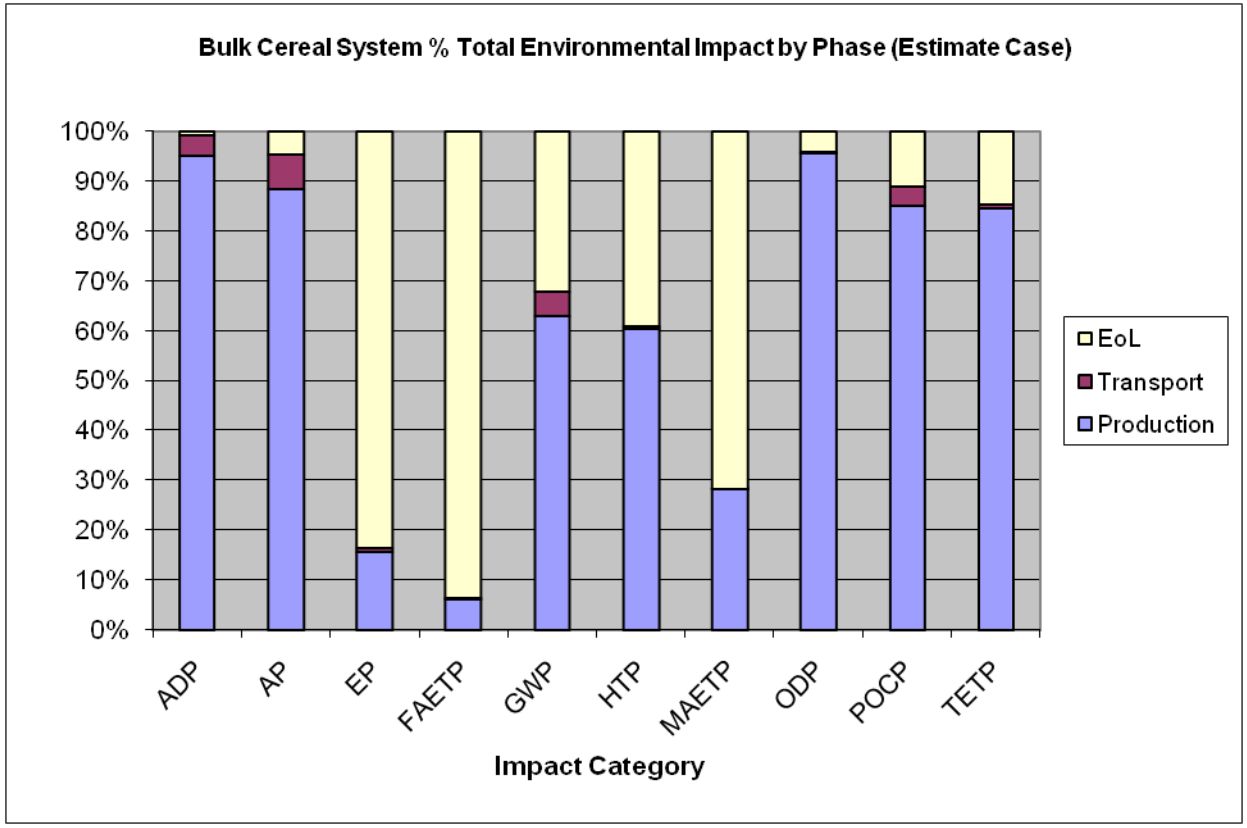

Figure A-16: Current Bulk System % Total Environmental Impact by Phase (Estimate Case)

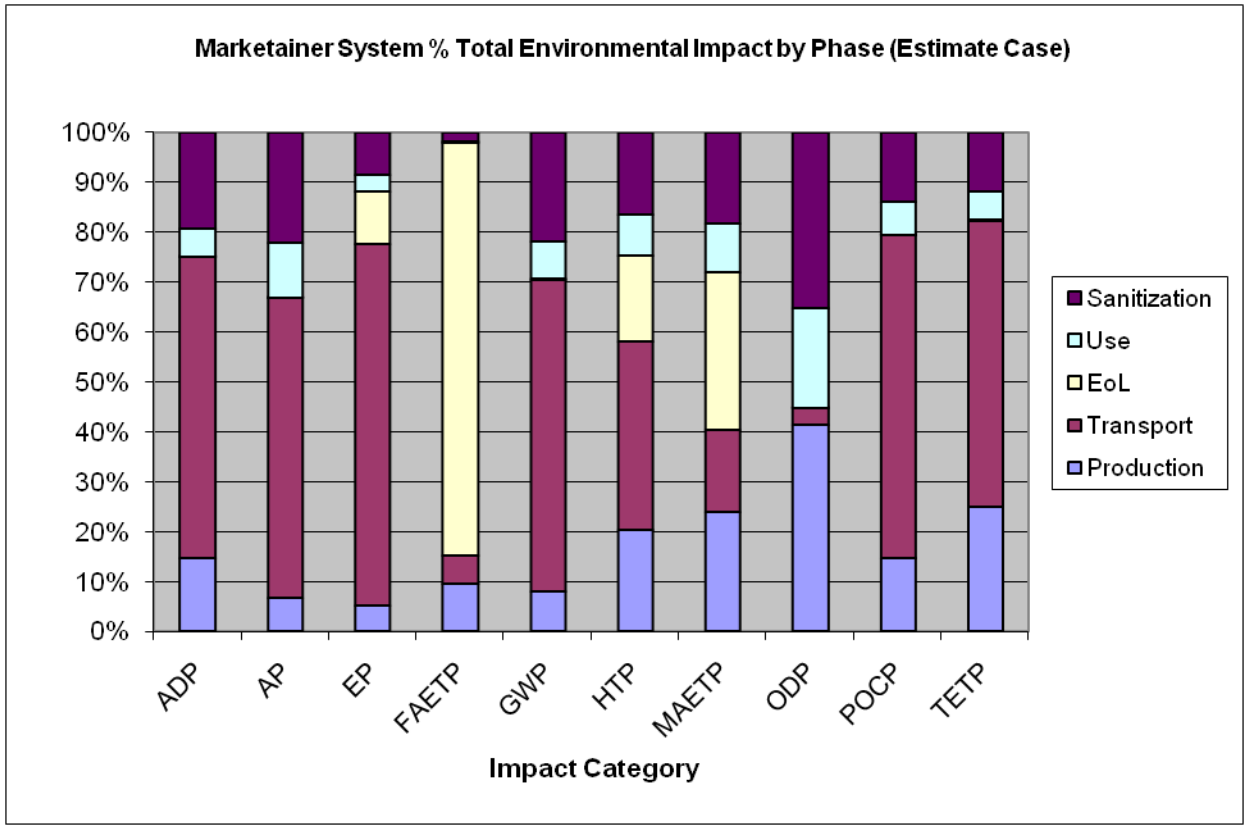

Figure A-17: Marketainer System % Total Environmental Impact by Phase (Estimate Case)

Appendix B: Complete Economic Analysis

Marketainer conducted an Economic Analysis of the costs associated with three packaging systems: conventional single-use packaging, current bulk systems, and the Marketainer bulk system. Figures and assumptions were based on data provided by Golden Temple of Oregon, LLC (GT),[10] the Isla Vista Food Cooperative (IVFC),[8] and United Natural Foods, Inc. (UNFI).[11] The same parameters used in the life-cycle assessment Estimate Case (Appendix A) were used for the purpose of this analysis. The costs estimated below are total costs incurred along the entire supply chain, and are distributed across multiple processes, from packaging purchase to end-of-life management.

General Assumptions

First, total Marketainer bulk bin capacity was calculated using estimated bin dimensions:

Bulk Bin Specifications:	
Inner length (cm)	33
Inner height (cm)	65
Inner width (cm)	15
Volume of container (L)	**32.18**
Volume of container (gal.)	**8.50**
Thickness (cm)	0.5
Sides: outer length (cm)	34
Sides: outer height (cm)	66
Front/back: outer width (cm)	15
Front/back: outer height (cm)	66
Top/bottom: outer length (cm)	33
Top/bottom: outer width (cm)	15
Total volume of material (cm3)	**3729.00**
Polypropylene density (g/cm3)	0.90
Total mass of Material (g)	**3356.10**

Table B-1: Marketainer bulk bin specifications

Average cereal density was estimated by GT to be 0.4177 kg/L. This allowed us to determine the mass of cereal shipped in each full bulk bin. Multiplying this by the expected bulk bin lifetime, we then calculated the amount of cereal shipped over the bin's entire life.

The total amount of cereal conveyed by Marketainer personal containers was calculated using the same method. Personal container capacity was determined assuming an inner length and height of 15 cm, inner width of 10 cm, and a thickness of 0.25 cm. Using the same cereal density assumption, this yielded a maximum capacity of 0.94 kg of cereal per

shopping trip, which was multiplied by the personal container's expected life to yield the amount of cereal conveyed over its lifetime.

Finally, the amount of product conveyed by the dispenser over its lifetime was simply calculated by estimating that it dispenses 4 full bins per week, and lasts for approximately 5 years.

The results of these calculations are used throughout the economic analysis, and are listed in Table B-2.

Marketainer System Assumptions:	
Bulk bin cycles / lifetime	250
Bins contain a maximum of (kg) of cereal	13.44
kg cereal conveyed by bin / lifetime	**3359.94**
Dispenser lifetime (weeks)	250
Average bins dispensed / wk.	4
kg cereal conveyed by dispenser / lifetime	**13439.78**
Personal container (PC) cycles / lifetime	250
PCs contain a maximum of (kg) of cereal	0.94
kg cereal conveyed by PC / lifetime	**234.96**

Table B-2: General Marketainer economic analysis assumptions

Stage 1: Costs at the Manufacturer

The packaging material costs were estimated per kg of cereal. The costs of packaging for boxed cereal (i.e. conventional disposable packaging) and bulk cereal (which also utilizes disposable packaging, albeit in smaller quantities) were obtained directly from GT. The target sale price of the Marketainer bulk bin is $75, which was divided by the total amount of cereal it is estimated to convey over its lifetime, as calculated above (Table B-2). The following table compares the costs of material involved in each packaging system.

Packaging at Manufacturer:	Boxed	Bulk	Marketainer
Bulk bin cost / unit	N/A	N/A	$75.00
Cost / kg cereal	**$0.3300**	**$0.0900**	**$0.0223**

Table B-3: Cost of packaging at manufacturer

Stage 2: Transportation Costs

Our analysis accounts solely for the cost of diesel consumption when considering transportation costs, as information on overhead transportation costs (e.g. wear and tear, labor, etc.) was not readily available. The total distance traveled was assumed to be from Eugene, OR (GT), to Moreno Valley, CA (the UNFI distribution center), and then to Isla Vista, CA (IVFC) -- approximately 1,750 km, one way.[18] Fuel economy of

the trucks was determined on a per-kg-of-cereal-shipped basis using the GaBi 4.3 LCA software (see Appendix A for more information). These numbers differ significantly among the three systems due to disparate packing densities and utilization ratios (e.g. boxed cereal inefficiently ships a large amount of air). Additionally, estimates for the Marketainer system include reverse logistics required to transport the empty bulk bins from IVFC back to GT. The price of diesel used was the U.S. national average on February 4, 2010.

Fuel:	Boxed	Bulk	Marketainer
Price of diesel ($/gal.)	$2.78	$2.78	$2.78
kg diesel needed / kg cereal	0.01163	0.00233	0.01392
Cost / kg cereal	**$0.01005**	**$0.00202**	**$0.01203**

Table B-4: Transportation fuel costs

Stage 3: Costs at the Retailer

Dispensing Units

For the Marketainer and current bulk systems, dispensing units are required at the retailer, incurring additional costs. The mechanical dispensers used in current bulk systems include a large compartment to store product, and cost around $150 per unit.[8] Marketainer dispensing units do not have the upper storage compartment (as this need is satisfied by the bulk bins which are plugged in directly), but do incorporate a computer interface linked to a weight-sensing gravity-fed dispensing unit. The target sales price, $200, is therefore slightly higher than current bulk dispensers.

Marketainer dispensers consume power once installed. The maximum power consumption was based on the power consumed by the LCD screen used in our functional prototype. The average price of electricity was estimated to be $0.102 / kWh.[20] Total power consumption per kg of cereal dispensed was calculated using the estimated number of full bins dispensed per week (Table B-2). All the costs associated with the Marketainer dispensing unit are tabulated in Table B-5.

Dispenser:	Boxed	Bulk	Marketainer
Dispenser cost / unit	N/A	$150.00	$200.00
Cost / kg cereal	**$0.0000**	**$0.0112**	**$0.0149**
Max power consumption (W)	N/A	N/A	8.7
Avg. hours / day activated	N/A	N/A	12
Energy cost / kWh	N/A	N/A	$0.1020
Energy cost / kg cereal	N/A	N/A	$0.0014
Total cost / kg cereal	**$0.0000**	**$0.0112**	**$0.0163**

Table B-5: Dispensing unit costs

Packaging Costs

Consumers using the current bulk and Marketainer systems must dispense the cereal into an additional package for transport to their homes. In the current bulk system, consumers typically dispense into a plastic disposable bag provided by the retailer. According to IVFC, these bags cost around $0.04 each. With the Marketainer system, consumers use reusable personal containers, estimated to sell for $3 each. Both the bag and the personal container are assumed to convey the same amount of cereal per trip (0.94 kg on average). Taking into account the estimated lifespans of both types of packaging (i.e. 1 use for the bag, 250 uses for the personal container), we calculated the cost of packaging per kg of product at the retailer in Table B-6.

Packaging at Retailer:	Boxed	Bulk	Marketainer
Cost / unit	N/A	$0.04	$3.00
Cost / kg cereal	**$0.0000**	**$0.0399**	**$0.0128**

Table B-6: Packaging costs at the retailer

Labor Savings

The cost of labor at the retailer significantly differs for each of the three systems. The current bulk system was used as a baseline, because IVFC noted that it is by far the most labor-intensive, considering stocking and sanitization procedures. IVFC estimates that, on average, stocking a Marketainer bulk bin's worth of product would be 3 minutes faster with the Marketainer system than current bulk (due to the bulk bin's ability to simply plug in, and because sanitization would be handled off-site). They further estimated that stocking an equivalent amount of boxed cereal would be 8 minutes faster than stocking current bulk, because they simply need to put the boxes on the shelf, and no sanitization is required. Considering the IVFC average stocker wage of $10 per hour, and assuming Marketainer and current bulk dispensers have the same lifespan, we can estimate the labor savings per kg of cereal dispensed.

Labor Savings (Compared to Current Bulk):	Boxed	Bulk	Marketainer
Estimated labor savings (min. / bin cycle)	8	N/A	3
Stocker average hourly wage	$10.00	N/A	$10.00
Labor savings ($ / wk. / dispensing unit)	$5.33	N/A	$2.00
Labor savings revenue / dispensing unit life	$1,333.33	N/A	$500.00
Labor savings / kg cereal	**$0.0992**	**$0.0000**	**$0.0372**

Table B-7: Labor savings compared to current bulk

Stage 4: Sanitization

The Marketainer and current bulk systems both include reusable components which require cleaning after use. Only the cost of sanitizing bulk bins and current bulk dispensers is considered in this analysis.

Sanitization costs are based on data obtained from IFCO Systems.[21] According to IVFC, current bulk dispensers are typically sanitized by hand, which is more time-consuming and less resource-efficient than sanitizing at IFCO's industrial sanitization facilities. Therefore, the cost of sanitization for current bulk is probably slightly underestimated here, but the actual value is likely still within the same order of magnitude.

Sanitization:	Boxed	Bulk	Marketainer
Cost of sanitization / bin	N/A	$0.22	$0.22
Cost / kg cereal	**$0.0000**	**$0.0164**	**$0.0164**

Table B-8: Sanitization costs

Stage 5: End of Life

The end-of-life (EoL) costs include the landfilling and recycling costs of all disposable packaging and of reusable personal containers, taking into account their expected lifespan. Santa Barbara County Environmental Services estimates an average cost of $65 per ton of waste processed.[22] Table B-9 includes the costs of EoL management, which are paid for by taxpayers.

End of Life:	Boxed	Bulk	Marketainer
EoL cost / short ton	$65.00	$65.00	$65.00
kg EoL packaging / kg cereal	0.23157	0.07644	0.00204
EoL Cost / kg cereal	**$0.0166**	**$0.0055**	**$0.0001**

Table B-9: End-of-life costs

Overall Costs

The cost per kg of cereal at each stage was totaled to provide an estimate for each system's overall life-cycle cost.

Life-Cycle Cost:	Boxed	Bulk	Marketainer
Packaging cost / kg cereal	$0.3300	$0.1411	$0.0514
Fuel cost / kg cereal	$0.0100	$0.0020	$0.0120
Sanitization cost / kg cereal	$0.0000	$0.0164	$0.0164
EoL cost / kg cereal	$0.0166	$0.0055	$0.0001
Total cost / kg cereal	**$0.3566**	**$0.1649**	**$0.0799**
Labor cost adjustment / kg cereal	-$0.0992	$0.0000	-$0.0372
Total labor-adjusted cost / kg cereal	**$0.2574**	**$0.1649**	**$0.0427**

Table B-10: Overall life-cycle cost per kg of cereal

In order to make the results more tangible, we multiplied these numbers out for 5,000 kg of cereal, a reasonable estimate for the annual total sold by IVFC.

Quantity / 5,000 kg Cereal:	Boxed	Bulk	Marketainer
Packaging cost	$1,650.00	$705.31	$256.79
Fuel cost	$50.23	$10.08	$60.16
Sanitization cost	$0.00	$81.85	$81.85
EoL cost	$82.96	$27.38	$0.73
Total cost	**$1,783.19**	**$824.62**	**$399.53**
Labor cost adjustment	-$496.04	$0.00	-$186.02
Total labor-adjusted cost	**$1,287.15**	**$824.62**	**$213.51**
Total labor-adjusted cost compared to boxed	**100.00%**	**64.07%**	**16.59%**

Table B-11: Overall life-cycle cost per 5,000 kg of cereal

Payback Periods

With these costs, we are able to calculate a payback period for each of the three Marketainer components. Each of these calculations takes into account the assumptions outlined in Table B-2 above. The bulk bin cost is borne by the manufacturer (GT), so it is compared to boxed and current bulk systems for packaging, fuel, and sanitization costs.

Bulk Bin Payback Period:	vs. Boxed	vs. Bulk
Packaging cost difference / kg of cereal	$0.3077	$0.0677
Sanitization cost difference / kg of cereal	-$0.0164	$0.0000
Fuel cost difference / kg of cereal	-$0.0020	-$0.0100
Overall cost difference / kg of cereal	$0.2893	$0.0577
Savings / bin cycle	$3.89	$0.77
Payback period (bin cycles)	**19.29**	**96.78**

Table B-12: Marketainer bulk bin payback period for GT (compared to boxed and current bulk)

The dispensing unit cost, including operation cost (e.g. electricity usage) in the case of Marketainer, is borne by the retailer (IVFC). The payback period is calculated in comparison to current bulk systems, and therefore applies if IVFC were to switch existing bulk dispensers to Marketainer dispensers.

Dispenser Payback Period:	
Unit cost difference / kg of cereal	-$0.0037
Operation cost difference / kg of cereal	-$0.0014
Labor cost difference / kg of cereal	$0.0372
Overall cost difference / kg of cereal	$0.0321
Savings / dispenser lifetime	$431.36
Payback period (years)	**2.23**

Table B-13: Marketainer dispenser payback period for IVFC (compared to current bulk)

Finally, the personal container cost is borne by the cereal consumer (IVFC shopper). The payback period is calculated in particular for consumers who switch from buying boxed cereal to bulk cereal, and use Marketainer personal containers to do so. It also assumes that the container is filled to capacity for each cycle (i.e. shopping trip). Cost savings arise from the significantly cheaper store price of bulk cereal when compared to the same product in boxed form.[8]

Personal Container Payback Period:	
Cost / kg boxed cereal	$13.21
Cost / kg bulk cereal	$8.49
Cost difference / kg cereal	$4.72
Savings / personal container cycle	$4.43
Payback period (personal container cycles)	**0.68**

Table B-14: Marketainer personal container payback period for consumer (compared to boxed)

Limitations

Marketainer conducted this economic analysis with limited information in many areas. This analysis could be improved by:

- Quantifying the overhead costs of transportation, including driver fees, truck fleet maintenance, and loading and unloading labor costs.
- More accurately determining the cost of Marketainer products (including repair and maintenance of dispensers) -- this was difficult as they have not yet been brought to market. Costs were estimated largely based on similar products, as well as our prototype (after assuming cost reductions resulting from mass production).
- Determining the cost of consumers' time spent shopping (e.g. using the travel-cost method for time valuation).
- Incorporating the time required and cost of sanitizing personal containers at home.
- Quantifying the effect of Marketainer's unique branding opportunities, and increased product demand due to lower prices at the retailer.
- Quantifying savings from in-store loss prevention and efficient product recalls with the Marketainer system.
- Breaking costs down more specifically by who pays.
- Conducting extensive sensitivity analysis on our assumptions.

Conclusion

In addition to the environmental benefits outlined in Appendix A, the Marketainer packaging system produces significant economic benefits as well. Compared to the current bulk system, Marketainer's overall life-cycle

cost (including packaging, fuel, sanitization, labor, and end-of-life costs) is nearly 75% less. Compared to boxed cereal, the savings climb to nearly 85%. Indeed, Table B-11 indicates that for every 5,000 kg of GT cereal sold by IVFC, the sum of all costs analyzed would be $1,287 using the boxed cereal system, $825 using the bulk system, and $214 using the Marketainer system.

In addition, the payback periods for each component of the Marketainer system are quite reasonable. Again assuming the scenario where GT cereal is sold at IVFC, for every bulk bin purchased to replace the production of boxed cereal, it would pay for itself within 20 shipments to the retailer. If a bin was purchased to replace the production of current bulk, it would pay for itself within 97 shipments to the retailer. Given the expected bin life of 250 shipments, the Marketainer bulk bin is a wise investment in both cases. For the retailer, for every Marketainer dispensing unit purchased instead of purchasing a new conventional bulk dispenser, they would make up the price difference in around half a year, due to labor savings alone. Replacing a still-useful bulk dispenser with a Marketainer dispenser would have a payback period of a little over 2 years, again due to labor savings. Finally, consumers who switch from buying conventional boxed cereal to bulk cereal using a Marketainer personal container can recoup the cost of the container after a single visit to the store.

Appendix C: Complete Financials

General Assumptions

- Bulk bins and dispensers are manufactured and sold directly to customers
- Personal container production is licensed out, with 4% of gross revenue collected as licensing fees
- Revenue is generated according to Tables C-1, C-2, and C-3
- Owner takes a $25k yearly salary for all 5 years
- Other employees are paid a $50k yearly salary
- Owner and employee payroll taxes are 10% of salary
- Workers' compensation insurance for employees is 5% of salary
- Contract labor wage is $15 / hour
- Engineers are paid $150 / hour
- Production-related labor costs assumed to be 10% of sales
- Variable manufacturing overhead makes up 2% of sales
- Product liability insurance is 1% of sales
- Transportation is 3% of sales
- Marketing is 3% of sales
- Accounting (bookkeeping) is $3k / year
- Legal fees from contract generation average $5k each
- Federal and state tax rates are 35% and 8% respectively on operating profit minus interest
- Depreciation is accounted for on a units-of-production basis, with no scrap value afterwards
- Inventory is generally manufactured 30 days in advance
- 5th year inventory in balance sheet based on growth factor of previous 2 years
- A/P (for materials) and A/R (for sales) periods are 30 days
- In cash flow, Year 2-5 sales are assumed to be evenly distributed
- Labor, utilities, etc. payable upon receipt
- A $3k line of credit will be maintained and paid off on a monthly basis, generating no interest

Timeline

Months 1-3

- Operations out of home office, $500 / month (i.e. half of estimated total rent)

- Initial incorporation as LLC ($500)
- Obtain copyrights and trademarks ($2.5k total)
- Set up accounting (bookkeeping)
- Heavy R&D to finalize product design (350 hours total for the year)
- File patents (2 design at $1.5k each, 1 utility for $7.5k)
- Secure initial client and negotiate contract
- Set up website, etc. with outside services ($10k over the year)
- Secure $200k in funding for initial manufacture

Months 4-8

- Initial $30k PPE investment for bulk bin injection molds (expected to produce 50k units)
- First bulk bin and dispenser prototype manufacturing run
- First bulk bins to market: 400 bulk bins will be sold to a single manufacturer for $100 each
- First dispensers to market: 25 dispensers will be provided for free to a single selected retailer
- Hire contract labor (400 hours) to help with quality assurance, etc.

Months 9-12

- Additional R&D to refine design after feedback from first customers
- Secure additional clients for non-prototype production run
- Finish accounting (bookkeeping) for year

Year 2

- Operations move to $3k / month location, 25% used for office work, 75% used for light assembly operation
- Prosecute patents ($1.5k each for design, $3.5k for utility)
- File Patent Cooperation Treaty for dispenser ($5k)
- Further $20k PPE investment to account for any design changes (expected to produce 100k units)
- Begin manufacture of non-prototype bulk bins and dispensers
- Sell bulk bins for $75 each to 3-4 different manufacturers
- Sell dispensers for $200 each to retailers supplied by the manufacturers
- 3,500 hours of contract labor
- 250 hours of additional R&D
- $15k spent on outside services (website maintenance, etc.)

- Partner with another firm to bring personal containers to market in Year 3

Year 3

- Expand sales to additional manufacturers and retailers
- Prosecute utility patent in US ($3.5k) and Europe ($5k)
- Begin collecting licensing fees on personal container sales (assumed to sell for $3 each)
- 6,800 hours of contract labor
- 250 hours of additional R&D
- $20k spent on outside services (website maintenance, etc.)

Year 4

- Operations move to $10k / month location, 15% used for office work, 85% used for light assembly operation
- Expand sales to additional manufacturers and retailers
- Prosecute utility patent in Europe ($2.5k)
- 13,500 hours of contract labor
- 150 hours of additional R&D
- $20k spent on outside services (website maintenance, etc.)

Year 5

- Expand sales to additional manufacturers and retailers
- Prosecute utility patent in Europe ($2.5k)
- 26,800 hours of contract labor
- 150 hours of additional R&D
- $20k spent on outside services (website maintenance, etc.)

Sales

Year	Unit Sales	Price / unit	Revenue	Material cost / unit	Total Cost
1	400	$100	$40,000	$10	$4,000
2	4,000	$75	$300,000	$10	$40,000
3	8,000	$75	$600,000	$10	$80,000
4	16,000	$75	$1,200,000	$10	$160,000
5	32,000	$75	$2,400,000	$10	$320,000

Table C-1: Bulk bin direct sales

Year	Unit Sales	Price / unit	Revenue	Material cost / unit	Total Cost
1	25	$0	$0	$2,000	$50,000
2	1,000	$200	$200,000	$100	$100,000
3	2,000	$200	$400,000	$100	$200,000
4	4,000	$200	$800,000	$100	$400,000
5	8,000	$200	$1,600,000	$100	$800,000

Table C-2: Dispenser direct sales

Year	Unit Sales	Price / unit	Revenue
1	0	$0	$0
2	0	$0	$0
3	100,000	$3	$12,000
4	200,000	$3	$24,000
5	400,000	$3	$48,000

Table C-3: Personal container sales (revenue generated from 4% licensing fee)

Proformas

Proforma Income Statement (Year 1 Monthly)

Month End	1	2	3	4	5	6
Revenues						
Product Sales	$-	$-	$-	$-	$10,000	$10,000
Cost of Materials	$-	$-	$-	$-	$13,500	$13,500
Labor	$-	$-	$-	$-	$1,000	$1,000
Fixed Manufacturing Overhead	$250	$250	$250	$250	$250	$250
Variable Manufacturing Overhead	$-	$-	$-	$-	$200	$200
Cost of Goods Sold (COGS)	$250	$250	$250	$250	$14,950	$14,950
Gross Profit: Product	$(250)	$(250)	$(250)	$(250)	$(4,950)	$(4,950)
Licensing Fees	$-	$-	$-	$-	$-	$-
Total Gross Profit	$(250)	$(250)	$(250)	$(250)	$(4,950)	$(4,950)
Operating Expenses						
Accounting	$1,500	$-	$-	$-	$-	$-
Contract Labor (Non-Manufacture)	$-	$-	$-	$-	$500	$500
Depreciation	$-	$-	$-	$-	$60	$60
Insurance (Product Liability)	$-	$-	$-	$-	$100	$100
Insurance (Worker's Comp.)	$-	$-	$-	$-	$-	$-
Legal (Non-IP)	$833	$833	$833	$278	$278	$278
Marketing	$-	$-	$-	$-	$300	$300
Office Expenses	$250	$250	$250	$250	$250	$250
Outside Services	$1,667	$1,667	$1,667	$556	$556	$556
Payroll Taxes	$208	$208	$208	$208	$208	$208
Research and Development	$13,125	$13,125	$1,094	$1,094	$1,094	$1,094
Salary Expenses	$2,083	$2,083	$2,083	$2,083	$2,083	$2,083
Transportation	$-	$-	$-	$-	$300	$300
Total Operating Expenses	$19,667	$18,167	$6,135	$4,469	$5,729	$5,729
Earnings Before Interest & Taxes	$(19,917)	$(18,417)	$(6,385)	$(4,719)	$(10,679)	$(10,679)
Interest	$-	$-	$-	$-	$-	$-
Taxes	$-	$-	$-	$-	$-	$-
Total Net Profit (Loss)	$(19,917)	$(18,417)	$(6,385)	$(4,719)	$(10,679)	$(10,679)

Table C-4-1: Proforma income statement (Year 1, monthly)

(Continued on next page.)

Proforma Income Statement (Year 1 Monthly)

Month End	7	8	9	10	11	12
Revenues						
Product Sales	$10,000	$10,000	$-	$-	$-	$-
Cost of Materials	$13,500	$13,500	$-	$-	$-	$-
Labor	$1,000	$1,000	$-	$-	$-	$-
Fixed Manufacturing Overhead	$250	$250	$250	$250	$250	$250
Variable Manufacturing Overhead	$200	$200	$-	$-	$-	$-
Cost of Goods Sold (COGS)	$14,950	$14,950	$250	$250	$250	$250
Gross Profit: Product	$(4,950)	$(4,950)	$(250)	$(250)	$(250)	$(250)
Licensing Fees	$-	$-	$-	$-	$-	$-
Total Gross Profit	$(4,950)	$(4,950)	$(250)	$(250)	$(250)	$(250)
Operating Expenses						
Accounting	$-	$-	$-	$-	$-	$1,500
Contract Labor (Non-Manufacture)	$500	$500	$-	$-	$-	$-
Depreciation	$60	$60	$-	$-	$-	$-
Insurance (Product Liability)	$100	$100	$-	$-	$-	$-
Insurance (Worker's Comp.)	$-	$-	$-	$-	$-	$-
Legal (Non-IP)	$278	$278	$278	$278	$278	$278
Marketing	$300	$300	$-	$-	$-	$-
Office Expenses	$250	$250	$250	$250	$250	$250
Outside Services	$556	$556	$556	$556	$556	$556
Payroll Taxes	$208	$208	$208	$208	$208	$208
Research and Development	$1,094	$1,094	$8,750	$8,750	$1,094	$1,094
Salary Expenses	$2,083	$2,083	$2,083	$2,083	$2,083	$2,083
Transportation	$300	$300	$-	$-	$-	$-
Total Operating Expenses	$5,729	$5,729	$12,125	$12,125	$4,469	$5,969
Earnings Before Interest & Taxes	$(10,679)	$(10,679)	$(12,375)	$(12,375)	$(4,719)	$(6,219)
Interest	$-	$-	$-	$-	$-	$-
Taxes	$-	$-	$-	$-	$-	$-
Total Net Profit (Loss)	$(10,679)	$(10,679)	$(12,375)	$(12,375)	$(4,719)	$(6,219)

Table C-4-2: Proforma income statement (Year 1, monthly)

(Continued from previous page.)

Proforma Cash Flow Statement (Year 1 Monthly)

Month End	0	1	2	3	4	5	6
Cash Flow from Operating Activities							
Starting Cash Position	$-	$50,000	$30,083	$6,417	$194,781	$160,063	$152,944
Net Income	$-	$(19,917)	$(18,417)	$(6,385)	$(4,719)	$(10,679)	$(10,679)
Additions (Sources of Cash)							
Depreciation	$-	$-	$-	$-	$-	$60	$60
Increase in Accounts Payable	$-	$-	$-	$-	$-	$13,500	$-
Subtractions (Uses of Cash)							
Increase in Accounts Receivable	$-	$-	$-	$-	$-	$(10,000)	$-
Increase in Inventory	$-	$-	$-	$-	$-	$-	$-
Net Cash Flow from Operations	$-	$(19,917)	$(18,417)	$(6,385)	$(4,719)	$(7,119)	$(10,619)
Cash Flows from Investing Activities							
Property, Plant, & Equipment	$-	$-	$-	$-	$(30,000)	$-	$-
Capitalized IP Costs	$-	$(3,000)	$(5,250)	$(5,250)	$-	$-	$-
Cash Flows from Financing Activities							
Funding Round	$50,000	$-	$-	$200,000	$-	$-	$-
Change in Notes Payable	$-	$3,000	$-	$-	$-	$-	$-
Net Change in Cash	$50,000	$(19,917)	$(23,667)	$188,365	$(34,719)	$(7,119)	$(10,619)
Closing Cash Position	$50,000	$30,083	$6,417	$194,781	$160,063	$152,944	$142,325

Table C-5-1: Proforma cash flow statement (Year 1, monthly)

(Continued on next page.)

Proforma Cash Flow Statement (Year 1 Monthly)

Month End	7	8	9	10	11	12	Year 1 Total
Cash Flow from Operating Activities							
Starting Cash Position	$142,325	$131,706	$121,088	$105,213	$92,838	$88,119	$50,000
Net Income	$(10,679)	$(10,679)	$(12,375)	$(12,375)	$(4,719)	$(6,219)	$(127,840)
Additions (Sources of Cash)							
Depreciation	$60	$60	$-	$-	$-	$-	$240
Increase in Accounts Payable	$-	$-	$(13,500)	$-	$-	$-	$-
Subtractions (Uses of Cash)							
Increase in Accounts Receivable	$-	$-	$10,000	$-	$-	$-	$-
Increase in Inventory	$-	$-	$-	$-	$-	$-	$-
Net Cash Flow from Operations	$(10,619)	$(10,619)	$(15,875)	$(12,375)	$(4,719)	$(6,219)	$(127,600)
Cash Flows from Investing Activities							
Property, Plant, & Equipment	$-	$-	$-	$-	$-	$-	$(30,000)
Capitalized IP Costs	$-	$-	$-	$-	$-	$-	$(13,500)
Cash Flows from Financing Activities							
Funding Round	$-	$-	$-	$-	$-	$-	$200,000
Change in Notes Payable	$-	$-	$-	$-	$-	$-	$3,000
Net Change in Cash	$(10,619)	$(10,619)	$(15,875)	$(12,375)	$(4,719)	$(6,219)	$31,900
Closing Cash Position	$131,706	$121,088	$105,213	$92,838	$88,119	$81,900	$81,900

Table C-5-2: Proforma cash flow statement (Year 1, monthly)

(Continued from previous page.)

Proforma Income Statement (5 Years)

Fiscal Year End	1	2	3	4	5
Revenues					
Product Sales	$40,000	$500,000	$1,000,000	$2,000,000	$4,000,000
Cost of Materials	$54,000	$140,000	$280,000	$560,000	$1,120,000
Labor	$4,000	$50,000	$100,000	$200,000	$400,000
Fixed Manufacturing Overhead	$3,000	$27,000	$27,000	$102,000	$102,000
Variable Manufacturing Overhead	$800	$10,000	$20,000	$40,000	$80,000
Cost of Goods Sold (COGS)	$61,800	$227,000	$427,000	$902,000	$1,702,000
Gross Profit: Product	$(21,800)	$273,000	$573,000	$1,098,000	$2,298,000
Licensing Fees	$-	$-	$12,000	$24,000	$48,000
Total Gross Profit	$(21,800)	$273,000	$585,000	$1,122,000	$2,346,000
Operating Expenses					
Accounting	$3,000	$3,000	$3,000	$3,000	$3,000
Contract Labor (Non-Manufacture)	$2,000	$2,500	$2,000	$2,500	$2,000
Depreciation	$240	$1,333	$2,667	$5,333	$10,667
Insurance (Product Liability)	$400	$5,000	$10,000	$20,000	$40,000
Insurance (Worker's Comp.)	$-	$-	$2,500	$7,500	$10,000
Legal (Non-IP)	$5,000	$20,000	$20,000	$20,000	$20,000
Marketing	$1,200	$15,000	$30,000	$60,000	$120,000
Office Expenses	$3,000	$9,000	$9,000	$18,000	$18,000
Outside Services	$10,000	$15,000	$20,000	$20,000	$20,000
Payroll Taxes	$2,500	$2,500	$7,500	$17,500	$22,500
Research and Development	$52,500	$37,500	$37,500	$22,500	$22,500
Salary Expenses	$25,000	$25,000	$75,000	$175,000	$225,000
Transportation	$1,200	$15,000	$30,000	$60,000	$120,000
Total Operating Expenses	$106,040	$150,833	$249,167	$431,333	$633,667
Operating Expenses as a Percent of Sales	265%	30%	25%	22%	16%
Earnings Before Interest & Taxes	$(127,840)	$122,167	$335,833	$690,667	$1,712,333
Operating Profit Margin	-320%	24%	34%	35%	43%
Interest	$-	$-	$-	$-	$-
Taxes	$-	$52,532	$144,408	$296,987	$736,303
Total Net Profit (Loss)	$(127,840)	$69,635	$191,425	$393,680	$976,030

Table C-6: Proforma income statement (5 years)

Proforma Cash Flow Statement (5 Years)

Fiscal Year End	0	1	2	3	4	5
Cash Flow from Operating Activities						
Starting Cash Position	$-	$50,000	$81,900	$55,578	$172,586	$444,254
Net Income	$-	$(127,840)	$69,635	$191,425	$393,680	$976,030
Additions (Sources of Cash)						
Depreciation	$-	$240	$1,333	$2,667	$5,333	$10,667
Increase in Accounts Payable	$-	$-	$7,064	$11,499	$22,998	$45,996
Subtractions (Uses of Cash)						
Increase in Accounts Receivable	$-	$-	$(37,782)	$(41,068)	$(82,136)	$(164,271)
Increase in Inventory	$-	$-	$(35,072)	$(39,014)	$(65,708)	$(91,881)
Net Cash Flow from Operations	$-	$(127,600)	$5,178	$125,509	$274,167	$776,541
Cash Flows from Investing Activities						
Property, Plant, & Equipment	$-	$(30,000)	$(20,000)	$-	$-	$-
Capitalized IP Costs	$-	$(13,500)	$(11,500)	$(8,500)	$(2,500)	$(2,500)
Cash Flows from Financing Activities						
Funding Round	$50,000	$200,000	$-	$-	$-	$-
Change in Notes Payable	$-	$3,000	$-	$-	$-	$-
Net Change in Cash	$50,000	$31,900	$(26,322)	$117,009	$271,667	$774,041
Closing Cash Position	$50,000	$81,900	$55,578	$172,586	$444,254	$1,218,294

Table C-7: Proforma cash flow statement (5 years)

Proforma Balance Sheet (5 Years)

Fiscal Year End	0	1	2	3	4	5
Assets						
Current Assets						
Cash	$50,000	$81,900	$55,578	$172,586	$444,254	$1,218,294
Accounts Receivable	$-	$-	$37,782	$78,850	$160,986	$325,257
Merchandise Inventory	$-	$-	$35,072	$74,086	$139,795	$231,675
Total Current Assets	$50,000	$81,900	$128,432	$325,523	$745,034	$1,775,226
Fixed Assets						
Property, Plant, & Equipment	$-	$30,000	$50,000	$50,000	$50,000	$50,000
Accumulated Depreciation	$-	$(240)	$(1,573)	$(4,240)	$(9,573)	$(20,240)
Total Fixed Assets	$-	$29,760	$48,427	$45,760	$40,427	$29,760
Intangible Assets						
Intellectual Property	$-	$13,500	$25,000	$33,500	$36,000	$38,500
Total Assets	$50,000	$125,160	$201,859	$404,783	$821,461	$1,843,486
Liabilities & Owner's Equity						
Accounts Payable	$-	$-	$7,064	$18,563	$41,561	$87,556
Notes Payable, Bank	$-	$3,000	$3,000	$3,000	$3,000	$3,000
Total Liabilities	$-	$3,000	$10,064	$21,563	$44,561	$90,556
Shareholder Equity	$50,000	$250,000	$250,000	$250,000	$250,000	$250,000
Retained Earnings	$-	$(127,840)	$(58,205)	$133,220	$526,900	$1,502,930
Total Equity	$50,000	$122,160	$191,795	$383,220	$776,900	$1,752,930
Total Liabilities & Owner's Equity	$50,000	$125,160	$201,859	$404,783	$821,461	$1,843,486

Table C-8: Proforma balance sheet (5 years)

Appendix D: Competitive Landscape

The potential competition for Marketainer ranges from existing bulk dispenser suppliers to disposable packaging manufacturers. However, none of these firms offer an integrated, high-tech system that addresses the entire product supply chain. The vision to revolutionize the shopping experience makes Marketainer unique. Still, it is important to analyze potential competitors in the market.

Bulk Bin Industry

The existing bulk bin industry consists mainly of industrial reusable plastic container (RPC) manufacturers. A number of the leading providers are listed below.[23]

Orbis Corporation

Orbis provides reusable containers to manufacturers. They analyze customer systems, design a solution and execute a reusable packaging program. They use life-cycle assessments to compare reusable and single-use packaging to help customers reduce their overall environmental impact.

IFCO Systems

IFCO Systems is an international logistics service provider with more than 210 locations worldwide. They operate a pool of more than 69 million RPCs globally. These RPCs are used primarily to transport fresh produce from growers to grocery retailers.

Buckhorn, Inc.

Buckhorn, Inc. offers collapsible bulk containers in a variety of sizes and capacities.

Decade Products, LLC

Decade Products manufactures bulk shipping and storage containers for industrial, agricultural and food processing applications worldwide. They are one of the few bulk bin suppliers to offer customized bulk containers.

Rehrig Pacific Company

Rehrig Pacific offers reusable containers for shipping food and beverage products.

Schoeller Arca Systems

Schoeller Arca Systems sells reusable, collapsible containers for shipping.

DuraGreen Bulk Containers

DuraGreen Containers offers environmentally sustainable reusable containers. Their bulk containers are made of plastic recycled from out-of-service containers. They are stackable, built for heavy-duty use, and easy to assemble and disassemble. DuraGreens containers differ from Marketainer's because they are not fully enclosed, airtight, nor as protective and hygienic.

Dispenser Industry

Trade Fixtures

Based in Little Rock, Arkansas, Trade Fixtures is a market leader in the bulk bin industry. Founded in 1982, Trade Fixtures was bought in 1999 by Display Technologies and later merged with another competing bulk company, Newleaf Designs. Today they have sold over 1 million units worldwide and have sales representatives in 46 countries. Their goal is “to offer the most innovative, functional products to customers.” They are capable of supplying everything from small-scale to mass-market grocers, and sell bins that can hold pet food, cereal, spices, herbs, coffee, tea, candy, natural foods and liquids. Currently, they advertise themselves as an “ecologically sound” alternative and promote the environmental benefits of their product. With modern bulk dispensers, a large market share, and green marketing focus, Trade Fixtures presents the biggest competitive threat to Marketainer. Some of Marketainer's potential partners already use Trade Fixtures' products. It is likely that Marketainer will need to compete directly with Trade Fixtures to capture its desired market.

Best Bins

Best Bins is a small start-up company, based in Chaska, Minnesota. They currently have two employees, offer two product sizes (four and eight gallons) and have $370k in annual sales. Their bins are marketed for their ease of assembly, comprised of only 9 parts (compared to 14-20 typical with most dispensers), and offer easy installation onto store shelves. While this company is small, it demonstrates that a range of successful bulk bin manufacturers exist, and are competing for the same market share at the regional and national levels.

Displays2Go

Created in 1974, Displays2Go has over 190 employees and sells over 4,000 different types of displays, ranging from retail store displays to trade show displays. Their products include bulk bins of various capacities, in four to twelve gallon sizes. Based on their size, they do have the potential to rival Marketainer in the marketplace. However, they manufacture a large array of products, and are unlikely to devote as many resources to competing against Marketainer directly.

Personal Container Industry

In the personal container industry, Tupperware, Ziploc, Lock & Lock, and Sonoco are potential competitors to Marketainer. All four firms have existing personal containers on the market that could potentially be used for bulk product storage. The size, shape, and price of these products vary widely.

Tupperware

Tupperware Brands Corporation is a publicly traded company that specializes in reusable food containers. As a multinational corporation, they generate $2 billion annually. They are the market leader in the personal container industry (having coined the common term for personal containers as “Tupperware”), and offer a plethora of personal containers, differing in size, shape and function. Given the size of the corporation and its market share, Tupperware is a sizable threat to Marketainer in the personal container market. While Marketainer can differentiate itself from Tupperware by offering branded containers, Tupperware can likely use existing partnerships to compete in this arena. An alternative for Marketainer would be to outsource the manufacturing of personal containers to Tupperware through a licensing agreement, thus reducing the threat of competition.

Ziploc

Owned by S. C. Johnson, a private company, Ziploc is another market leader in personal containers. S. C. Johnson operates in 110 countries and generates $8.8 billion annually from cleaning and hygienic products. They manufacturer both plastic sealable bags and personal containers. Due to its size, Ziploc is a potential competitor to Marketainer in personal container manufacturing. However, as with Tupperware, they will not be able to easily duplicate the integrated system of Marketainer's product line. Customers may attempt to use their containers to store bulk products. However, Ziploc's personal containers are thin and flexible, and are unlikely to be suitable for holding large amounts of dense material. Ziploc could also be licensed to use Marketainer's technology to manufacture personal containers through a partnership agreement.

Lock & Lock

Lock & Lock is a private company specializing in airtight reusable containers that store consumable solids and liquids. Founded in 1985, Lock & Lock has over 600 products available on the market, and generates $160 million in sales annually. Currently, they are the leading sellers of personal containers in Korea and China, and are planning to expand to the US. Their products are differentiated by a unique locking mechanism around the rim of their containers. The company envisions itself as being the world leader in airtight food containers by the end of 2010. Similar to Tupperware and Ziploc, Lock & Lock is a potential competitor to Marketainer in the personal container industry. However, due to their low market penetration within the US they are less likely to be an immediate threat. There is also the potential to partner with Lock & Lock if we seek to introduce our system to Asian markets.

Sonoco

Sonoco is a publicly traded company specializing in packing materials for consumer goods in the US, Canada and Europe. Sonoco generates over $4 billion in revenue annually, and partnered with Target to create a personal container that allows customers to place entire cereal boxes inside to maintain freshness. Since their unique products are sold exclusively at Target stores, Sonoco may use its leverage with the retail powerhouse to prevent adoption of the Marketainer system. This is a potential future threat to Marketainer, but presents little immediate threat.

Disposable Packaging Industry

If Marketainer is successful, the disposable packaging industry could potentially lose a major revenue stream for liquid and flowable solid products. In order to turn these competitors into partners, Marketainer will attempt to work with them to shift to reusable containers and bulk bins.

Georgia-Pacific

Georgia-Pacific is a large building and packing company with over 45,000 employees. They have a very diverse portfolio of packaging products spanning many industries including agriculture, construction, and toiletries. Given their expansive company and chemical research, they may be capable of surviving an industry change from disposable packaging to reusable personal containers.

Smurfit-Stone

Similar to Georgia-Pacific, Smurfit-Stone is a consumer and industrial packaging company. With facilities in nearly every state and 22,000 employees in the US, Canada, Mexico and Asia, Smurfit-Stone is an industry leader. They supply General Mills and Kellogg with cereal boxes. Like Georgia-Pacific, they would likely be capable of manufacturing Marketainer personal and bulk containers. Smurfit-Stone is also a company with a strong corporate responsibility policy and the company may welcome the opportunity to green the flowable liquid and solid product distribution process.

Appendix E: Decision-Making Process

When creating the Marketainer system, several iterations of the design and operational features were considered. Marketainer realizes that for every new feature added to our system, there are economic and environmental trade-offs. We also recognize that there are significant barriers to adoption. Thus, Marketainer has designed a system that will be implemented in phases. The following illustrates the different characteristics of the bulk bin and personal container designs we will roll out.

Bulk Bin

Phase I:

- Disposable interior bladder
- Collapsible bin
- Little sanitization required
- Low-complexity reverse logistics

Considerations:

- Decreased water usage
- Increased fossil fuel usage
- Disposable packaging required

Phase II:

- No bladder
- No collapsibility
- Increased sanitation needs
- Increase in reverse logistics complexity

Considerations:

- Increased water usage
- Decreased fossil fuel usage
- No disposable packaging required

Personal Containers

Phase I:

- Any containers may be used in the system (including disposable plastic bags)
- Requires a lower level of consumer buy-in

- Can potentially charge consumers for disposable bags, or discount their purchase if they bring in their own personal containers
- Increased spillage
- Weighs at the bulk bin

Phase II:

- Uses standardized Marketainer containers
- Requires greater consumer buy-in
- Decreased spillage
- Locks in at the dispenser base and weighs at the bulk bin

Appendix F: Proof-of-Concept Prototype

The Marketainer team designed and built a proof-of-concept prototype to demonstrate our system. This prototype was designed specifically for dry, non-perishable, flowable solids, such as cereal. The prototype was constructed to complement several 3D computer animated design simulations (created in Solid Works 3D) of the ideal Marketainer system. This prototype tangibly demonstrates the basic functionality of the Marketainer system. As the system design evolves over time and funding increases, we will incorporate additional functionality and improve our working prototypes.

The Marketainer prototype consists of three main components:

- A custom-fabricated acrylic bulk bin (approximately 5 gallon capacity), which locks into the dispensing unit
- A dispensing unit (constructed from a Trade Fixtures Radeus Model #618/624) with a small LCD touch screen, capable of dispensing product and interacting with the consumer through a custom-built graphical user interface (GUI)
- A set of personal containers and a customized canvas bag (the Marketainer Personal Container Carrying Kit) designed to hold a wide variety of products

Although the dispensing unit has a built-in card-holder designed to hold the Marketainer card, this is currently just for demonstration purposes and does not offer any functionality. Additionally, the prototype does not actually incorporate weight or volume sensors. The touch screen displays a GUI programmed to simulate a typical consumer transaction. The personal container kit design was based off a wardrobe stylist's set bag, and was constructed by sewing a variety of pockets onto an existing canvas bag. It supports a number of different personal container shapes and sizes. The Marketainer logos on each component were printed as stickers by a local print shop in Goleta, CA.

Figure F-1: The Marketainer bulk bin prototype

Figure F-2: The Marketainer dispenser and personal container prototypes

Appendix G: The Complete Marketainer Experience

The Marketainer experience is designed to lead the reader through the experience of each Marketainer system user: the manufacturer, the retailer, and the consumer.

The Manufacturer Experience

Bulk bins are purchased from Marketainer. These bulk bins are protected by a limited warranty which covers manufacturing defects. Any defective bulk bins covered under the warranty are returned to and replaced by Marketainer. All broken bins not covered by the Marketainer warranty are managed and disposed of by the owners.

Once under the manufacturer’s ownership, company branding and product specific labels can be added to the bins as desired. The labels on the outside of each bulk bin will advertise the product contained inside when displayed in retailing facilities. These advertisements are similar to those on current single use disposable packages, but on a larger scale. Manufacturers also have the option to purchase and customize Marketainer personal containers for an extended branding opportunity. Permanent labels and images can be applied to the containers to allow for continual brand exposure. These customized containers can then be sold directly to consumers online, or to retailers for resale within their facilities.

Once the bulk bins have been customized and sanitized, they are ready to be filled. Products are loaded directly into the bulk bins immediately following the production stage. The bins are then sealed and compactly loaded into trucks, minimizing the inefficient transport of empty air space. The full bulk bins are then transported to retailers, who have purchased the products contained in the bins.

After the product is sold to the consumer, empty bulk bins are returned to the manufacturer. This is coordinated between retailers, distributors, and manufacturers in a way that optimizes reverse logistics. The used, empty bulk bins are cleaned and sanitized through an efficient industrial washing process (either en route to the manufacturer, or at the manufacturer's facility). The bulk bins are then ready for refilling and the cycle begins again. The manufacturer is relieved of the economic and environmental costs of regularly consuming large volumes of disposable packaging. Additional cost savings from improvements in transportation efficiency and product protection can be passed on to both retailers and consumers.

The Retailer Experience

Gravity-fed dispensing units are purchased from Marketainer. These dispensers have a lifetime guarantee for all plastic parts and a limited warranty on all electronic parts. The installation and set up of all dispensing units (and the associated computer system) into the retailers existing facility is done by Marketainer personnel or locally-contracted service providers. Additionally, employees at each retailer will be trained by Marketainer in the basic upkeep and troubleshooting procedure of the Marketainer system. Technical problems beyond the level of store employees can be taken care of by a technician employed or contracted by Marketainer, and is covered under the limited warranty. Once electronics have reached the end of their usable life, they are returned to Marketainer for end-of-life management and, if still under warranty, replaced. This process similarly applies to defective dispensing units under warranty. Retailers can also purchase Marketainer personal containers for sale to consumers in their stores. Additionally, retailers will facilitate the process through which consumers obtain a card that activates the dispensing units (either Marketainer-specific or retailer-specific).

Retailers order and receive products in filled bulk bins from the product manufacturers or distributors. These bulk bins are stored in the back of the store in a predetermined stock area, informed by turnover rates. Once the on-floor supply diminishes to a low level, a computerized warning is triggered by the volume and weight sensors, notifying the retailer. At this point, the empty bulk bin is removed from the dispensing unit and stored in the back of the house until the next distributor pick-up, again coordinated by manufacturers, distributors and retailers. The dispensing units are easily disassembled to allow for the removal of all electronic parts and easy access to the interior surface area for cleaning. The detachable parts of the dispensing units are cleaned and sanitized on a regular basis, either by hand or by an in-store industrial dishwasher.

Back on the floor, products are restocked by plugging a full bulk bin into the dispensing unit. Once plugged in, the bottom panel of the bulk bin is unlatched, allowing the product to gravity-feed into the dispenser. This easy-to-lock-in system saves retailers the time, effort, and product waste that results from stocking each dispensing unit by the conventional method.

The bulk bin will slowly empty as consumers dispense the product into their personal containers. Computer technology and weight sensors built into the dispensing unit allow for easy monitoring of the quantity of product being sold (by weight and volume) and sales totals of each product, as well as the level of the product remaining in the dispenser and bulk bin. This information is tracked instantaneously with each transaction. In-house card scanning technology facilitates the tracking of purchase information on a customer-by-

customer basis. When a customer checks out, a simple swipe of their card will bring up all of the products dispensed by the Marketainer system during that shopping trip. This facilitates a quick and easy check-out by eliminating the need to weigh and manually input a unique product code for each item purchased. The retailer increases operational efficiency, reduces its environmental impact, and experiences cost savings through the purchase of lower-priced products, labor savings at both stocking and check-out, increased utilization of storage and stocking space, and less packaging waste management.

The Consumer Experience

Consumers obtain either a retailer-specific card or a Marketainer card at the store, free of charge. In exchange, consumers provide the retailer with a small amount of personal information (such as their name, physical address, and e-mail address) in order to facilitate information exchange between the two parties. Consumers can also choose to purchase personal containers from retailers for use in the Marketainer system. These personal containers will be offered in a variety of shapes and sizes to accommodate a wide range of products.

To achieve the optimal environmental benefits of the Marketainer system, consumers can bring their personal containers and swipe card to the retail establishment. However, even if they do not, it is still possible to use the Marketainer system. To purchase a bulk product from the system, consumers will input their card into a reader located on the dispensing unit. If they do not have their card with them, they will be able to input other identifying information, such as their phone number and unique personal identification number (PIN). The consumer then positions their personal container below the dispenser. If a Marketainer personal container is being used, the dispensing system will lock the base of the container into the dispensing unit.

At this point the consumer has the option to predetermine the amount of product they want, based either on weight or on price. Utilizing built-in weight sensors, the dispensing unit can calculate the amount of product flowing out of the system and will automatically dispense the predetermined amount of product. This eliminates inconveniences normally created by different-sized or partially-filled personal containers. The consumer also has the option of manually dispensing the product with a simple start and stop button. The locked-in container prevents product spillage, a benefit to the consumer since they pay for the amount of product they dispense. If the consumer has not brought a personal container with them to the retail establishment, post-consumer recycled plastic bags will be available for them to use and recycle upon disposal.

For all Marketainer purchases, the consumer, product and purchase information will be stored in the retailer's centralized computer system. As consumers shop for additional bulk items using their Marketainer card, the computer system will continue to monitor all products being dispensed under their account. At check out, a single swipe of their card will reveal all Marketainer item purchases and automatically total this portion of their bill. The consumer can pay and leave without having to unload their cart or wait for each bulk product to be weighed and manually entered into the system.

Once at home the consumer can use their PIN to look up information on the Marketainer website regarding the products they have purchased. Details such as nutritional information, ingredients, expiration dates and recipes will be available here. Furthermore, the consumer can sign up to receive e-mail notifications when products they have purchased near their expiration date, or if anything they purchased has been recalled. The consumer can clean their personal container as they see fit, and bring it back to the retailer to continue using the Marketainer system. The consumer experiences cost savings and a more sustainable standard of living through an increasingly-convenient and timely shopping experience, augmented purchasing power, lower-priced products, and avoided packaging waste.

Appendix H: System Comparison

Disposable Packaging vs. Current Bulk	
• Maintains product integrity from manufacturer to consumer -- superior product protection, sanitation, and freshness (until packaging is breached) • More advertising opportunities for manufacturers • More product information provided • Consumers have access to product information and are exposed to brand at home • Less time and labor required for retailers (stocking and checkout) • Wider selection of products available • Less time-consuming for shoppers ("grab and go") • Simple and less intimidating for consumers • Cleaner in-store product display (no partially empty bins, spillage, etc.) • No cleaning/sanitation of dispensers required (easier in terms of compliance with regulation)	• Lower environmental impact • Lower packaging costs for manufacturers • Lower product costs for consumers, which drives up demand for retailers and manufacturers • Reduced space requirements • More efficient transportation logistics • Consumers can purchase product in any quantity • Consumers can use their own/preferred packaging containers • Consumers can clearly see the product before they purchase it • Less packaging waste for consumers to deal with at home, and for retailers to deal with at the store

Current Bulk vs. Marketainer	
• System already integrated into current retailers and manufacturers • Few reverse logistics / back-hauling required • Cleaning / sanitization only required by retailers • Less overall system maintenance and technology-related upkeep • No need for consumer to acquire card first	• Lower environmental impact • Cost savings for manufacturers and consumers through avoided packaging production • Cost savings for retailers due to easier stocking, cleaning, and checkout, as well as reduced spillage and theft • End-of-life cost savings for retailers and consumers • Superior product protection, sanitation, and freshness • Improved convenience / time savings at checkout for both consumers and retailers due to intelligent dispensing units • Web-based system providing extensive product information to consumers • Electronic monitoring of in-store product stock levels, and simplified restocking procedure • Instantaneous and precise retailer feedback on sales, turnover rates, loss, etc. • Superior advertising opportunities • Streamlines the bulk-goods buying process for all parties involved in the supply chain • Education-oriented marketing campaign directly addresses resistance to bulk adoption • Addresses the needs of the entire supply chain • Innovative and novel

Disposable Packaging vs. Marketainer	
• System and infrastructure already in place • Industry leaders reputation and relationships already well established • Thorough existing knowledge of the market and potential competition • Industry leaders are well funded/financial backed • Lower dependence on advanced technology and engineering	• Lower environmental impact • Lower packaging costs for manufacturers • Lower product costs for consumers • Reduced space requirements • More efficient packing density • Consumers can purchase product in any quantity • Educational opportunities stemming from consumer unfamiliarity with food supply chain issues

Appendix I: Market Research Interviews

Reasoning

- Marketainer should pursue a range of product retailers to gain insight into retailer adoption motivations
- Target retailers should include those with an existing bulk system in place as well as retailers that do currently not offer bulk, so they can provide feedback on the pros and cons of their systems
- Marketainer should also pursue a variety of product manufacturers
- In order to understand a wide range of manufacturer's packaging issues, interviews should include manufacturers that are already taking steps to minimize packaging, as well those that are not

Interviews

Retailer: In Person Interview with Denver Dale, Bulk Foods Manager, Isla Vista Food Cooperative (IVFC)
May 21, 2009

What do you like about the current bulk system?

- Allows IVFC to have a lot of product in a relatively small area (can stack and allows for density of product)
- Good for limited space

What do you dislike about the bulk system?

- Flimsy & awkward, particularly the trade fixtures
- Bows down with the weight, end pieces lift up
- Can be heavy
- Time consuming for the employees waling back and forth
- Always spillage > dependent on what it is
- Can save retailers money
- Also improves the safety of the store – flour on the floor is pretty slippery
- Grains and oats are particularly difficult
- Can also be time consuming
- Crew has to stand on a footstool to stock
- Awkward to carry

What improvements would you make to the IVFC bulk system?
Can you help us to illustrate the supply chain?

- Talk to Steve – longest tenured employee at IVFC
- Producers can choose to work with a distributor or not
- Producers send their products to a central distributor
- The distributors distribute to regional distributors
- There may be another intermediate step depending on the type of product

- And then the product ends up at the retailers on a full size 18 wheeler (always dropping off and picking up)
- Coop gets 2 deliveries a week
- For the local food stuff go to Shawn McMahon – much simpler
- Veritable vegetable picks up organic produce from all over California and distributes up and down CA > gets 2 deliveries a week (more staple products) > whatever they can't get locally
- Participate in a local backyard garden program

Could you stereotype a typical bulk customer?
- In IV, strange – different than other stores because of the area
- Mostly students
- In the past mostly hippie, earth lovers
- Changing now – with Trader Joe's & Lazy Acres including bulk in their stores people are adjusting to it

Do you get customer complaints specific to the bulk section, and if so, what is there nature?
- Not so much customer complaints
- Business complaints are cleanliness
- People complain about staleness
- Sensitive about allergen stuff – current rule is that if you have allergies you don't buy bulk – Marketainer could address this

Tell us about the current system:
- Pull the bin off the shelf, stock in the back and then bring it back out
- For the gravity fed bins you remove the whole shelf
- Detrimental for the employees

How many distribution centers do you deal with?
- Just 1, unified natural foods

How often do you clean the bins?
- Fairly often depending on the bins
- For a flour bin you can wipe it off and let it air dry
- For the date bins you have to rinse it several times
- Can be very labor intensive
- If they could heat clean the bins it would be way easier…
- For cat or dog food it's hard to do smaller quantities – especially in terms of stocking

Branding:
- Manufacturers don't have a big incentive to go bulk because they don't have any branding opportunities:
- Could just make the display bigger
- Nutritional information can be provided

- Could always just refill the bin with the same product and that would allow us to “brand” bins
- When a product gets near the bottom, the container gets replaced. Why?
- If there’s only a little bit of the item left people don’t buy it. It looks bad
- MARKETAINER needs to address the “bottom of the bin” problem...

Notes:

- Bulk honey is a “slow disaster” – MARKETAINER would be great for that because of the reduction in spillage
- Bulk oil comes in 35 lbs containers – if it spills it’s everywhere and creates a big hazard
- If you could seal the contents in a way where there’s no breach in sanitation it would be much more effective -- and could provide some sort of cost savings
- Professionals talk about logistics, amateurs talk about tactics
- Trying to redo their labor hours – MARKETAINER could potentially save 8 hours a week, conservatively > could pay people more & improve the quality of the work environment
- The coop is already sending back reusable boxes to the manufacturers
- The soap manufacturer sends their products in reusable totes that the coop sends back during the next delivery
- The truckers are already accustomed to
- Can we make them collapsible or make components that are easily broken down?
- With standardized bin sizes it’s much easier to calculate shipping charges
- People will be reluctant to adopt the system if it’s too specialized, it’ll take more effort on their part
- The bins should easily fit into their current setup – they shouldn’t have to spend money refitting
- Dispenser should have replaceable parts for cleaning

Retailer: In Store Interview with Bulk Section Manager, Santa Barbara Whole Foods Market
November 30, 2009

Have you ever thought of expanding the bulk section? What would it take to shift your store to offer more bulk (both internal and external changes)?

- The size of a Whole Foods bulk department depends on the size of the store. They will offer the best sellers first and expand from there.
- He said the Santa Barbara Whole Foods bulk department is relatively large, but doesn’t offer items like spices or protein powder that some Whole Foods offer.

- They do sell honey, which is constantly heated with a 40W bulb. Because it is always heated, he said it is not that hard to clean.

What features about bulk are most important?
- Sanitation. Clean the honey and peanut butter dispensers by hand, but most bins are washed in their industrial high pressure dishwasher.
- They also have an overseeing organization that provides a third party certification for cleanliness with the organic bulk products. This requires additional cleaning protocol after the dish-washing. This is done by hand.

Discussion of Marketainer:
- Liked the Marketainer idea. Didn't see too many problems at first but then started to think of more. Biggest ones were that many products currently offered in bulk are not flowable, like dried fruits and anything gummy. He also saw sanitation concerns with a personal container that locks in with/touches the dispenser.
- Didn't think they had much of a problem with "finds," or small crumbs collecting at the bottom of the bulk bins.

What consumer behaviors do you most notice when people approach the bulk section?
- Thinks those that don't use bulk probably do so because of false ideas about the sanitation/cleanliness of the products.

Manufacturers:
- Many manufacturers require minimum sized orders
- The size of bulk packages shipped from manufacturers to retailer depends, but is usually in about 25lb bags

Retailer: In Person Interview with Justin Ross, Manager, Gelson's Markets
December 8, 2009

Do you currently sell bulk?
- No, except for coffee. All the products in the store have a 1-day shelf life

If not, have you ever thought of offering a bulk section?
- Gelson's won't offer a bulk section because of infestation

What features about bulk are most important? What are least important?
- Freshness and sanitation are the most important.

Notes:

- Bulk coffee cycles through three times a week, Justin was not sure how much coffee they go through
- Justin suggested that the vendors should stock, clean and maintain the bulk section, not market employees

Retailer: In Person Interview with Adrianna, Manager of Bulk Foods, Lazy Acres
December 8, 2009

Do you currently sell bulk?

- Yes

What considerations are most important to you: shelf spacing, storing efficiency, labor costs, etc? (Possibly have them rank responses in priority preference)

- 25 lbs is the average size of a bulk product from the manufacturer, but they also purchase 50 lb bags. Only 30 lb bags can go in gravity bins on the top shelf, which is important because they won't stock items up there that can't be held over their head

What features about bulk are most important? What are least important?

- Freshness -- Lazy Acres only buys items that will sell so it avoids freshness issues ("old crops")
- Sanitation – most important: bulk section has daily cleaning tasks and every Sunday the floors are cleaned underneath the bins

Preference of owning v leasing dispensers:

- Adrianna would need to see the numbers for whether or not they would invest

Do you care about collapsible bulk bins?

- There is limited space in the back room so this could be essential

What consumer behaviors do you most notice when people approach the bulk section?

- Customers have to adjust at first. Lazy Acres allows them to try before they buy.

Notes:

- Bulk section is allotted 120 man hours per week
- Maintenance is allotted an additional 40 hours per week, this still comes out of their bottom line but doesn't affect the sales budget
- They have no stocking fees but Sunridge Farms paid for their fixtures through a deal that essentially guarantees 50% of all displays are Sunridge Farms products
- Question: would retailer be able to look (taste/test) the product?

- Coffee would be a great place to start
- Lazy Acres can't tare the Tupperware sold in store, they have to do it upstairs

Retailer: In Person Interview with Chevo, Bulk Ordering Manager, Lassens Natural Foods & Vitamins
December 9, 2009

Why do you currently sell bulk?
- Because it is cheaper than prepackaged foods and they can offer organic options

What are its benefits? Drawbacks?
- No drawbacks that he knows of

What would it take to shift your store to offer bulk (both internal and external changes)?
- Would have to talk to Frontier Natural Products where their dispenser come from

What considerations are most important to you: shelf spacing, storing efficiency, labor costs, etc? (Possibly have them rank responses in priority preference)
- Price is most important

What features about bulk are most important? What are least important?
- Chevo knows most of the customers who purchase bulk, if not he asks them if they need any help but most don't

Notes:
- Chevo has worked at Lassens for 2 years and has had no complaints other than freshness which are rare
- Difference between Lassens and other stores is that they don't sell alcohol – draws a different type of consumer
- Lassens also carries their own line of vitamins. Vitamins wouldn't work in bulk for the following reasons:
- Vitamins have a short shelf life
- They are sensitive to moisture

Retailer: Phone Interview with Cynthia Lavia, Director of Distribution Administrative Services, Ralphs
December 14, 2009

Do you currently sell bulk?
- No

Why not?

- That's not our demographic of shoppers

Have you ever thought of offering a bulk section?

- Our sister store, Food4Less (sometimes known as Foods Co) offers a large bulk section. They sell to a different demographic.

Retailer: In Store Interview with Shaun Cox, Grocery Manager, Santa Barbara Whole Foods Market
December 12, 2009

Do you currently sell bulk?

- Yes

Why or why not?

- Mostly customer demand. What each store offers in bulk depends on local demand.
- When they first open the store they look at regional sales numbers and offer similar products. Allocation of bulk products is determined by the regional office at that point. Then they see what is doing well from sales and based on customer feed back and demand and tweak it from there.
- Also, larger stores have more bulk items.

Why they don't offer more bulk products:

- Space limitations

What items do you carry in bulk?

- Mostly dried foods: nuts, grains, etc. Also have peanut better and soap.

Non-food products offered:

- Whole Body -- bulk soap
- Note: Whole Body is a company that has entire areas/displays dedicated exclusively to it, so I asked about those displays:
- Some of those displays are for specialization. Others may have a contract with Whole Foods. Otherwise it is determined by him based on shelf space and customers demand.

What are the benefits of bulk? What motivation do you have for buying and selling bulk item? Drawbacks?

- Customers can buy as little or as much as they want of products
- Usually cheaper, but not always true. Not sure about how pricing is determined.
- They are very big on maintaining product integrity and organic integrity so there are not many sanitation issues

- They have a bulk person/employee who is very on top of it, section has constant monitoring.

Bin details:
What brand(s) of bulk bins do you carry?
- Didn’t know

Do you own or lease these bins?
- Own

Is there a warranty on these bins?
- Didn’t know

Length of warranty? Coverage?
- Didn’t know

What are the dimensions of you bulk bins?
- Didn’t know

How many bulk bins do you have in your store?
- Approximately 187

Ratio of gravity to scoop bins?
- We have 50-70 gravity fed bins (After the interview I went into the store and counted about 30)
- The gravity bins have catchers underneath
- Moral -- the have mostly scoop bins

How are the bins dealt with once they are no longer usable?
- He has never seen a bulk bin “go bad” since they are hard, tough plastic. They might break, in which case they would replace it with a new one.

Who handles End-of-life (EoL) of bins? Bin manufacturer or retailer?
- Never seen one go bad unless damaged

How do you clean the bins?
- Mostly in the industrial dishwasher. Some by hand, like the peanut butters.

Who cleans them?
- When done by hand, usually the bulk guy (manager)

How frequently are they cleaned?
- On a rotation that changes depending on what needs to be cleaned the most, but every bin should be cleaned at least once a month.

To what extent are they cleaned?

- They use the “Good Organics” protocol, so cleared very thoroughly.
- Keep a log for protocol/proof.

If store uses an in-house dishwasher:
Do you know the energy and water consumption of this dishwasher?

- Didn’t know
- This is the prepared foods dishwasher. It’s super powerful so bins are assumed to have been sanitized

Heat and amount of water required to run one cycle?

- Didn’t know

Energy use required to run one cycle?

- Didn’t know

Frequency ran (for bulk cleaning)?

Determined by a period of time -- about once a month

- Another interesting fact is that they have an entire walk in fridge for bulk products. All of the bulk products are stored in here. Shaun said it allows items to keep longer. I asked about items that didn’t need to be refrigerated and he said if he has the space in a fridge that’s running anyway, he might as well use it. There were a few non-bulk products in there as well.

Sales details:
What is the average turnover rate of an x-sized bulk bin (full to empty)?

- Couldn’t tell me, proprietary information

What percentage of the stores total sales do you think comes from bulk products?

- Couldn’t tell me, proprietary information

Are bulk products more profitable to you, the retailer?

- Not necessarily, maybe if there is a really good deal from the manufacturer

Are bulk products priced lower than their prepackaged counterpart, i.e. cost saving for consumers?

- Usually, but not always

Expansion and Retailer Needs:

- What would it take to shift your store to expand its bulk section to offer more options such as cleaning or personal car products (both internal and external changes)?
- Got the impression it was customer demand more than anything

Bulk and Marketainer features?
Sanitation:

- Addressed above, food integrity very important to them

Spillage:

- Definitely happens. It's a penny by penny problem, but it does add up nation or worldwide
- Employee spillage during loading/pouring -- sure mistakes happen, but not too common, wouldn't have someone pouring a bag that they cannot lift

Protection of food integrity:

- Their greatest concern

Collapsible bulk bins (for back of the house storing):

- Space is always an issue -- wasted space is wasted money, more efficient is always better

Theft:

- Grazing is a more common problem. It happens. Also penny by penny issue but if it brings people in the store then ok with it
- He also mentioned that another issue is sometimes people will buy the organic version of a product but try and use the less expensive PLU of the conventional product at the register
- Will give people products if they're not offered in bulk and the customer just wants a small amount
- Lets people give stuff back, would never force anyone to buy anything, it's more important to keep the customer happy, decision is whether or not to put the product back into the bins. Would maybe put organic product back into a conventional bin, but not an organic product back into an organic product bin. Otherwise would maybe throw away/compost the product if questionable. A good test is whether or not he would eat it himself. If not it is definitely going to be disposed of

Personal Containers:

- No one brings in their own personal containers
- Offer consumers disposable bags -- recycled and recyclable

Ease of integration into current system

- Important concern. Marketainer doesn't seem like it would be easily integrated into the current system

What consumer behaviors do you most notice when people approach the bulk section?

- He said he had a common misconception of who used bulk before he started. Assumed it was mostly “hippies” but learned that actually everyone does use it for their own personal reason --for example older people more used to it because it’s what they grew up with, better price deal, quantity of product needed, product only available in bulk
- Reasons people don’t use bulk -- unfamiliar, scared of sanitation and contamination

Do you make an effort to educate people about bulk issues?

- Offer a free “bulk basics” book for consumer education out in store. It would require too much time to educate on an individual by individual basis. Does it when he has a chance.

Manufacturers and Logistics:

- What is the average size of the bulk products sent to you by retailers?
- Receive products from manufacturers in everything from 50lb bags (oatmeal) to 5lb bags (salt)

Bulk manufacturer packaging:

- Plastic bags and cardboard boxes. about 50-50 in what comes in loose bags v having secondary box (ex: rice -- loose bag)
- Whole Foods recycles 100% of this packaging

Do trucks leave empty?

- Some do, some don’t

If not, what are they carrying?

- Pick up pallets and sometimes compost

- He explained to me that Whole Foods Markets uses multiple distributors. This includes one that Whole Foods owns and operated. They have their own Whole Foods warehouse.
- In order to coordinate reverse logistics as in the Marketainer system, this could be done with the Whole Foods distributors, but not the ones they don’t control. It would have to be all Whole Foods trucks and would have to all come from same area. But currently they have many distributors.

The Marketainer model:

- He talked a couple of times about the major shift of the entire system that Marketainer is. Not in a bad way, but more like, this couldn’t be done overnight, or in one step.

- He mentioned that all ideas start on paper though (since this is a Masters thesis) and sometimes get picked up a long time later
- He talked about the possibility of a computerized system that can vacuum suck everything from the back of house into front/personal containers after weight or price is entered by customer. In his idea this wouldn't even require a different dispenser for each product as long as things like allergens could be dealt with.
- Mentioned a bar called Yankee Doodle where all drinks are made using computerized pours from kegs
- Talked about how it would save time and man power all the way around to have everything computerized. Thought it was a good idea, but didn't talk about the feasibility of implementation
- Also talked about how this would provide instant and near perfect feedback of what is and is not selling, how much, if things are walking away, etc.
- He did say that doesn't think buying in bulk is highly inconvenient right now. He compared it to buying fruits or vegetables.

Retailer: E-mail Interview with Kendra M. Doyel, Group Vice President, Public Relations & Government Affairs, Ralphs Grocery Company, Food4Less/Foods Co on behalf of both Ralphs and Food4Less
December 21, 2009

Do you currently sell bulk?
- No

Why not?
- We constantly evaluate our offering to our customers. At this time, it is not something that fits our stores or our business model.

Have you ever thought of offering a bulk section?
- We have looked into this option.

What would it take to shift your store to offer a bulk section (both internal and external changes)?
- We would have to work closely with our vendors to provide the correct products and method of getting them to the customer, fitting them in to our stores (at Ralphs, we are the product of many mergers so there are many different stores/formats), getting them on our trucks, fitting in to our warehouse (we are building an automated warehouse in Paramount right now that is designed to handle products based on their exact dimensions) etc. Margins are so small in the grocery industry (less than 2%) that it would have to help to maintain costs and be user friendly for our employees and customers.

Kendra did state that some Food4Less stores do offer some bulk products:

- Very little – maybe a couple of products (nuts are an example) in a very few stores. Definitely not widespread.

Retailer: Phone Interview with Gene Rathswohl, Category Manager-Grocery/Bulk Foods, Henry's Farmers Market
January 14, 2010

About Henry's Farmers Market:

- Henry's is one of the original stores to feature bulk -- have improved on and helped bulk products to grow. Have a signature bulk department and are a leader of bulk in the retailer grocery industry.
- 40 stores – 8 in Texas, 32 in Southern California
- Expanding to Northern California
- Have been successful despite the economy
- Cross between Whole Foods (cheaper but similar shopping experience) and Trader Joe's (more services and experiences)
- Sell everything -- full service grocery

Do you currently sell bulk?

- Yes

What are its benefits? What motivation do you have for buying and selling bulk items?

- Point of differentiation -- "Henry's Farmers markets"
- Farmers market look and feel -- different from other grocery stores
- Different perception people have when they come in, different feel and shopping experience
- Very profitable
- Recent bulk resurgence due to the economy because you can save money

Drawbacks?

- Have to keep it clean -- hygiene
- Making sure customer understands that it is clean and safe
- Can sell more packaged products in the space that it takes up because of perception
- Check out can be inconvenient. Have a booklet at the register to look up items. Workers become familiar over time. Same as produce.

Bin details:

- What brand(s) of bulk bins do you carry?
- Trade fixtures -- biggest bulk bin distributor

Do you own or lease these bins?
- Own

Is there a warranty on these bins?
- Good question. Not sure. Have a contract with them so they would replace bad bins, etc.

Lifespan of bins?
- General upkeep is required. Some parts wear out faster than others -- parts where there are connections, etc. Other damage depends on dropping. Bins themselves pretty sturdy, wouldn't expect to replace in a few years

How many bulk bins do you have in your store?
- About 200 bins + 15 barrels
- Barrels -- for higher volume selling items

Ratio of gravity fed to scoop bins?
- Impression was half and half -- located under each other

Store layout:
- Have a different store layout
- Bulk is front and center of the store, 1/3 of store layout

What items do you carry in bulk?
- Nuts, grains, dried fruit rice and beans, oats, chocolate items, sweets, candy, snacks

Any unique items like peanut butter, honey, spices?
- We have peanut butter. It but comes prepackaged in tubs -- plastic see through. Not ground by customers themselves.

Cleaning and Hygiene:
Does your store use an in-house dishwasher?
- No

How do you clean the bins?
- All cleaned by hand. Schedule directed to the stores.
- Monitored by store director

Who cleans them?
- Bulk supervisor and maybe 1 or 2 other clerks in the department

How frequently are they cleaned?
- Schedule directed to the stores
- Some cleaned more frequently than others
- Clean certain things every day

How long does it take to clean each bin (gravity v scoop)?

- All cleaned by hand, taken off to back room, soaked
- Rotating
- Dirtier stuff soaks overnight
- Time for drying
- Rotating, so always extra bins etc to make quick switch
- Scoop bins have more pours/crevices so harder to get in there.
- Use to use painters bucket, which was easier to clean
- Cleaning done at night
- Keep sweep logs
- Cleaned throughout the day were needed

What do you do if a customer dispenses an item from the bulk section and then decides they don't want it?

- It's discarded, can't do much else with it. Can't make customer take it.
- Can also help customer dispense products

Sales details:

- What is the average turnover rate of an x-sized bulk bin (full to empty)?
- Scoop bins have volume of usually about between 8-10lbs.
- Barrel can hold almost 100lbs of oats -- move fast, especially on sale. Couple 100 lbs a day.
- Stocking depends on store. Start day off full then stock throughout the day as needed.

What percentage of the stores total sales do you think comes from bulk products?

- Between x-xx%
- Monthly inventory of bulk products would have between $x-xx. Not much compared to dry grocery
- That's why other grocery stores won't give up the space
- But still a profitable margin

Are bulk products more profitable to you, the retailer?

- Yes so costs savings past on to consumer

Are bulk products priced lower than their prepackaged counterpart, i.e. cost saving for consumers?

- Yes, sell for less because of less cost
- Less labor costs, less marketing costs

Ex: 30-25 lb bag of cashews

- Distributor located in Southern CA, buys from grower who packages and labels

- Then stocked and ordered as needed
- Distributor buys ingredients, and mix themselves (ex: trail mix)
- But still much lower cost than 12 oz bag prepackaged etc
- Definitely cost saving in labor and package
- Distributor: about 95% of our bulk products come from one: Torn and Glasser
- UNFI supplies grocery but not bulk -- 1 extra step and higher cost on bulk

Do you experience a lot of spillage while stocking/loading your bulk bins?

- We budget in for shrink, but it mostly comes from customers
- Not much occurring in the back of the house

Expansion and Retailer Needs details:

- What would it take to shift your store to expand its bulk section to offer more options such as cleaning or personal care products (both internal and external changes)?
- Laughing…Talks to president about it all the time.
- Space. Used to have more. But decisions were made.
- Gravity bins can sell larger variety in less space. Win-win.
- When they didn't have those it took up a lot more space
- Expanding takes away from other departments that they have developed towards the total business of the store.
- Could definitely use more space

What consumer behaviors do you notice most when people approach the bulk section?

- Have very loyal bulk shoppers
- Cost is attractive
- Hygiene concerns -- if store doesn't do a good job keeping in clean -- but this true in any department
- Other hurdle or barrier -- gravity bins take effort, a lot of work for consumer, but then they know it hasn't been touched
- Some people love this process/shopping experience
- If there is a way to make it easier and clean and safe to shop -- buckets back in the day, but sanitation aspect turned off customers -- left exposed
- People tend to buy less now
- People afraid of gravity bins now
- Hard to control
- Use gravity to maintain hygiene -- no hands going inside

Do customers ever bring in their own personal containers for packaging bulk goods?

- Not really, haven't seen it
- We supply a bag on a role with a twist tie

- Think people sometimes bring it home then pour it into a personal container at home
- Would allow it, but customer would pay for the weight of the container

On shifting consumer behavior:
- See more and more people bring bags
- It's a learning curve and it takes time
- See it a lot more now than even 5 years ago

Grazing:
- Have signs up discouraging it
- Taking samples is ok, especially if it makes people more willing to buy and item
- Try to turn it into a positive
- Obviously not sanitary
- Not a huge economic cost
- Just look out for it and part of our training is to be respectful in your approach to people doing it

Manufacturers and Logistics:
- How do the store's general (reverse) logistics with distributors work.
- Do trucks leave empty?
- Yes. Have multiple deliveries so not going from full to empty. Back hauling.

Storage:
- We order from distributors 3 times a week so there's not much back stock which makes it easier to manage and rotate

Marketainer's reverse logistics:
- Reverse logistics would add costs
- Someone would need to manage bins -- loss etc (ex: milk crates have a huge loss rate)
- Cleaning bulk bins also adds cost
- Can see the environmental benefit but seems like there would be high costs of managing it
- Also take up space -- consider one size that tubs come in
- Some stuff comes in different and unique sized boxes
- Now bulk comes in recycled cardboard and plastic bag -- easy to but on a pallet and stack it
- Would bins always be filled to capacity?

Other Marketainer feedback:
- Sensor determining the weight of the product great idea
- Check out info on swipe card great idea
- Cleaning and price of dispensers concerns

- Electronics would have to separate for cleaning
- Infrastructure concerns
- How would bins be set up and the computerized system? Wouldn't be that hard though
- Card -- barrier to entry
- Definitely a good idea
- Can see someone developing and investing in it for sure

Retailer: In Person Interview with Mark, Co-Owner, Healthy Pet January 15, 2010

Why do you currently sell bulk?

- Bulk is inherent in pet food and feed stores – some items will always be in bulk. They currently offer a few items such as treats and pig parts without packaging

What are its benefits?

- It's good for trying new things out.

Drawbacks?

- The drawbacks are that it is a pain to keep the food fresh

What features about bulk are most important? What are least important?

- Product freshness is important
- Protecting of food integrity – Mark mentioned that they just got rid of bulk biscuits due to bugs eggs hatching after about a month. This created a loss for the store that wasn't worth the trouble of maintaining their bulk biscuits (Also true of bird seed).

What consumer behaviors do you most notice when people approach the bulk section?

- Most people don't mind grabbing items with their hands because it's for their dog or cat the same way they would if they were to eat it themselves.

What product(s) would you recommend be sold in bulk?

- Treats and parts, but Mark doesn't think that food would work because of the higher end market and how they prefer to buy standard sizes. He did think that kitty liter would be a great product to segue to bulk – also, store size is going to be important as adoption of our systems starts

Notes:

- Healthy Pet targets higher-end pet owners
- Average sizes for pet food come in 6 lbs (sm.), 15 lbs (med.), and 30 lbs (lg.)
- Healthy Pet has fridges for frozen foods

Manufacturer: Phone Interview with Consumer Relations, Barilla America, Inc.
January 24, 2010

Does your company currently offer bulk foods?

- Yes, but not for resale, only to large scale buyers like restaurants

What is the average size of the bulk products you offer?

- 10-20 lb. bags

How are these products packaged? What packaging materials are used?

- Plastic bags

Distributor: Phone Interview with Greg Glasser, Torn & Glasser
January 26, 2010

Please provide a brief description of your company:

- We work exclusively with all bulk products. We are an importer and manufacturer, not just a distributor. We import, process and package dried foods. We also might repackage products. Also roast, salt, mix, etc. We deal exclusively with bulk. We buy directly from the grower or the sheller, etc. in anything from 25lbs to 1,000's of lbs. containers. If we sell a product in its original package, it's sold under the grower's brand. If we are mixing a product for a company, it is sold under their brand. But if a product is repacked or mixed by us then it becomes our brand. Some companies have their own distributors too, on top of using Torn & Glasser.
- We are a distribution hub and a wholesale product consolidator. We are located near a dock, literally like you would see in the movies. This is a pretty efficient arrangement in LA because so many other companies and ports are in close proximity. There are 4 wholesale markets near us.

Transportation mechanisms:
What transportation methods does your company utilize (trucks, freight trains, freight ships)?

- Have used rail, but have not been using it lately due to inconveniences -- untimeliness (late), more labor, etc. Mostly use trucks or similar.

What size trucks do you use?

- Semis, bobtails, city vans, fork lifts.

How many of each of the above does your company own?

- Not sure, would have to check, maybe 10

Are trucks restricted by weight or by volume?

- Both. It's a trade-off. You pack the truck until it's full. Idea of filling "the cube." Want things on pallets for labor purposes.

Would you prefer to move lighter trucks with less product and more air space or heavier trucks containing more product?

- Heavier. Want truck full and heavy. Not too heavy because there is a legal max based on the size/weight of the truck. That's what the weigh scales on freeways are for. If a truck is over, they have to have another truck come offload stuff (which is inefficient). But other than that heavy doesn't matter. Always want the trucks to be full. We bill per weight of product.

Can you provide estimated shipping metrics, such as the average costs of shipping a certain volume of product a certain distance (examples are fine)?

- A round figure for a full truck is usually 2-3 cents a pound.

Does your company have any concern for the inefficient transportation of air and if so, how is this addressed?

- Yes, don't want air space. Want to maximize "the cube."

Can you provide similar storage metrics, such as the cost of storing a certain volume of product for a period of time?

- The quicker the turn around the better because it impacts your cash flow. Would prefer to hold products somewhere else, in someone else's storage, on their dime. But sometimes have to buy things based on the season. If something goes out of season in October you have to buy enough to last until next October. If you try to buy it from them in January they may not have anymore because you waited until January. Need to take things when you can get them.

Operation details:
Do you pick up products from manufacturers or do they transport it to you?

- Sometimes manufacturers use a third party trucking company to ship stuff to us

Does your company utilize any reverse logistics (do they pick anything up from retailers when they drop products off, or do they leave empty)?

- Coming back empty. Have time limitations on the road. About 10 hours. Drivers have to keep logs. Manufacturer might try to utilize this more. Goal is to be backhauling. Trucking companies do this. Always want the trucks to be full. Otherwise they're losing money. We may use a third party trucking company too, especially when going out of state, due to greater restrictions, paperwork, etc. It

really depends on what's going on -- may pick stuff up if it makes sense and there's something we can bring back on the way, or may just have it shipped if we don't have and pick ups. Economics drives a lot of these decisions.

Do you have any cleaning facilities (for products or re-usable packaging)?

- I used to try to reuse up until about 10 years. Issue is the FDA. There are now tons of allergen and food safety concerns. Now we would have to sterilize the package. Mentioned recent food recalls. Tough hearings now. You see people going to jail for a mistake like reusing a bag. The FDA is looking for blood. There's a lot less tolerance.
- Example: consider a 2,500 lb tote of almonds. There is potential for cross contamination of allergens between raw and roasted almonds. Recycling would be the only way to address packaging waste now.

Discussion of the Marketainer bulk bin:

- Key is being able to prove a sanitization process met the allergen cleaning FDA guidelines. Would require a stainless steel container. Or molded plastic with no nooks or crannies for things to hide. Most manufacturers wouldn't do it. Retailers aren't falling under the same FDA review/scrutiny than a food manufacturer is.
- Lining would help on some level.

Bulk products:

- Would you consider offering bulk products that require reverse logistics (for reusable packaging)?
- Don't think outside trucking companies would because they don't always travel in a loop. Could just as easily pay for a truck to backhaul it.

More discussion of Marketainer and the reverse logistics issue:

- Best suited to be done at a retail level. The level of liability in food safety is too great. Manufacturers won't buy in because once it leaves the manufacturers facility they don't know what happens to it. It's all about liability.
- Also would probably add more cost to sanitize bins than to throw away (for example) a 50 cent case between the added requirements: time, transport back, diesel fuel consumption, unloading, sanitization, etc.
- Also, selling from bins that aren't full doesn't always work. Retailers don't want half empty bins on display. They will tell you that you can't sell from an empty bin.

Retailer: Phone Interview, Merchandise Logistics Team, Wal-Mart
January 27, 2010

Can you tell us more about your interest in the supply chain? What specifically are you looking to improve?

- Responsible for space and flow management in the distribution system. Make sure that products arrive on time and correctly
- Seasonal and key event planning
- Voice of the distribution centers (DC)

Does Wal-Mart use a metric that converts square feet of warehouse/inventory space into an economic unit?

- Do not have a good metric for back room or DC space
- Tried it, because they want to maximize it (squeeze the most value out of it)
- Have to go to a sanitizing facility first, then to a DC, then to the suppliers
- The back room is limited space, so most reusables sit outside the store
- RPCs (returnable plastic containers)
- Most produce is packaged in RPC
- Comes from the fields to the DCs and then to the store
- Half of the volume of the RPCs are unloaded at the DC, get back onto another truck immediately, head to a wash center and then to the store
- Producers own the RPC and are responsible for cleaning them
- The owners of the RPCs rent them to the produce suppliers, at a lower cost than what the corrugate counterpart would be
- Roughly 35-40% of produce suppliers use RPCs
- Labor savings for stocking and rotating produce, but also provide a lower cost of goods
- There are only 2 owners -- IFCO Systems and Georgia Pacific

How important is storage space in store. I know that you previously expressed the importance of stocking minimal inventory, but what does that mean down the supply chain?

- Take it from the financial viewpoint – the cost of moving RPCs around doesn't create an economic value, but having bleach on the shelf to prepare for the incoming weekend flow does
- The cost of doing business – if it's merchandise with a value it's one thing, but just an empty container waiting for its pickup point then the space is invaluable for that container (it's simply in the way and it's costing me money – I want it to zero)

Does Wal-Mart typically maximize the utilization ratio of transport by volume or by mass? In other words, what is the limiting factor in terms of transporting goods such as cereal or dog food?

- Nelson – the cereal manufacturer was reluctant to get rid of the box space
- Trucks Weight out before they cube out
- Not as important as when you're only shipping food, but is important when you're mixing food and toys
- Its dependent on what it's shipped with
- The trailer will typically reach its maximum weight before it can reach its max volume

- There are different networks for different commodities and they have different regional DCs
- Products go from manufacturers, to their DC, to a Wal-Mart DC, to a store (if there's no other step like sanitization in the chain)
- Apparel and shoes go through an apparel network

What is the Wal-Mart approach to reverse logistics? Do trucks leave the store empty or do they return with reusable containers such as totes?

- Bring RPCs back
- They have an extensive backhaul network – an empty trailer has significant value, looking for business to fill those empty trailers
- There has been an aggressive campaign to adopt backhaul so that
- Not just a dollar/mi for the trailers, it's more of am I giving up backhaul revenue?

Is Marketainer feasible for Wal-Mart?

- Category specific level – not on a store-wide level (look into in-store brands being put into bulk more likely)
- Perhaps garden center peat moss

Notes:

- Look into the German packaging model – use toothpaste as an example
- There are reverse logistics to any product, but to put the waste back into the stream instead of sending it to landfill is definitely a win

Appendix J: Literature Review

Assumption: Disposable packaging negatively impacts the environment.

Packaging is classified into three types, depending on use. The container that is in direct contact with the product (e.g. a can, bottle, jar, tube, carton, drum, bag, etc.) is the primary package. Any outer wrapping that helps to store, transport, inform consumers, display and/or protect the product is secondary packaging. The decorated carton or gift box is a common example. Lastly, tertiary packaging is used to group products for storage and transportation such as large pallets of shrink-wrapped boxes that are a common warehouse sight. For any given product, anywhere from one to all three types of packaging may be necessary.[27]

Packaging represents roughly one-third of municipal waste in the United States.[1] The environmental impacts of the manufacturing, use and disposal of packaging materials includes the formation of greenhouse gases (e.g. CO2), the release of toxins (e.g. vinyl chloride monomer) and the scarring of landscape (e.g. mining pits).[2] A Tellus Institute study found that 95% of the environmental cost of packaging is in the production process.[7] The energy and resources used in this process create a formidable carbon footprint, as the entire system is directly linked to deforestation and relies upon cheap availability of nonrenewable petroleum resources. Both of these factors are key drivers of global climate change.

Composition analyses of 3,418 kg of residual waste in Vienna showed that up to 60% of household waste (by weight) originates from food, food packaging, food preparation residues and leftovers.[24] In the last decade, Americans wasted about 7.1 million tons of cans which, had they been recycled, would have yielded energy equivalent to 16 million barrels of crude oil, enough to generate electricity for 2.7 million homes a year.[24] Disposable packaging negatively impacts the environment, from production to disposal.

Assumption: Disposable packaging is a multi-billion-dollar burden to food manufacturers and consumers.

Packaging expenses increase the overall cost of production as well as the number of steps in the production supply chain. Consumers end up paying an average of 15-35% more for food due to the disposable packaging involved in its distribution.[6] Apart from increasing the cost of food products, the costs associated with the end-of-life management of disposable packaging are a pressing issue.[25] In New York City alone, one less grocery bag consumed per person per year would reduce 5 million pounds of waste and save $250k in disposal costs.[2] In a survey on food marketing costs, it was found that costs associated with food packaging

are the second largest component of the bill, second only to labor. In 2000, $53.5 billion was spent on disposable food packaging in the US, which is an increase of 47% from 1990. Paperboard boxes and containers are the largest packaging cost and constitute approximately 40% of total packaging expenses.[3]

Assumption: Many shoppers are unaware of the extent of the economic and environmental consequences of consuming disposable packaging.

According to a bulk-dispensing system commercial feasibility study conducted by the Waste & Resources Action Programme (WRAP), the majority of consumers were unable to identify environmental or economic benefits as an advantage of bulk systems (when compared to conventional disposable packaging systems). Only 37% of those surveyed acknowledged reduced environmental impact as a potential benefit to bulk systems.[5]

The lack of knowledge on the potential for direct cost savings by consumers is especially staggering. Only 15% surveyed identified cost savings as a potential benefit of bulk systems, 11% of consumers saw no benefit to bulk bins and 3% even perceived bulk systems to be more expensive.[5] In reality, analyses of current bulk systems operating in the US reveal common cost savings between 30-60%.[5] On average, 8% of the retail price of food products is due to disposable packaging.[3] One often unnoticed economic advantage of bulk systems is portion control, or the ability of the consumer to purchase only the quantity they want. When purchasing prepackaged products, consumers often buy volumes larger than they need, which can result in food waste, and thus a loss of money. The avoidance of food waste provides further cost savings for consumers.[5] Furthermore, the disposal of the waste generated from one-time-use packaging (a third of all municipal waste in the US) costs billions of taxpayer dollars every year.[1]

The misinformation related to bulk bin systems can be associated with a lack of education provided to consumers. During the WRAP commercial feasibility study, one quarter of consumers interviewed responded that they did not know anything about self-dispensing units. Even fewer people had used or even seen a modern gravity-fed self-dispense system.[5] Supermarkets appear to be the main driver in this market, and education initiatives taken by them could have a significant effect on consumer practices. The People’s Food Cooperative in Ann Arbor, Michigan, for example, has effectively taken on this role by educating consumers through their “Stop Waste Generation” program, providing literature to customers that emphasizes the need for purchasing environmentally friendly products, supplying customers with reusable and recycled bags and containers, and seeking suggestion and feedback to facilitate further waste reduction.[4] Suggestions by consumers in other markets have

included providing more, clear information on the life cycle of their food packaging and noting cost differences to make financial incentives clear. Both of these practices would help consumers to make better, greener choices, both in terms of the environment and cost benefits.[5]

Assumption: Bulk packaging solutions, which can reduce economic costs and environmental impact, are becoming increasingly popular.

Today, bulk systems can be found operating successfully in countries across the world. Target markets span from value stores to natural food stores and everything in between, including shopping malls, supermarkets and pet food shops. Stores utilizing bulk technology also range in size from megastores to mom-and-pop shops.[5]

When interviewed, managers of stores utilizing bulk systems reported it is highly profitable.[4] According to the People's Food Cooperative in Ann Arbor, Michigan, "the end result is that bulk foods provide a wider potential profit margin than prepackaged foods."[4] The WRAP commercial feasibility study reported that profit margins can be as high as 50% on some bulk items, a range rarely attained by prepackaged goods.[5]

In most stores, 80-90% of the items in self-dispense bins are also available prepackaged, and are located nearby. This gives consumers the opportunity to compare prices and make informed choices. Along with lower prices and reduced packaging waste, consumers also like purchasing from bulk bins because they can control the quantity they buy, reducing food waste. Consumers can also try new products in small portions, play with different ingredients, mix and match different products and dispense goods into their own personal containers to save the hassle of repacking them at home.[5]

According to research by The Natural Foods Merchandiser, if the bulk section were removed from their favorite store, over 60% of naturals shoppers would go elsewhere. "It's growing like wildfire. Grocery stores are seeing the success of Wild Oats and Whole Foods," claimed Vice President of BestBins Inc., Kyle McDonough.[26] On average, most stores have to refill 60% of their bulk bins at least once a day. Not only are bulk systems growing across the market, but they are also expanding within stores to include new products such as health and beauty items and liquid goods.[5]

These success stories show that the objections to bulk bin systems have been effectively addressed and overcome in many areas. By building upon these models, there is potential for bulk systems to continue expanding, allowing the associated economic and environmental benefits to overcome the barriers to adoption.[2]

Assumption: Even with these bulk systems, there is still a significant amount of waste generated from a complete supply chain perspective.

The current bulk system still requires a significant amount of packaging material, including disposable packing used to transport goods from the manufacturer to the retailer and from the retailer to the consumer. This packaging is typically in the form of cardboard boxes, paper sacks, and plastic bags. According to a University of Florida report on the impacts of packaging, “modern society could not exist without a mature and advanced packaging system... packaging coincides with society's wants and needs.”[27]

While eliminating a significant amount of disposable waste in consumers homes, gravity-fed bulk bins can have an in-store environmental footprint similar to prepackaged goods.[5] The footprint for gravity feed bins is affected by the size of the bin and the quantity of the good sold. However, scoop bins and liquid dispensing units can have a smaller footprint if large bins are used. Additionally, the stocking of current bulk dispensing units creates significant waste due to spillage.[5]

Golden Temple of Oregon, LLC provided Marketainer with specific packaging information to compare their boxed and bulk cereal.[10] Accounting for all primary, secondary, and tertiary packaging, Golden Temple's boxed cereals (sold as Peace Cereal) generate an average of 0.232 kg of packaging waste per kg of cereal delivered to the end-use consumer. Even the bulk version of the same cereals still generates an estimated 0.076 kg of packaging waste per kg of cereal delivered. Unfortunately, current bulk systems' reliance on secondary and tertiary packaging, in addition to the disposable bag typically utilized by consumers at the store, still generates significant negative economic and environmental impacts.

Assumption: Many consumers, retailers, and manufacturers are averse to bulk systems due to perceptions of them being unsanitary, inconvenient, increasing labor costs, restricting advertising options, etc.

Bulk food has developed the stigma of being “unsanitary” and “inconvenient.” The 2007 WRAP study found that consumers were hesitant to utilize bulk systems because of “freshness, hygiene and lack of information about the products.”[5] Johnson et al. observed 867 interactions with bulk food bins across 14 supermarkets and determined that “actual or potential problems included the accidental or deliberate contamination of bulk foods through the insertion of foreign materials into the bins, use of hand to access the product, spillage, children playing in the bins, and snacking on food without paying.”[28] Retailers have not been as aggressive in pursuing bulk systems in stores because of consumer hesitancy as noted above in addition to the problem of theft, or grazing.[28]

Manufacturers are reluctant to move towards bulk due to food safety and branding concerns. A 2007 study found that “packaging is integral to boosting perceptions of safety and will therefore be an important part of more concerted efforts to regain consumer trust going forward.”[29] The same study also recognizes that packaging is the primary point of identification for consumers and that more than 50% of decisions about which items to purchase are made at the shelf. These factors, among others, have led to the resistance of bulk systems in the mainstream.

Assumption: There is a clear demand for sustainable shopping solutions (e.g. reusable bags), especially if they improve upon the status quo in additional ways (sanitation, convenience, etc.).

Since the early nineties there have been several studies that examine the willingness of consumers to purchase environmentally sound products. A study by Schwepker and Cornwell found that consumers would be willing to buy products with less packaging, even if they are less attractive, to eliminate unnecessary packaging.[30] The same study discovered that as environmental issues become more pertinent, so does the consumers' desire to lessen their impact on the environment. These behavioral changes can be interpreted as purchasing changes.[30] An earlier study observed that 82% of consumers polled had at least a 5% greater willingness-to-pay for products that are environmentally sound, an increase of 49% over the previous year.[31] Green shopping trends have led to “sustainable consumption” guidelines being promoted both in national and international arenas.[32] As green shopping trends become more prominent so do green marketing trends. Advertisers have turned their attention towards this segment of the market, and found that ads focusing on “environmentally friendly production” have been successful in capturing market share.[33] With increased attention being paid to environmental issues, consumer behavior is adapting to become more "eco-friendly."

Assumption: There have been recent advances in materials science (e.g. bioplastics) which may further reduce the environmental impact of reusable packaging.

The use of bioplastics in the packaging sector has become increasingly common. The latest generation of these materials are completely derived from renewable biomass, rather than fossil fuels.[34] This can result in a lower environmental impact than conventional plastics, encouraging energy independence, reducing greenhouse gas emissions, and reducing landfill size.[34] A major challenge in using bioplastics for food packaging, however, is ensuring that they do not biodegrade too soon, decreasing product shelf-life.[34] Furthermore, there is some dispute over the environmental benefits of bioplastics. Bioplastics currently require significantly more energy and fossil-fuel consumption to manufacture than

petroleum-based plastics.[35] This consumption is in addition to the agricultural resources that are required for production, causing additional concerns (e.g. land use competing with food, impact of fertilizers and pesticides on the environment).

Bioplastic production technology is still young, and many of these criticisms are directed primarily at PHA (polyhydroxyalkanoate).[35] PLA (polylactide), another type of bioplastic, shows much promise with its reduced energy requirements and additional durability. These energy savings are further heightened when the production energy comes from renewable sources such as solar, wind, or the incineration of plant byproducts.[35] Indeed, an independent 2006 LCA, commissioned by Cargill-Dow-owned NatureWorks LLC, a major manufacturer of PLA products, quantified PLA packaging's impressive cradle-to-grave environmental potential –- particularly when utilizing wind power in production and when recycled after use. The study does note, however, the increase in aquatic eutrophication and nitrogen emissions resulting from additional corn production.[36]

Assumption: Life-cycle assessment (LCA) is an appropriate and effective tool for identifying the costs and environmental externalities of supply chains.

Life-cycle assessments (LCAs) have the ability to verify or reject assumptions about the environmental impacts of different products. For example, a Tellus Institute environmental life-cycle assessment determined that 95% of the environmental cost of food packaging comes from the production process, while only 5% comes from its use and disposal. The same study also found that the impact of recycling some plastics may be worse than throwing them away.[7] These findings are counterintuitive and will have major impacts on determining how to move forward in reducing the environmental footprint of disposable food packaging. LCA has become an internationally accepted method of evaluating environmental impacts, and good LCA practices have been codified in the ISO 14040 standards.

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Appendix L: The Team

Rori Cowan

A Los Angeles native, Rori Cowan graduated from California State University, Monterey Bay in 2006 with a BS in Earth Systems Science & Policy while specializing in Marine and Coastal Ecology. Following graduation, Rori joined her brother to build a minority-owned and operated full service real estate company in Los Angeles. It was there that she learned how business worked and how to build internal infrastructure for any type of business. She brought this knowledge with her to the fashion industry where she worked with a celebrity wardrobe stylist to streamline her business practices. Currently Rori is a second year Master's candidate at the Bren School specializing in Corporate Environmental Management and pursuing an Eco-Entrepreneurship certificate having received several Bren Foundation Fellowships in addition to the the Fleisher Fellowship for Eco-Entrepreneurship. She is the co-chair of the Bren School Sustainability Committee and an active member of the Environmental Justice Coalition on campus.

Hylton Edingfield

Hylton Edingfield grew up near San Diego, CA, and attended UC San Diego and the University of Edinburgh as an undergraduate, receiving a BA in Applied Mathematics in 2006. After graduating, he worked as a mathematician for Science Applications International Corporation on a project to optimize oil refinery efficiency for BP. Once this project was completed, Hylton moved to Chiba, Japan, where he worked as an English language teacher in public elementary and junior high schools for nine months. He returned to the US to attend the Bren School of Environmental Science & Management. Hylton is specializing in Corporate Environmental Management with an Eco-Entrepreneurship focus, and is the recipient of the prestigious Bren Foundation Fellowship, the Fleisher Fellowship for Eco-Entrepreneurship, the Technology Management Program Young Innovators Scholarship (2009 and 2010), and is a Presidential Management Fellow Finalist.

Kathryn Tannenbaum

Katie Tannenbaum was born and raised in California, the daughter of two professors. She attended UC Santa Barbara immediately following high school and graduated in 2007 with a BS in Mathematics and a minor in Sport Management. She spent the following year living in the Virgin Islands and traveling around the Caribbean. While abroad, Katie taught Math at the University of the Virgin Islands and conducted research with the UVI Marine Biology Department on local sea turtles. She is now a

second-year Master's candidate at the Bren School specializing in Pollution Prevention & Remediation.

Priya Vytla

Priya Vytla graduated in Chemical Engineering from Andhra University, Visakhapatnam, India in 2008 and joined the Bren School as a Masters candidate. She is specializing in Corporate Environmental Management and Pollution Prevention & Remediation with a focus on Eco-Entrepreneurship. Taking advantage of attending school abroad, Priya has been exploring California's scenic wonders and traveling up and down the state. She is interested in resource productivity, energy efficiency, life-cycle assessment and dealing with environmental issues in developing countries.

Roland Geyer (Academic Advisor)

Born and educated in Germany, where he was trained in engineering and physics, Roland Geyer came to the Bren School in 2003 and now teaches courses in production and operations management, and in the emerging field of Industrial Ecology. Geyer is interested in the life-cycle of manufactured goods -– the processes in the form of energy and material flows that are related to transforming raw materials into products and, ultimately, waste -– and in the environmental and economic potential of reuse and recycling activities. He also studies the evolution of green business plans, a model that relates corporate financial performance to corporate environmental performance. Geyer has worked extensively as an advisor to the steel industry as it evolves and creates better products that can be made with fewer resources.

Appendix M: Acknowledgments

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