Optimizing Packaging for an E-commerce World

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Executive Summary

Designed as the buying and selling of goods through online services, e-commerce is a rapidly expanding channel. A new distribution channel, e-commerce offers opportunities to reach a wider market, provides for generally lower costs, permits comparison shopping, and provides the opportunity to locate rare goods as just a few advantages.[1] Yet, as e-commerce expands, it is important to understand that this new distribution channel is a far more complex and interconnected logistics system than that used for traditional "bricks and mortar" retail.

This alternative distribution channel creates new challenges and opportunities for packaging that were not previously considered within a traditional retail environment. As e-commerce is beginning to be viewed as an independent distribution paradigm, the related challenges and benefits will provide an opportunity to design a new logistics system that significantly affects the future of packaging. This paradigm shift allows for sustainability and optimization to be central to these efforts.

As the distribution system for e-commerce shifts, so too will the needs of packaging. While consumers' expectations are similar between both retail and e-commerce (rapid receipt of product, ease of recovery/disposal and product protection), industry responses to meet these needs will differ.

Key areas identified for intervention and further development include:

1. More collaboration and transparency to increase industry knowledge of best formats and materials for e-commerce packaging, with the intent of optimizing packaging and its systems to improve transportation efficiencies as well as reduce costs associated with damaged products.

2. Supply chain collaboration in systems recovery, as different and new materials are introduced to meet the unique demands of e-commerce.

3. Research regarding e-commerce packaging materials and disposal are needed to help develop responsible strategies/policies for reduction and reuse/recovery.

4. As reverse logistics become more sophisticated in response to e-commerce demand, opportunities exist for new packaging designs or recovery schemes that leverage these systems while also reducing instances of product damage.

5. Safety standards for new formats, or product distribution and transit are needed. Additionally, as perishable goods increasingly enter the e-commerce market, standards to ensure safe food handling will be required.

To optimize package design and materials, the needs and impacts of the entire system, including both the product and the package, must be understood and reflected. Thus, optimizing packaging for e-commerce may very well look different than design for traditional retail, due to the different demands of the respective distribution chains.

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[1] E-Sales Track.com "Advantages and Disadvantages of E-Commerce". http://www.esalestrack.com/blog/2008/09/advantages-and-disadvantages-of.html.

E-Commerce: A Rapidly Expanding New Distribution Channel

The rapidly expanding e-commerce sales channel continues to experience dramatic growth. E-commerce sales between 2014 and 2018 are expected to grow a cumulative 88.4 percent.[2] Despite this rapid increase, e-commerce still has significant growth potential: To date, the channel has only captured an estimated 8.5 percent of total North American sales.[3]

A key reason to focus on the e-commerce distribution channel is its need for a far more complex and interconnected logistic system than that used for traditional "bricks and mortar" retail. E-commerce products are viewed and purchased online, in the absence of a physical store presence. Purchases are then delivered directly to consumers through a process which requires more "touchpoints" and risk of damage than that of traditional retail.[4] Lastly, purchases made online tend to result in significantly higher return rates than purchases made in traditional stores.[5] These shifts place an emphasis on different attributes of packaging than those needed for traditional retail optimization. Thus, the packaging value chain is re-evaluating its offerings to respond to this new channel of distribution.

E-commerce offers a unique opportunity to effectively and efficiently design a new logistics system for the future of packaging. Leaders in this sphere will be those who understand these shifts and work to redefine packaging and the broader supply chain, thus anticipating and addressing the different challenges a new distribution format requires.

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[2] E-Marketer, (Aug. 2016) "Retail E-Commerce Sales World Wide 2015-2020)" https://www.emarketer.com/Chart/Retail-Ecommerce-Sales-Worldwide-2015-2020-trillions-change-of-total-retail-sales/194275.

[3] US Census Bureau News. "Quarterly Retail E-commerce Sales 3rd Quarter 2016". http://www.census.gov/retail/mrts/www/data/pdf/ec_current.pdf.

[4] Walt Peterson (Nestlé) Presentation for AMERIPEN at PackExpo 2016.

[5] Sourcing Journal (Nov. 2015), "E-Commerce Return Rates Expected to Exceed 30%";
National Retail Federation, (2015) "2015: Consumer Returns in the Retail Industry: Annual Returns Survey.";
Shorr Packaging Blog (2015) "E-commerce Returns: Best Practices." http://www.shorr.com/packaging-news/2015-10/e-commerce-returns-best-practices.

Rather than simply tackling problems as they arise, redefining packaging for e-commerce will require a holistic approach that examines the entire distribution system. Doing so creates the opportunity to understand where the interconnections can create challenges or provide solutions, identify unintended consequences, and target collaborations. This is an unprecedented opportunity to establish environmental optimization as a core aspect of an emerging new channel of distribution.

What Makes the E-Commerce Delivery Channel Different from Traditional Retail?

The traditional retail logistics system is relatively linear: Suppliers ship products, often unitized in large quantities for safe shipping and efficient storage, to a warehouse or back-of-store where they are inventoried until individual units are needed on-shelf for retail display. The consumer then purchases products on-site and is generally responsible for taking their purchases with them.

In this model, transportation and logistics are primarily focused between the supplier, warehouse and retailer. Movement of the product predominately comes in the form of freight, forklift and pallets. To meet the needs of this process, packaging is developed as a system of three:

1. **Primary packaging** generally comes into direct contact with the product and is designed to contain, protect, and communicate product, brand, marketing, regulatory and other relevant attributes. It can also serve as a theft-deterrent for high value items.

2. **Secondary packaging** is generally designed to aggregate multiple primary packages into a larger unit for the purpose of safe and efficient handling and transport to retailers, as well as to minimize damage. Secondary packaging can also be designed to be display-ready and thus serve an additional purpose in-store for the retailer.

3. **Tertiary packaging** further aggregates generally like products and groups secondary packaging together, creating very efficient loads for shipping. This may be referred to as a "unit load" and can include pallets, shrink wrap, strapping, banding and dunnage.

Figure 1: Traditional Retail Logistics System
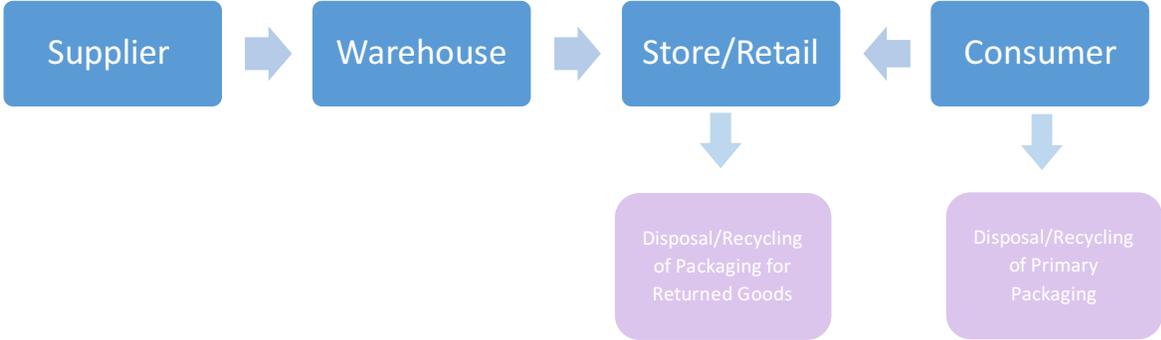
E-commerce upsets this traditional paradigm. The point of sale is no longer in store, but on a digital device, with the transaction completed in virtual space before the consumer receives the final product. The consumer now replaces the retailer as the focal point of the supply chain and a far more complex logistical process must be followed to deliver product(s) to the end user.   Bulk products are now sent to a fulfillment center where individual orders are then broken down for shipment directly to the consumer. Transport providers, such as *FedEx, UPS* and the *US Postal Service*, then use sortation centers to aggregate delivery to regional locations and use parcel carriers (and drones, potentially) to access consumer homes as the final delivery point.

This new logistics system engages more service providers and processes, resulting in significantly more touchpoints than the traditional retail environment. Products are handled an average of five times in a traditional retail supply chain, as handling is highly mechanised with the use of pallets and forklifts. In the e-commerce network, products tend to be handled manually and may potentially be handled 20 times or more[6].

Figure 2: Simplified E-Commerce Logistics System
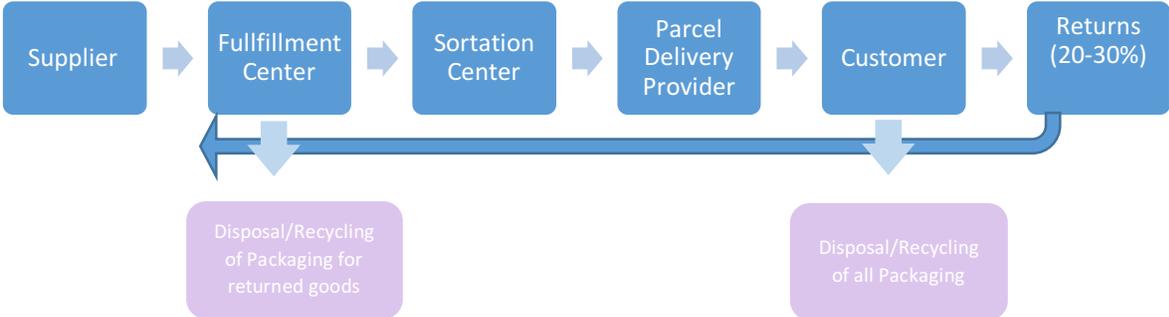
In this new environment, the three level packaging system designed for palletization and retail display becomes less efficient. In some cases, it may be less important for the primary package to serve promotional purposes and other attributes deemed necessary in a retail environment. Instead, packaging might be designed to primarily meet the functional needs of the product. Also, secondary packaging now becomes the delivery vehicle and has a more important role in product protection. In many instances, tertiary packaging (needed for bundling) becomes largely irrelevant.

When comparing and contrasting between e-commerce and traditional retail, the rapid advancement towards omnichannel distribution—the integration of both online and in-store consumer experiences— further complicates how packaging must respond. In an omnichannel system, the consumer or product provider may leverage aspects of both systems. The consumer may purchase online but choose to pick-up in-store, or a retailer may use a storefront as a fulfillment center—inventorying or even shipping directly from within.

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[6] Walt Peterson (Nestlé) Presentation for AMERIPEN at PackExpo 2016.

Table 1: Comparing Logistics Systems

	Traditional Retail Logistics System	E-Commerce Logistics System	Omni-channel Logistics System
Retail Types	"Bricks and mortar" storefront.	Retailer is anyone who can set up an online storefront. May be manufacturer, retailer or a third-party facilitator/aggregator.	Both "bricks and mortar" storefronts and online. Storefronts may also serve as fulfillment centers.
Transportation Package End Point	Secondary and tertiary packaging is collected for disposal or recovery at retail level. Consumer responsible for transport of primary package.	Direct to consumer. Consumer must handle disposal or recovery for all primary and secondary packaging.	Responsible for disposal of secondary and tertiary as required by bricks and mortar storefront. If shipping direct to consumer, additional transport packaging is required and will be the consumer's end responsibility.
Purposes of Primary Packaging	Containment, protection, shelf impact, communication vehicle, merchandising.	Containment, product protection.	Can be both, depending on the final distribution channel.
Consumer Engagement with Packaging	Engagement occurs at point of purchase. Packaging plays a role in finalizing sale.	Engagement occurs after point of purchase. Packaging plays a role in purchase reinforcement.	Engagement may occur at a variety of points.
Transportation Formats	Primarily high density freight carriers, forklifts and pallets.	A wide range of transportation methods, from freight carriers to UBER drivers, and potentially drones. More touchpoints, handlers, and manual interactions to deliver direct to consumer.	Depending on the final distribution channel it may include all formats.
Return Rate	9%[7]	20-30%[8] Requires investment into more complex reverse logistics and reusable packaging.	Unknown.

Understanding Consumer Expectations for E-Commerce versus Traditional Retail

As e-commerce and omni-commerce channels shift the centerpoint of the logistics system from retailer to consumer, a new set of expectations emerges. These consumers are seeking ways to maximize convenience, choice, and price—establishing a completely different shopping experience.[9] Processes

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[7] Sourcing Journal, (Nov 2015), "E-Commerce Return Rates Expected to Exceed 30%;
National Retail Federation, (2015) "2015: Consumer Returns in the Retail Industry: Annual Returns Survey."
[8] Ibid.
[9] Righby, Darrelk K., (2011). "The Future of Shopping" Harvard Business Review." https://hbr.org/2011/12/the-future-of-shopping;
Nielson, (2015). "The Future of Grocery: Ecommerce, Digital Technology and Changing Shopping Preferences Around the World."

that create these efficiencies are essential to success. With the proper consideration, packaging can deliver the required attributes and benefits.

Rapid Delivery

Consumers increasingly demand rapid gratification and online sellers are stepping up their efforts to respond accordingly. Advancements with programs like one-day or same-day delivery or pickup are increasing consumers' expectations of how quickly they should receive an order.[10] This trend is challenging retailers to re-consider the traditional shipment process. Where goods traditionally moved from manufacturing or port hubs to retail storefronts, e-commerce has driven the emergence of multiple hub and spoke systems. In this new model, a variety of goods are stored in fullfillment centers, or retail stores, located in or near all major urban areas. This increases access to products, thus reducing the time to deliver goods across a widely distributed network.

The hub and spoke model improves shipping time, but can complicate the ability to efficiently aggregate a "basket" of products, since multiple products may be located across a variety of facilities rather than all within a centralized hub. An inability to package a "basket of goods" for delivery means multiple packages may need to be shipped in order to complete what the consumer views as one order.

Ease of Return

E-commerce requires purchasing products without the benefit of being able to physically interact with them. Online buyers rely instead on images, product descriptions and online reviews to make purchase decisions. This inability to inspect products for factors such as quality, size, color, and texture may create a higher level of dissatisfaction with their purchases upon reciept. [11]

In addition, the increased risk of damage to products as a result of the highly physical distribution pattern inherent to e-commerce further drives a substantially higher return rate than with traditional retail stores.[12] Since the rate of return is greater with e-commerce, consumers expect an easy return process: Sixty-two percent of e-commerce customers want a return label in the box or an easy to print label, and 47 percent want an easy to follow process.[13]

To offer the efficiency their consumers expect, retailers can combine free shipping labels with packaging that can be reused for the return. It is expected that these additional services will create an increase in the use of re-usable packaging, including resealable plastic mailers and corrugate with tear strips which can help reduce packaging size for return reuse.

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[10] According to an article in the Wall Street Journal, consumer's satisfaction with e-commerce delivery speed peaks after 4.8 days. Anything beyond that is considered inconvenient. As one day shipping continues to increase this number continues to decrease. http://www.wsj.com/articles/online-shoppers-want-delivery-faster-cheaper-survey-shows-1465851072

[11] National Retail Federation, (2015) "2015: Consumer Returns in the Retail Industry: Annual Returns Survey.";
Dua, Tanya " How Retailers are Combatting E-commerce Returns this Holiday Season." Digiday Blog
http://digiday.com/brands/retailers-combatting-ecommerce-returns-holiday-season/.

[12] Sourcing Journal (Nov 2015), "E-Commerce Return Rates Expected to Exceed 30%";
 National Retail Federation, (2015) "2015: Consumer Returns in the Retail Industry: Annual Returns Survey."

[13] Shorr Packaging Blog, (2015) "E-commerce Returns: Best Practices" http://www.shorr.com/packaging-news/2015-10/e-commerce-returns-best-practices.

Packaging that Protects

Damage prevention is one of the key roles of packaging. Ninety percent of global consumers believe packaging plays an important role in ensuring product safety.[14] Fifty-eight percent of Americans say that their relationship with an e-retailer would be impacted if they received a damaged product.[15] A Stella Services study indicates that 7-10% of e-commerce packages arrive to consumers with some damage.[16]

In the U.S. alone, e-commerce damage is estimated to be $6 billion per year.[17] Damaged product requires return shipment and re-issue or re-imbursement. Depending on the product, the cumulative environmental impact of damage may very likely be more than the added packaging required to ensure sufficienct protection: According to *PMMI, the Association for Packaging and Processing Technologies*, replacing a damaged product can cost an e-commerce vendor up to seventeen times more than the original cost to ship.[18]

Further, because consumers are quick to use social media to bemoan or celebrate an e-commerce package, failures can have a broad impact on brand reputation.[19] Failure to provide adequate product protection can significantly impact cost, along with environmental and brand reputation.

Ease of Disposal and Recovery

Consumers also expect easy disposal of packaging materials. In a 2014 study, over 50 percent of consumers noted that their biggest frustration with e-commerce was related to the ease of, and access to, disposal of packaging.[20] One third of respondents noted they disliked packaging that was hard to dispose of (e.g. takes up too much space in the bin, requires breakdown), and an additional quarter were annoyed with packaging material that was difficult to recycle or unrecyclable. In the same study, over 77 percent of consumers note that the packaging a company uses for e-commerce was viewed as being reflective of its environmental values.

To the consumer, packaging that is recyclable is the best option for the environment,[21] but recycling must be made easy for them. As companies continue to develop packaging for e-commerce, striking the balance between ease of recycling and packaging efficiency may prove to be a challenge. An increase in corrugated for added protection will demand more space in the bin. Flexible films frequently used with meal-kit deliveries may not be recyclable. Open dialogue and education, along with innovations in packaging and recovery, will be key to meeting these expectations.

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[14] WestRock (2015). "Packaging Matters: for Product Safety and Consumer Confidence"   https://www.westrock.com/-/media/pdf/insights/pm-safetyreport-wrk-pdf.pdf.

[15] Sealed Air, (2015) "2014 Sealed Air E-commerce study: Packaging for E-commerce Success." https://sealedair.com/sites/default/files/Sealed%20Air%20e-commerce%20survey_executive%20summary_FINAL_digital.pdf.

[16] Stella Services (Nov 2013) "StellaService Study: One in Ten E-Commerce Packages Arrive Damaged." http://bright.stellaservice.com/fulfillment-3/stellaservice-study-one-in-ten-ecommerce-packages-arrive-damaged/.

[17] Vicki Case (Sealed Air) Presentation for AMERIPEN at PackExpo 2016.

[18] PMMI (2015). "E-commerce Market Assessment."

[19] PWC (2016) "Total Retail Survey 2016: Online Shoppers Around the World Are Fundamentally Disrupting Retail Again." http://www.pwc.com/gx/en/industries/retail-consumer/global-total-retail.html.

[20] 2014 Sealed Air E-commerce study: Packaging for E-commerce Success. https://sealedair.com/sites/default/files/Sealed%20Air%20e-commerce%20survey_executive%20summary_FINAL_digital.pdf.

[21] Ibid: "78% of consumers stated that environmentally friendly packaging is material that can be easily recycled".

Table 2: Meeting Consumer Expectations for E-Commerce—a Systems Perspective

Consumer Expects	Responsive Shifts in the Logistics System	Outstanding Challenges to Address across the Logistics System
Speed	Hub and Spoke Model for distribution.	Vast distribution network may complicate ability to aggregate orders for efficiency.
	Box on Demand Systems provide for rapid and individualized packaging per order, but may be costly and/or inefficient for small to mid sized firms to purchase.	Need to package and ship rapidly may complicate ability to optimize packaging.
		Use of omnichannel further complicates packaging design as retail inventory may be enlisted for shipment direct to consumer.
Easy Return	New reusable designs, including tear strips and resealable mailers.	Depending on shipment box and consumer behaviour, size may not be optimized for return shipping.
	Increased development of reverse logistics.	Can systems be developed further for application in recovery of hard to handle materials (i.e. ice packs, flexible films).
No damage	More research and Dvelopment to ensure appropriate packaging is used to meet distribution requirements for vibration, impact, temperature.	Package testing standards that reflect e-commerce conditions need to be expanded and developed.
Easy Recovery/ Disposal	Shift towards more recyclable materials encouraged by supplier expectation programs and consumer preference.	Some packaging materials which are more durable, or provide superior product protection within the e-commerce system, may not be currently recyclable.
Food Safety	Storefronts offer the equipment necessary to keep foods cool or heated, expecting consumers to transport safely home.	New packaging materials and designs, as well as logistics systems, are being introduced to ensure safe delivery of fresh food products. Recovery systems to respond to this emerging need have not yet been established for many materials/formats.

How is Packaging Currently Being Adapted to Respond to E-Commerce?

Current packaging has evolved to primarily serve the needs of the traditional retail environment. However, future packaging optimization will require changes that are designed to reflect the differing needs for shipping direct to the consumer.

Material and Design Failures and Success

Anecdotal research suggests that some traditional formats popular in retail environments may need to be replaced for e-commerce delivery. For example, the increased vibration that results from mutiple transport providers may compromise popular packaging closures. The increased touchpoints which occur throughout the distribution chain may require packaging that offers greater impact resistance--replacing materials which may break or shatter with more malleable formats.[22]

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[22] Proprietary Data shared with AMERIPEN.
Bemis, (2015) "Packaging for a New Era of E-Commerce: How E-Commerce Will Transform Packaging."

Understanding which formats work and which do not will help target innovations that offer added value in an e-commerce setting. As new services and products continue to enter the e-commerce channel (i.e. meal kits and personal care products), greater emphasis will need to be placed on understanding and documenting best formats for delivery.

Specific SKUs

Based on the different packaging needs in major distribution channels, there is increasing awareness of the potential need to create specific SKU's for e-commerce rather than adopting the SKU's used for legacy retail channels. In a 2014 study by *Packaging Digest*, 62 percent of respondents felt that products sold through e-commerce should use packaging designed for this channel. Only 14 percent indicated their preference that this not occur.[23]

Such a shift may require new formats or materials. Secondary packaging may or may not be required, and tertiary packaging is likely to be unncecessary for deliveries made direct to the consumer. However, designing for two different channels becomes much more complicated (and expensive) when multiple channels exist concurrently: Where pick-up and shipping may be store-based, stocking both formats may be costly and burdensome. Additionally, consumers viewing in-store but purchasing online or requesting direct delivery may expect receipt of the same product in packaging they viewed in-store.

Packaging Optimization

Much of the current e-commerce packaging innovation has revolved around packaging optimization. Three key shifts across the supply chain are supporting this transition. These will continue to assert significant influence in the future:

a. *Dimensional Shipping*
In 2015, small parcel carriers introduced dimensional pricing. Under this model, shipping costs are based on the higher of two measurements: packaging weight or size. With shipping costs now assessed based on the relative space the package occupies in relation to its weight, it is becoming more important for e-retailers to optimize their packaging and reduce "empty air" in order to reduce total costs. In addition to driving packaging optimization, this shift is also resulting in an increased emphasis on lighter weight materials.

b. *Box-on-Demand*
Box-on-demand systems offer fulfillment centers the opportunity to design shipment packaging based upon the dimensions of each order received. Rather than stocking generic sizes and filling those boxes based on best available access, box-on-demand offers a highly computerized assessment to create specific packaging produced at the point of fulfillment that most efficiently contains each individual order. This is a significant advantage to high volume centers, but may still be cost prohibitive to smaller retailers.

c. *Consumer Feedback*
The use of social media in e-commerce has given rise to the ability for individual consumers to provide insight into e-commerce packaging. With consumers' ability to be publicly critical,

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[23] Packaging Digest, (Dec. 1, 2014) "Escalating E-Commerce Sales Need Better Packaging."

companies are quickly responding in hopes of incentiving packaging optimization. Programs like Amazon's *Frustration Free Packaging* outlines best practices guidelines based upon consumer feedback. Vendors who ascribe to the guidelines receive preferential retail profile. Similar incentive programs to encourage third parties to optimize packaging sent by large retailers can be found across the industry.

Future Opportunities to Develop a Sustainable E-Commerce Packaging Supply Chain

As e-commerce shifts the focus from an established retail network to a disparate network of consumers, a whole new chain of actions is established to provide direct delivery and to respond to new expectations. As these shifts become better understood, the process of developing responsive strategies will improve. Ensuring that these strategies avoid unintended consequences remains key. Doing so will require dialogue and collaboration across the supply chain. Working together, the entire industry can utilize this opportunity to integrate sustainability into e-commerce supply chains much earlier in their development.

Understanding Effective Packaging Design Strategies

As more is learned about shipping products for e-commerce, the understanding of what designs and materials work best will grow. While there is some initial research and anecdotal evidence by vendors, there is no national association or collaborating body making information on effective e-commerce materials or fomats available, or assisting in testing for application. The International Safe Transit Authority (ISTA) has traditionally played a role with testing and has recently begun to develop further studies on damage,[24] however, more investment into research and sharing of existing data by players across the supply chain will help standardize and share best practices on materials and design decisions suitable for e-commerce.

Recovery Considerations for Emerging E-commerce Packaging

As e-commerce packaging changes, consideration must be given to the end of life management of those materials. As corrugate rises in curbside collection, it replaces a flagging paper stream lost from the decline of legacy newspaper circulations and home delivery. It also creates more challenges in terms of transportation logistics, as it takes up more space but weighs less in transport. Additionally, the emergence of new materials which may offer strong protective qualities at lighter weights versus traditional protective packaging (i.e. jute, wheat straw, molded pulp, multi-material films) challenge existing waste streams that are not yet scaled to sort, process, or commoditize these materials. Consideration and collaboration across the supply chain will be required so that all players in the e-commerce packaging waste stream can anticipate and plan for these and future shifts expected by continued e-commerce growth.

Material Demand Studies on Source Reduction and Recovery

In the traditional retail environment, secondary and tertiary packaging was disposed of by retailers. Consumers were responsible for the disposal of primary packaging only. As e-commerce increases the

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[24] ISTA currently has a number of RFPs out to better understanding the e-commerce supply chain and how they can protect products in transit. To learn more: https://www.ista.org/pages/procedures/advocateprogram.php.

amount of protective packaging going to consumers, frustration related to this increase in packaging is rising. In this case, previous policies focused on capturing commercial recycling may need to shift to assist consumers with residential recovery.

Additionally, understanding if cumulative packaging material is increasing or decreasing as a result of e-commerce will assist in evaluating if packaging disposal is simply shifting to the consumer or is indeed growing. This knowledege will further help to identify how best to leverage recovery systems and influence design through effective policies and mandates, ensuring that these valued materials are collected at the end of their life in a cost effective manner.

Utilizing Reverse Logistics for Packaging Recovery

Significant investments into innovative logistic systems is occurring. This is a result of the need to coordinate mutiple delivery systems while providing transparency to both the consumer and retailer, and to establishing return systems. Not only are companies investing in how to get the product to the consumer (and back if necessary), they are also investing in solutions to simplify delivery and to create takeback schemes where packaging or other products are contributing to consumer frustration.

The idea of establishing collection and takeback programs is perhaps best embraced by the meal kit community, which has faced significant consumer pushback resulting from the diverse amount of packaging required to ship pre-planned meals direct to homes.[25] While many meal kit companies offer a takeback service, these have limited appeal as many of the materials they accept are already embraced by existing community recycling programs and/or because the amount of work to clean and sort materials is beyond what most consumers wish to invest in.[26]

Alternative takeback programs involve re-useable packaging innovations which require pickup and return after use.[27] As reverse logistic schemes continue to advance, an opportunity to leverage these systems for application with hard to handle materials or emerging packaging designs may offer opportunities to support existing collection schemes or create alternative systems. Further exploration of this option for hard to handle materials or service formats may thus be of value.

Testing and Safety Mechanisms Need to be Developed

A rapidly expanding area for e-commerce is the distribution of home furnishings and other heavy products. In a traditional retail supply chain, these products were palletized and transported by freight and forklift to a retail environment. Home delivery would then be managed by a specialized team. Should a product fall, this process assured maximum drops of six to eight inches and was subject to safe transport testing mechanisms established by ITSA and/ or ATSM.[28]

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[25] Erway, Cathy, (Aug. 2016) "Meal Kit Delivery's Packaging Problem." Edible Manhattan Blog
http://www.ediblemanhattan.com/foodshed-2/meal-kit-deliverys-packaging-problem/.
Strom, Stephanie (Aug. 2016) "A Tantalizing Offering from a Meal Kit Service: The Box" New York Times
https://www.nytimes.com/2016/08/04/business/a-tantalizing-offering-from-a-meal-kit-service-the-box.html?_r=0.
[26] Ibid.
[27] Example includes Fresh Realm Vessel " This Box Opens Up New Possibilities for Fresh Food Delivery" Fortune Magazine Online Blog. (Aug. 2015) http://fortune.com/2015/08/03/freshrealm-cold-delivery/.
[28] Packaging Digest, (Oct. 2016) "3 Ways 'The Amazon Effect' Impacts Protective Packaging."
http://www.packagingdigest.com/protective-packaging/3ways-amazoneffect-impacts-packaging1610/page/0/1.

However, in the e-commerce environment, heavy items are shipped independently and handled by individuals rather than on pallet and with forklift (e.g., mattresses and toilets). Such a change now subjects heavier products to potential drops of at least 12-24 inches, depending on the mode of handling.[29] There are currently no standards or testing formats to ensure safe transport for both the item and those handling it. This is an area where new industry standards for packaging and transport could help reduce damage and establish safer working environments.

Additionally, the expansion of online grocery delivery increases opportunities for spoilage, contamination and malicious tampering. Testing to ensure the safe distribution of foods should be established.

Conclusion

To optimize design and materials, the needs and impacts of the entire system, including both the product and the package, must be understood and reflected. Thus, optimizing packaging for e-commerce may very well look different than design for traditional retail, due to the different demands of the respective distribution chains.

Opportunities to invest in further development of the packaging supply chain for e-commerce and subsequently omni-commerce scan the breadth of distribution channel and solutions will come only through industry collaboration and transparency.

Table 3: Emerging Opportunities for Optimizing E-commerce Packaging

Opportunity	Details
Industry-Wide Understanding of Effective Packaging Strategies.	Information on what materials and formats work best for e-commerce, and/or omni-commerce, should be shared and distributed.
Anticipating "Evolving Tons" (Mix of Materials).	As e-commerce introduces new materials and packaging formats, collaboration along the supply chain to plan for, and identify, best recovery options will be needed.
Materials Demand Studies.	Understanding where and how e-commerce packaging materials are being generated and disposed of may help to develop responsible strategies/policies for reduction and reuse/recovery.
Leveraging Reverse Logistics.	As reverse logistics becomes more sophisticated in response to e-commerce demand, opportunities exist for new packaging designs or recovery schemes that leverage these systems.
New Safety Testing and Protocols are Needed.	Safety standards for new forms or product distribution and transit are needed. Additionally, as new products such as perishable goods enter the e-commerce market, standards to ensure safe food handling will be required.

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[29] Ibid.