

Packaging, Thinking Inside the Box

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Is sustainability having an impact on packaging?

Sustainability is having an impact on many industries, both directly and indirectly. When we look at the kinds of items that wind up in landfills, the packaging industry looks like a good candidate for sustainability efforts. In 2009, Americans discarded about 243 million tons of trash, and on average, that is 4.34 pounds per person per day. For a packaging example, we throw away 2.5 million plastic bottles every hour, less than 3% of which are recycled. So it stands to reason that it is wise to consider sustainability when making packaging decisions. This paper will examine sustainability as it pertains to packaging.

What is packaging?

Packaging is the science, art, and technology of enclosing products for storage, sale, and use, or protecting products for distribution. Packaging also may be used as a marketing tool, displaying information and informing the potential buyer, and as an operations tool with its design or inclusion of sensors applied to curtail theft, or augment inventory processes. Packaging has a very complex supply chain, a short life, it is energy and resource intense, and is perceived by the consumer to be waste. A great deal of effort is already put into the packaging decision, and an industry has evolved for this purpose.

Packaging seems to make use of contemporary technology. According to archeologists, the first packages used the natural materials available at the time: baskets made from reeds, wineskins, wooden boxes or barrels, ceramic or pottery vases, woven bags, and even glass and bronze vessels. Most of today's packaging is derived from oil or wood, and is discarded upon delivery of the product. The transition from substantial and reusable containers to single purpose, single use vehicles, seems to have accelerated in the previous two centuries and most notably since the discovery of oil, as one might expect. We feel certain that wood byproducts will be addressed in another, 'paper,' so this 'paper' will focus on the oil based products used most for packaging, namely plastics and polystyrene.

Packaging is a \$900B industry by market capitalization. The breakdown for plastics and polystyrene was not readily discernable, but if store shelves are any indication, paper, plastics and polystyrene are all in heavy use.

Who is packaging?

For plastics, a local example is Graham Packaging in York, PA. Graham Packaging is a \$4.5B concern serving the food, beverage, personal care, healthcare, household, and automotive lubricants and chemical product categories and national brands that we all would recognize. A worldwide leader in the design, manufacture and sale of custom blow-molded plastic containers, they specialize in products made from high density polyethylene, referred to as "HDPE," polyethylene terephthalate, referred to as "PET," and polypropylene resins. A quick check reveals that Graham Packaging has already embraced sustainability. The Graham Recycling

Center, also in York, accepts recyclable plastic from all around the country, and is one of the largest suppliers of bottle-grade recycled plastics in the world. This keeps a significant amount of plastic from occupying landfills, while producing millions of pounds of Post Consumer Resin (PCR) each year. According to Graham Packaging, plastic makes sustainable sense, because a 26 oz. PET pasta jar uses 2.5 times less greenhouse gas to produce than its glass equivalent glass being the most common form of packaging waste. Likewise, a #10 can made of high density polyethylene uses 6 times less greenhouse gas to produce than its steel equivalent.

Further, Graham Packaging states that sustainability continues to be a focus and a priority for the company, and even though the senior accountant I interviewed was not aware of any overt sustainability initiatives, this does not mean that sustainability is not built into the design process. Graham Packaging has defined 4 sustainability objectives, the "4Rs," as follows:

- **Research:** Continue to develop materials and solutions that enhance our sustainability. [Interestingly, this "R" is missing in most of the other literature I have encountered.]
- **Recycle:** Recycle and promote recycling through our efforts at our Graham Recycling Company, at Graham Packaging Company facilities, and with trade associations. [This plays into the cradle to cradle concept.]
- **Reduce:** Develop and improve technologies and products that reduce the amount of resources used to manufacture our products. [The industry objective includes material, water, and energy conservation, and goes further to say this means reducing the number of layers, materials, and toxins at source.]
- **Redesign:** Design products and operations that result in a lower carbon footprint and improved efficiencies. Graham Packaging states: "We have incorporated significant use of post consumer resin into many of our products, reduced the amount of material we use through lightweighting, reduced energy consumption and greenhouse gas emissions, conserved water, oil and trees, and heavily supported recycling programs through our Graham Recycling Center and through various trade associations."

Lightweighting refers to the design of the container, to use less resin and fuel, and make the container store more efficiently and weigh less, both of which translate to reduced transportation costs and greenhouse gas emissions. The industry objective calls for packaging that is reusable, refillable, returnable and durable to the greatest extent possible, but should make use of timed degradation, which Graham Packaging does in fact do. But as Graham Packaging products demonstrate, redesign may also make use of more efficient and perhaps unconventional shapes.

For polystyrene, a local participant is Dart Container in Leola, PA. Dart Container has 13 domestic plants, as well as plants in Australia, Argentina, Canada, Mexico, and the United Kingdom. Dart Container addresses sustainability with a slightly different posture. According to Dart Container: "reusables have a statically (sic) higher level of microbial contamination than disposables [which] favors the presumption that single service [products] offer a measure of protection that would be missed if solid waste considerations barred them from use." They state another advantage of using foam is that foam insulates better than paper. Dart Container also states that scientific data [not referenced or available] confirms that Dart foam products will

consume less energy to produce than paper alternatives, provide an environmentally sound choice when compared to alternatives on a cradle-to-grave life-cycle basis, are stable and safe in landfills, and burn cleanly in modern municipal energy-from-waste facilities. One might note that cradle-to-grave thinking is not necessarily sustainability driven.

Dart Container recycles their products, which are made of polystyrene. Polystyrene is a thermoplastic, which means that it can be completely and easily recycled. Dart Container practices energy conservation, by recovering heat from the cupmaking process to warm buildings and applying technology to lighting. Dart Container uses landfill gas to run the boilers and recaptures pentane gas for use in other production processes. They also choose inks that cure by ultraviolet light, to avoid the solvent emissions associated with typical solvent-based printing inks. Additionally through careful design, the amount of material used to produce many products has been reduced with no impact to product performance. According to some concerns including the U.S. Government, polystyrene, also called white foam, requires 1/2 gallon of fuel per pound to produce, is responsible for 25% of landfill use, does not deteriorate in less than geological time, and is made from benzene, a known carcinogen. On June 10, 2011, the U.S. Department of Health and Human Services listed styrene in its 12th Report on Carcinogens (RoC) as a substance that is "reasonably anticipated to be a human carcinogen." According to Dart Container, the Styrene Industry will "Contest Vigorously the Unwarranted Listing of Styrene," stating that the National Toxicology Program "ignored the preponderance of data that fail to suggest a cancer concern for this substance." [Anyone associated with the electronics industries will also note that white foam has destroyed more product through electrostatic discharge than it has protected. It does keep coffee hot and Turkey Hill iced tea cold, however, so maybe it is best used in a product, not to package a product.]

The new shape and substance of packaging

There are many complaints against existing packaging. Some packaging appears to be toxic or bad for the environment. Other packaging, such as so called clamshells, can open us before we can open them. Then there is the matter of trust; A result of textile manufacturing in China, recycled material must now be tested for traces of low-quality industrial plastic, which could taint food with heavy metals including lead. Thus, some recycled plastic that isn't what it claims to be, so tighter control over the entire process must be achieved. One way to avoid the consequences of using potentially toxic materials is find adequate substitutes for them and simply not use them. Taking a page from the scientific application of existing technologies, some clever person realized that nature has figured out rather efficient ways of solving many of the problems we now face. That is, alternative materials and processes may already exist in nature. For instance it is possible to apply a new technology to convert CO₂ with other direct materials into polycarbonates, rather than the energy intensive multistep process we currently endure.

Likewise, a new "plastic" called mycelium can be made into a polymer. Mycelium is grown and is compostable. Better yet, it can be formed and self assemble by a biological processes over a

few days, which also results in no waste from manufacture. Mycelium can be made from local waste resources, such as husks, has excellent insulating and moisture resistant properties, and breaks down quickly when discarded. Mycelium can be easily made to any shape desired, and as we know, proper packaging shape design will yield lower storage, handling, and transportation costs.

A holistic approaches best support sustainability. There is an accepted framework for designing packaging for sustainability. This framework is known as the 3Rs (refer to Graham Packaging 1+3R above), and the drivers for the 3Rs sustainable packaging framework are as follows.

For Retailers:

- Focus on weight reduction, but no common goals or definitions across retailers
- Driving cost-reducing or cost-neutral solutions
- Sometimes willing to pay a premium if investing in 'hero' brand-enhancing projects

For the Government:

- Proliferation of regulation and policy measures (such as taxation)
- Move from weight to carbon [footprint] focus

For Packagers:

- Reacting to retailer demands
- Leaders are investing in research and development (R&D) and new products to develop solutions
- Have historically been slow to engage in the wider debate around sustainable packaging

For Consumers:

- Demanding more sustainable solutions in general
- Unwilling to pay a premium for sustainable products unless it is a key part of the brand message
- Increasingly aware of 'wasteful' packaging due to the growing requirement to sort and recycle

There are already a number of packaging solutions that are designed using this framework. Some examples include the use of asparagus fibers as reinforcing materials, resulting in 100% biodegradable packaging, and a baby food pouch that is a stand-up retort pouch that is re-closable and reduces volume, weight, energy, and packaging component complexity when compared to other formats in the product category. In another example, Pangea Organics, a maker of skin care products, designed biodegradable cartons that are made of recycled newspaper and a sprinkling of seeds. When customers plant the opened packaging material in the ground, they will sprout flowers or herbs and even though this packaging was slightly more expensive, it proved to be a benefit because sales nearly quadrupled. Finally, a new package design from Sealed Air Corporation "uses a proprietary retention frame and elastomeric film to hold the items securely in place during shipment."

But for sustainability to have the best impact possible, the consumer must be involved. In general, we cannot expect people to quickly change their behavior and embrace sustainability, unless of course we make them think it was their own idea. I, for one, would like to see more use of refillable dispensers where possible, with large refills available. The dispenser could be a

product unto itself, and the refill could advertize the dispenser! This could work well for many products such as soaps, detergents, shampoos and other personal products, and even for candy. A glaring example of a refillable dispenser that took on a life of its own is the PEZ dispenser. This is brand re-enforcement at its finest with built in sustainability benefits. Sometimes the solution to a present challenge can be found in the past.

Conclusion

Perhaps to restate the original question: Does sustainability offer a benefit to packaging? The obvious answer appears to be a resounding yes. But how can we know for sure?

First we need to define a metric. This means we need to know what the intended use of the measurement is, who the intended recipient of the data is, and how the data will be normalized. Further, we need to identify the indicators, of which there are 3 types. Core indicators are quantifiable or quantitative and speak to the interest of the stockholders. Supplemental indicators augment the core indicators by providing more specific or detailed data. And correlating indicators are those of significant importance, but may not be of interest to the stockholder, for example, the Kg of greenhouse gas emissions per Kg of product produced, or how much of that product was recycled. Yet even these indicators have an impact on the bottom line, and therefore are of interest to accounting. Typically, for all things sustainable, the common metrics are in fact greenhouse gas contribution, also known as the carbon footprint, and how much of that product was recycled.

Now, with the metrics in place, we can measure efficiency and sustainability of the product, in this case, the packaging. The activities involved in producing packaging are traceable and therefore may have real expense and asset values assigned to them. They may impact, but will most likely enhance, profit. Now that's sustainability at the core.

As we have seen, sustainability has certainly effected packaging, but packaging also plays a crucial role in sustainability. As with most things involving our environment, the issue is complex. Hopefully, progress will continue along these lines, and all countries will actively participate in packaging sustainability and other sustainability initiatives. Our collective future depends on it.

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