Limeloop

REUSABLE PACKAGING TO DRIVE DIGITAL LOGISTICS AND IOT

A CALL FOR COLLECTIVE CIRCULARITY

CONTENTS

THE RISE IN E-COMMERCE

Current climate crisis warrant a logistical
evolution from traditional systems to
sustainable IoT systems.

KEY WORDS

Logistics
The detailed coordination of a complex operation involving many people, facilities, or supplies.

Digital Logistics
Logistics systems which ensure end-to-end visibility across the supply chain.

Circular economy
A transitional model which designs out waste and pollution, keeps products and materials in use, and regenerates natural systems by redefining economic, social, and environmental capital.

Linear economy ("Take-make-dispose")
The current supply chain; raw materials are used to manufacture goods, which are then sold to consumers, who dispose of them when they have reached "end-of-life".

End-of-life
When an asset is no longer useful to its owner (i.e. - clothing, packaging)

Supply chain management
The management of the flow of goods and services, including the movement and storage of raw materials, inventory, and finished goods; as well as end-to-end order fulfillment from point of origin to point of consumption.

End-to-end visibility (E2E)
Touch points across the supply chain, involving the process in its entirety, starting at the procurement of materials from suppliers and ending when the product reaches the consumer and even beyond.

Asset management

A systematic approach to the governance and realization of value from the things that a group or entity is responsible for, over their whole life cycles; applicable to both tangible and intangible assets.

Sustainability

The capacity to reduce resource consumption by way of human activity which ensures ecological, economical, and sociological harmony at a systemic level.

E-commerce (Electronic commerce; eCommerce)

A business model in which brands sell goods to other brands and consumers who purchase said goods over the Internet.

Single-use packaging (plastics and cardboard)

Goods made from fossil fuels, designed to be disposed of immediately after use.

Sustainable packaging (Reusable packaging)

Packaging manufactured of upcycled or recycled material, specifically designed for multiple trips through the supply chain due to its extended life; a reusable package or container is designed for reuse without impairment of its protective function, making it a smart host for IoT.

Upcycle (Creative reuse)

The process of transforming by-products, waste materials, useless, or unwanted products into new materials or products perceived to be of greater quality, such as artistic value or environmental value.

Zero-Party Data

Data volunteered by consumers to brands, typically involving their purchasing preferences.

First-Party Data

Data collected by brands directly from consumers across different platforms (i.e. social media, email, website)

Waste management

The processes and actions required to manage waste from its inception to its final disposal.

Decarbonization

An economy based on low-carbon power sources which produce minimal output of greenhouse gas emissions into the atmosphere, specifically carbon dioxide.

Centralized data (database)

Data which is located, stored, and maintained in a single location; this location is most often a central computer or database system, for example a desktop or server CPU, or a mainframe computer.

Decentralized data

A system where no single entity has exclusive control over data and/or its processes.

Post-purchase experience

The period of time after a customer acquires a product or service, and their behavior in consuming said product or service.

Reverse logistics
The process of moving goods beyond their typical destination, in particular for reuse (i.e. - reusable packaging with IoT, which collects data on this process, informing predictive analytics)

Predictive Analytics
The use of data, statistical algorithms and machine learning techniques to identify the likelihood of future outcomes based on robust data. The goal is to go beyond knowing what has happened to provide a best assessment of what will happen in the future.

IoT (Internet of Things)
The network of physical objects, so known as, "things" — which are embedded with sensors, software, and other technologies used for the purpose of connecting and exchanging data with other devices and systems over the Internet.

Last Mile
The expensive, and often convoluted, last-step in getting goods to consumers' front doors.
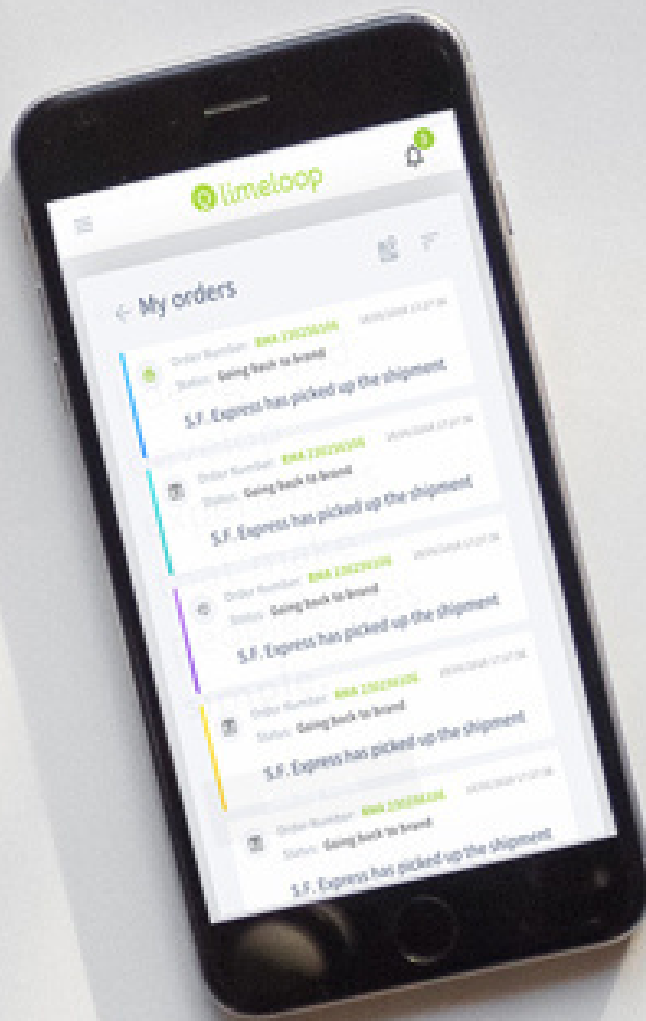
Crowdsourcing
The practice of obtaining information or input into a task or project by enlisting the services of a large number of people, either paid or unpaid, typically via the internet.

KEY
TAKE
AWAYS

- The consistent rise in e-commerce and the current climate crisis warrant a logistical evolution from traditional systems to sustainable IoT systems.

- The current "take-make-dispose" supply chain is oversaturated, leaving suppliers and manufacturers struggling with inventory management and order fulfillment, and impacting consumer experience.

- It costs more to recycle cardboard and plastic packaging due to the lack of value in recycled materials and to the inefficiencies in recycling processes.

- Reusable packaging adds value in solving the current supply chain's environmental, economical, and sociological problems, but only if implemented with digital logistics systems, from which brands will progress in meeting sustainability initiatives.

- Reusable packaging provides two-way communication between not only brands and consumers but between brands, consumers, 3PLs and carriers, closing loops in the supply chain and improving the consumer experience.

- Due to its interconnectedness, collective efforts across the supply chain are warranted in transitioning from linear to circular, including the aforementioned personas.

SUMMARY

SMB - Implementation

- Small and Midsize Businesses (SMB) have the power to launch trending sustainability demands to the next actionable level: implementation.
- Partnering with reusable packaging suppliers, SMBs can influence consumer behavior at a more targeted scale.

Enterprise - Maintenance

- Enterprise can maintain the foundation by applying reusable packaging and IoT technologies at a larger scale. This, then, impacts the global economy versus more localized SMB, demonstrating global circularity and sustainability.
- Implementing reuse and interconnection aids in actionable progress towards sustainability initiatives, especially with data sharing and predictive analytics providing insight into measurable environmental savings.
  - Researching and sharing findings on sustainable implementation of digital logistics equipped with IoT technology allows for informed and smart decisions.

Retail Locations and Hubs - Collection

- Storefronts fulfilling e-commerce orders from their brick and mortars provide unique opportunities for brands and consumers to implement reusable packaging with IoT.
- Becoming collection hubs, storefronts can not only offer reusable packaging, but collect it as consumers return to their store to either shop or drop-off their reusable package.

3PLs - Connection

- 3PLs are the source from which the circular economy flows. Because they host and store various valuable data, 3PLs can act as a bridge between traditional and digital logistics.
    - Working with SMB and enterprise to form a functionable and shareable data hub--both among brands and among industries-- decentralizes data, driving collaborative circularity and smarter

Carriers - Transportation

- Carriers not only keep goods in motion, delivering them across borders and oceans, but they, also, secure goods and, in the case of reusable packaging, collect packages for recirculation.
- Carriers are needed at the consumer level to pick up returned packages at their homes, but also needed at a high-level in transporting the reusable packaging as the goods themselves.

Last Mile - Delivery

- Speedy order fulfillment and delivery are no longer customer service features; they're consumer expectations, proposing significant costs and obstacles for brands attempting to deliver numerous small packages across geographic locations.
- Reusable packaging with IoT offers brands opportunities in crowdsourcing deliveries, utilizing local delivery services better equipped at navigating certain rural or urban areas.

Consumers - Advocation & Education

- Consumers are advocating for more sustainability, including the packaging their favorite brands use. Consumers can request brands implement reusable packaging.
  - Participation in reuse programs and becoming educated on single-use packaging and where products are coming from, can ignite change from both sides.

ABSTRACT

This paper outlines why digital logistics are the future of sustainable supply chains, by defining sustainable and reusable packaging, outlining the missed environmental, economical, and sociological opportunities in not implementing digital logistics, and demonstrating how reusable packaging, as a vehicle for IoT, aids in working towards sustainability initiatives. Further, it provides examples of supply chains implementing IoT logistics systems and suggestive next steps to collective circularity.

INTRODUCTION

The ancient Greeks and Romans may have referred to it as "logistikas" then, but logistics, as it's understood today, had its place, first, in war [24]. Fast forward to the Industrial Revolution, and railways and ships added layers to logistics. WWI, then, further evolved transportation and communication, creating a global logistics system - yet a system still founded in war [31].

It wasn't until WWII that logistics found its place in business, focusing more on exporting goods. It was then, too, logistics became an industry. An industry responsible for moving goods from point A to point B, across borders and oceans, as smoothly as possible[31]. Fast forward yet again to 2021. The supply chain certainly evolved, becoming increasingly more complex, yet traditional logistics remained and seemed to be keeping up. That was, until, COVID-19 swept across the country, increasing e-commerce purchases and illuminating the weaknesses of the country's linear supply chain.

"Consumers spent $861.12 billion online with U.S. merchants in 2020, up an incredible 44.0% year over year"[1]. This shift in consumer behavior demonstrates the need for yet another logistical evolution as industries, such as retail and food, struggle with anticipating and reacting to consumer demand in areas of storage, inventory management, transportation, packaging, and communications[48]. Consumer behavior, then, is not only an indicator of a logistical evolution, but of a system transformation, too. How brands react to consumer demand, but also how they anticipate it is becoming more and more expensive - storing and managing inventory stockpiles for when the demand is there can get pricey when considering the cost of managing warehousing and transportation. And reacting to demand is proving to be just as expensive because traditional logistics systems are falling short, "There is thus an imperative to making sure that logistics is carried out effectively and efficiently, through the most appropriate allocation of resources along the entire supply chain"[48].

Jumpseller put it simply:

"All this online shopping means a lot more shipping... While the average retail item is handled five times before it is bought, most products purchased online are handled up to 20 times before reaching the customer's hands. To protect those products, online retailers resort to piling on packaging - think bubble wrap, styrofoam, and massive cardboard boxes - most of which will go straight to a landfill" [8].

As e-commerce purchasing steadily increases, sustainability concerns, along with the lack of visibility across the supply chain, leave businesses looking to reusability and digital logistics for solutions. Reusable packaging eliminates waste in shipping, and when equipped with IoT, reusable packaging aids in smarter and more efficient storage, inventory management, transportation, and communications. The key is, then, in collectivity - collecting and sharing data across fulfillment centers, warehouses, transportation hubs, carriers, and customer service centers, industry wide, to better navigate goods from point A to point B with efficiency sans waste.

PACKAGING

The Sustainable Packaging Coalition® (SPC), a project of GreenBlue®:

"envisions a world where all packaging is sourced responsibly, designed to be effective and safe throughout its life cycle, meets market criteria for performance and cost, is made entirely using renewable energy, and once used, is recycled efficiently to provide a valuable resource for subsequent generations. In summary: a true closed loop system for all packaging materials"[20].

Reusable packaging is sustainable packaging. Then again, there's so much more to circularity than the packaging itself. Traditionally, of course, packaging is used to safely and securely transport goods from brands to consumers. But, the SPC points out that packaging can also be a vehicle for consumer education, differentiated marketing, and positive environmental impact. They believe, "through intelligent packaging and system design, it is possible to 'design out' the potential negative impact of packaging on the environment and societies," creating a "closed loop flow of packaging materials in a system that is economically robust and provides benefit throughout its life cycle - a sustainable packaging system" [20].

Now, circularity and sustainability may not necessarily be interchangeable, according to Rachel Meidl, author of "A Circular Economy Does Not Necessarily Translate To Sustainability" from *Forbes*, because for the system to become sustainably circular, environmental, economical, and sociological factors must be considered, in every circumstance, as their own circular loops; for, "sustainability is a feature of a system in its entirety, not a singular focus on any individual part," and circularity typically refers to economic principles applicable to business models [33]. But reusable packaging encourages collectivity throughout the system because of its IoT, connecting the loops while also closing them, as demonstrated by the SPC, making it a vehicle for collective, circular sustainability.

SMART REUSABLE PACKAGING

The SPC refers to "intelligent packaging and system design" as the blueprint for establishing a circular economic model. Reusable packaging, thus, cannot aid circularity and sustainability without driving digital logistics, by way of IoT. IoT refers to the digitization of physical objects connected using the Physical Internet, creating an overlap. For example, the transportation industry relies heavily on IoT in navigating deliveries of supplies, raw materials, and consumer goods[58]. According to Sanjeev Verma, contributor to RFID Journal, "This reflects the importance of choosing a smart technology to manage the various operations and functioning of the transportation industry," adding:

"Location tracking of differently sized cargoes, vehicles and fleets has become a necessary part of the logistics industry, especially for timely product deliveries. Comparing it with conventional technologies or existing systems, it becomes quite expensive to manage everything at once, but the involvement of the IoT keeps the costs significantly low"[58].

This example demonstrates one application of IoT, collecting data on cargo containers versus consumer packages.

But reusable packaging allows scalability for SMB and Enterprise across industries. Brands (working within their own systems or with a 3PL) using data from reusable packaging, equipped with IoT, gather a holistic understanding of each step in the logistics loop - fulfillment, delivery, consumer experience, and reverse logistics.

Because the collected data is real-time, brands can stay connected and keep up with consumer demand while also adjusting practices based on the collected data, and over time, preempt supply chain occurrences and trends with predictive analytics. IoT and digital logistics go hand-in-hand because reusable packaging, then, becomes a traveling data hub.

But what about privacy? Data is invaluable, and must be protected, secured, and willingly collected. Security, then, may be found in decentralizing data, allowing brands, working with or without a 3PL, multiple access points to said data across fulfillment centers and warehouses, cutting out the middleman. And what kind of data? Unlike first-party data, which refers to data owned by brands, zero-party data is, "data a customer intentionally and proactively shares with a brand, and might include preference centre data, purchase intentions, personal context, and how the individual wants the brand to recognise them;" in other words, consumers grant brands permission to use said data[35]. Thus, reusable packaging equipped with IoT, as a traveling data hub, warrants digital platforms where collected data, volunteered by consumers, may be stored and analyzed by both brands and consumers - as consumer participation is an integral part of a circular supply chain.

To illustrate, Upchoose, an organic baby clothing subscription service, saw participation rates and consumer adoption reach 100% following an opt-in program which kicked off after partnering with LimeLoop in 2018[5]. On average, consumer adoption and participation among brands working with LimeLoop reusable packaging is marked by a return rate of 90%[5]. Given the demand for sustainability, positive trends follow suit with high rates of consumer participation and package return rates. The implementation of reusable packaging, equipped with IoT, allowed UpChoose and LimeLoop to create touch-points with consumers comparable to traditional retail experiences, bringing consumers back into brick and mortar, while continuing to meet e-commerce expectations.

PACKAGING

ENVIRONMENTAL

IIn 2018, there were 292.4 million tons of waste, 23.05% of which were paper and paper products, including cardboard[39]. Prior to the pandemic that number was expected to rise, and with a COVID-induced spike in e-commerce, it likely has. The US's largest forest products company "produced more than 2.7 million short tons of corrugated packaging, up 2 percent year over year, according to its third-quarter earnings report" in 2020[10].

Cardboard packaging can be recycled up to five times after its initial use, if it meets the proper conditions needed for recology and hasn't been contaminated. Recycling is a best case scenario, though in practice it is imperfect and often recyclable material does not have a life beyond single-use. In 2018, 4.2 million tons of cardboard were incinerated and 17.2 million tons ended up in landfills[39]. Similarly, only 14 percent of all plastic packaging is collected for recycling after use, while only 9 percent of single-use plastic is recycled, with the residual "11 million metric tons of plastic waste entering the ocean every year"[32, 43, 55].

According to Kedzierski et al, "Approximately 50% of plastic objects made are intended for single use and only 20% to 25% for long-term use"[29]. What's more, according to a study conducted and released by Oceana in 2020, "Amazon generated an estimated 465 million pounds, or 211 million kilograms (kg), of plastic packaging," in 2019. Shipping over 7 billion packages, "the company uses so much plastic packaging that it would circle around the Earth more than 500 times if expressed in the form of e-commerce's ubiquitous air pillows"[37].
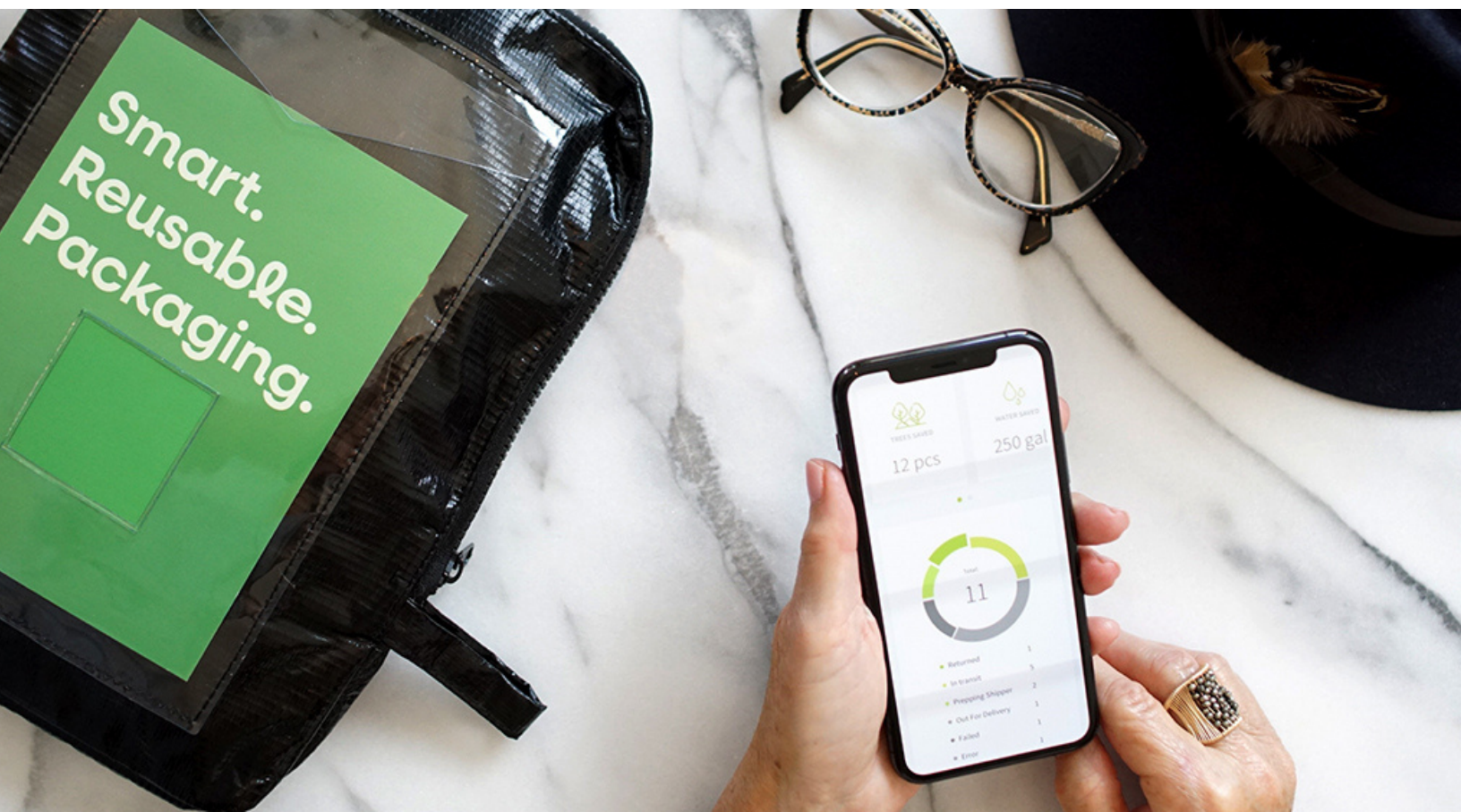
Kedzierski et al adds, "Thus, as the use of plastic materials has increased, the quantities of waste generated have also increased: of the 8300 million tonnes of plastic produced worldwide between 1950 and 2015, 4900 million tonnes were discarded (Geyer et al., 2017)"[29]. Waste management is integral to a "healthy community and a healthy environment" yet, designing for single-use pushes waste management past its limits, impacting the environment, perhaps more so now than ever before.

"Human-caused emissions of carbon dioxide need to fall 45% from 2010 levels by 2030 and reach net zero by 2050 to limit climate change catastrophe," writes Benjamin Laker, contributor for Forbes[30]. Troubling, though, is the findings of a recent study done by the Intergovernmental Panel on Climate Change (IPCC) which indicate "the connection between human emissions of greenhouse gases and global warming is 'unequivocal,'" and cite 2030 to 2035 as the peak years of global warming if the current system isn't transformed[18].

With the US reenergizing a green transition, coupled with consumer demand, it's no wonder brands are in hyperdrive to generate sustainable solutions. On January 20, 2021, the Biden Administration rejoined the Paris Climate Agreement declaring new greenhouse gas emissions initiatives for 2030, with the goal to ultimately become net-zero by 2050[49, 50]. Industry leaders recognize the stakes as well - cost, risk, and consumer LTV: "consumers are no longer willing to support companies that don't prioritize sustainability," writes Jeff Sternberg, with TechCrunch[52].

There are, then, three missed environmental opportunities for brands continuing to ship with single-use packaging: 1) reducing emissions from manufacturing and shipping single-use packaging; 2) reducing emissions from collecting, transporting, reproducing, and redistributing recycled material and 3) reducing carbon emissions contributed by incineration and waste management. With emissions consistently creeping dangerously high, single-use packaging must be reevaluated as a contributing factor.

But brands can't do this alone. Digital logistics unveils the environmental impact and sustainable savings through the data collected by way of IoT, housed by reusable packaging. This quantification of environmental savings means brands can better manage and measure company and federal sustainability initiatives and make sustainable business decisions for the future of collective circularity.
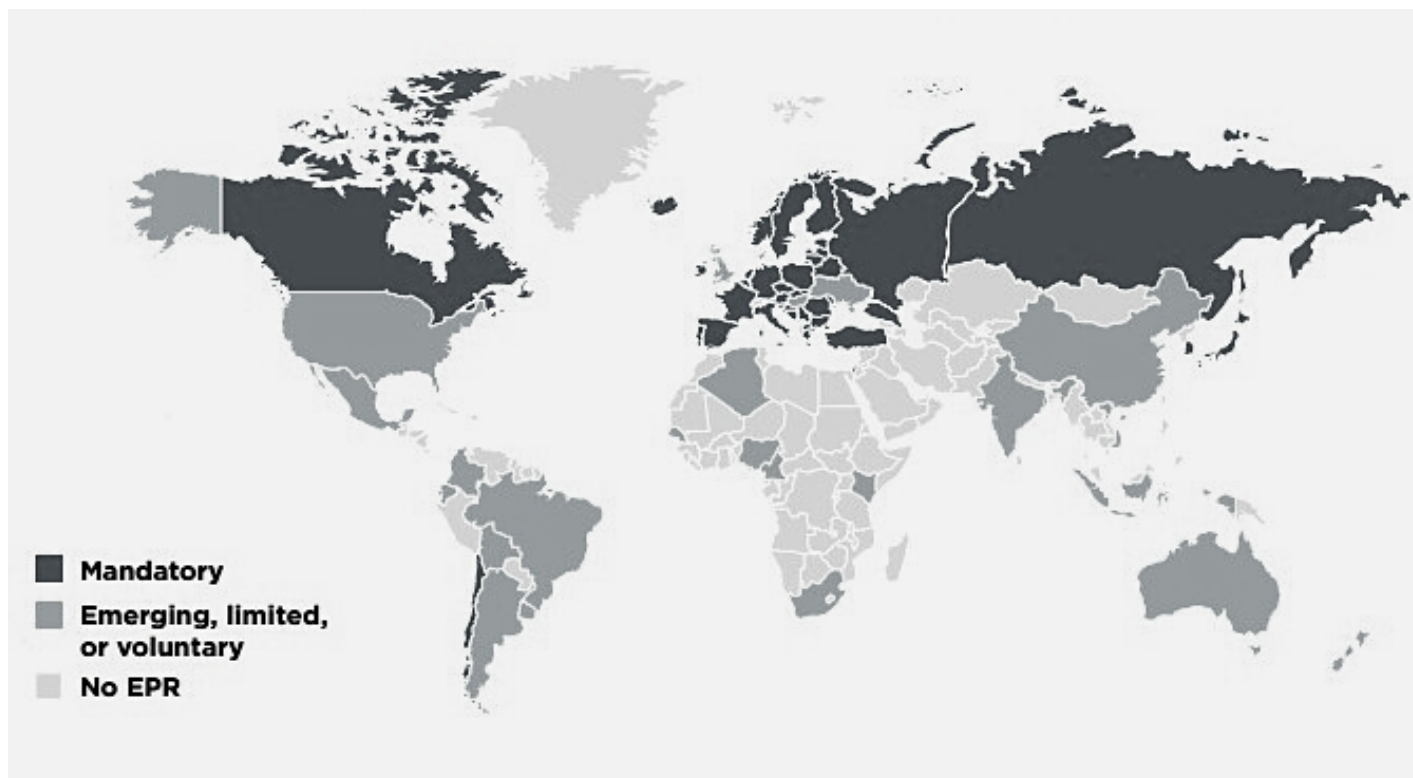
ECONOMICAL

"When Operation National Sword took effect in 2018, China insisted that it would accept only the noncontaminated recyclables that its manufacturers could use. As a result, the market for recyclables collapsed. Global exports of recyclable plastic to China, for example, dropped by 99% in 2018"[26].

With the overnight loss of a worldwide recyclables buyer and a resulting surplus of recyclables, recycling companies charged cities more, in some cases four times what they had charged the previous year[7]. And because of these steep charges, small municipalities, such as Franklin, New Hampshire, closed their recycling centers, having to pay "$125 per ton simply to dispose of recyclables," outlined in a report by the Manhattan Institute[26]. Similarly, just last year, a recycling plant in Hampton, Maine, offering recycling services to more than 100 municipalities, closed due to high disposal costs and collecting inefficiencies - despite taxpayers paying "$16 to 17.5 million per year to manage recycling and disposal programs, according to the Maine Department of Environmental Protection"[38, 42, 51].

The Ellen MacArthur Foundation (EMF) adds:

"Circulation of packaging that cannot be eliminated or reused involves collection, sorting, and recycling. However this process comes at a net cost for practically all packaging formats in most geographies. Over time, the economics can be improved significantly through better design, technological advancements, and economies of scale"[14].

EMF EPR legislation by geolocation

Extended Producer Responsibility (EPR) legislation, though scarce, attempts to remedy the costs of recycling by distributing recology fees so brands pay to recycle their packaging, as well as working with brands to design sustainable alternatives. Yet, cities and small town municipalities are still forced to either incinerate or landfill their recycled materials because they simply cannot afford recology. As a result, the US generates packaging waste that is too expensive to recycle, with solutions focusing on policy rather than packaging.

The Baker Institute, contributing to *Forbes*, cites the Ellen MacArthur Foundation when it writes:

"The overall goal of circularity is to create narrower and closed energy and material loops through circular and regenerative supplies, reengineering materials, resource recovery, sharing platforms, product as a service schemes, and product life extension via remanufacture, reuse, resell, repair and refurbishing"[2, 34].

It isn't enough to outline how the current "take-make-dispose" linear supply chain impacts the environment. Value must be added to these 'out-of-sight, out-of-mind' hindrances. Judith Evans and Emiko Terazono with *Financial Times*, cite data commodities group, Mintec, when stating, "Packaging costs have jumped almost 40 per cent since the start of 2020 amid intense demand"[13]. And with the cost of raw materials at their highest, sustainable, better yet, reusable, alternatives are, demonstratively, more cost effective[23]. For example, a report by Carbon180, as cited by the Baker Institute, "estimates the total annual market opportunity of replacing existing materials with those derived from captured CO2 (thus being regenerative) at US$5.91 trillion globally," with fuels ($3.82 trillion), building materials ($1.37 trillion), and plastics ($0.41 trillion) comprising the total market [34]. This is just one example of how circularity adds value to sustainability, which according to Financial Management, has an estimated growth of $10 trillion by 2030 [56].

The economical missed opportunities, then, in remaining with traditional logistics and packaging are found in each step of a package's lifecycle: paying to manufacture, store, and ship the packaging, while also paying and consuming the energy it takes to dispose of it. Not to mention the further losses brands will experience as the market for collective, circular sustainability grows year over year. "A survey published by Element Three and SMARI supported that same idea: sustainability was a product attribute that 87% of US Millennial internet users would be willing to pay more for," as outlined by Greg Petro, contributor for *Forbes* [40]. With reusable packaging, manufacturing and disposal costs decrease as reusability eliminates such recurring needs. Further, with IoT, brands have the opportunity to capitalize on the closed loops of cost and resource consumption designed to be predictable and circular.

SOCIOLOGICAL

In 2018, The Ellen MacArthur Foundation, through New Plastics Economy, launched the Global Commitment - a community of businesses committed to working "to eliminate the plastic items we don't need; innovate so all plastic we do need is designed to be safely reused, recycled, or composted; and circulate everything we use to keep it in the economy and out of the environment"[19].

One hundred plus brands, including "L'Oréal; MARS; Nestlé; PepsiCo; The Coca-Cola Company; and Unilever; the world's largest retailer - Walmart; major packaging producers such as Amcor and Berry Global; and two of the largest resource management specialists - Veolia and Suez," agreed to the commitment in hopes of reversing climate change and reaching more sustainable packaging practices [19].

EMF's Global Commitment may have been established before the pandemic and, thus, before the shift in consumer behavior from brick and mortar to e-commerce, but as Petro, from *Forbes*, writes "The pandemic didn't start the sustainability revolution..." Yet, the Global Commitment, along with other similar sustainability initiatives, puts the "sustainability revolution," as Petro adds, "into hyperdrive, and Gen Z is in the driver's seat"[41]. With their feet on the accelerator, Gen Z consumers raised the bar on the e-commerce experience, as they were born into the digital age and make up about 67 percent of the population in the United States [17, 57]. And Gen Z, not only demands sustainability as digital consumers, but influences it as brands weigh how to approach and further deliver on consumer demands.

Additionally, general consumer expectations of their e-commerce experiences are higher due to the digitization of society, arguably the bar set by Gen Z. According to Loni Stark, Senior Director of Strategy and Product Marketing at Adobe:

"A whopping 42% of respondents said they get annoyed when their content isn't personalized. That's followed by 33% who get annoyed when content is poorly designed, and 29% when content isn't optimized for their devices. What's more, an alarming 66% of consumers said encountering any of these situations would stop them from making a purchase" [3].

Herein lies a missed sociological opportunity for brands - better, personalized e-commerce experiences. As the SCP pointed out, sustainable packaging, in particular reusable packaging, offers brands opportunities to educate consumers and differentiate their marketing content and strategies. Becoming an asset in itself, IoT, housed in reusable packaging, combines data collected from the package with zero-party data volunteered by consumers. This holistic picture allows brands to customize marketing material be it educational, promotional, or continual, generating a brick and mortar experience for e-commerce consumers.

Further, e-commerce communications between brands and consumers are typically as linear as the supply chain. Once the consumer places his or her order, they can track its progress, know (variably) when it'll arrive, and enjoy its arrival. But what brands are, then, missing out on are the reverse logistics informing a consumer's post-purchase experience. According to Amit Sharma, author of "Online Retailers Should Care More About the Post-Purchase Experience" in *Harvard Business Review*, "Today, retail brands create customer experiences around these four moments and focus on driving shoppers to click the 'buy' button. Yet it's important for brands to remember this is not the end of the journey for the customer" [46].

Additional to those four moments is when the consumer uses the product for the first time, or opens their package. Sharma adds, "When a customer makes a purchase online, there's an "experience gap" from the time the customer checks out to when the product arrives. This is the new moment of truth for online shoppers" [46]. The "new moment of truth," in the consumer experience, with reusable packaging, then, is in consumer retention. Again, Sharma adds:

"Providing a positive experience at this time of anticipation is a tremendous opportunity for retailers to deepen their relationships with customers and build loyalty for their brands. Surprisingly, only 16% of companies are focused on customer retention, even though it costs at least five times more to acquire a new customer than to keep an existing one" [46].

Traditional logistics and packaging cannot satisfy "the new moment of truth" for consumers because its analog and disposable nature makes it essentially a dead end. Reusable packaging, equipped with IoT, closes the 'experience gap' with reverse logistics, by engaging consumers with visibility into their package's journey, while, also, allowing brands visibility into the post purchase experience, generating circular communication between brands and consumers and encouraging further circularity within brands and their operations.

CIRCULAR
ECONOMY

In 2020, Vodafone asked businesses how they were using IoT solutions to succeed in their IoT Spotlight survey. They found: "eighty-four percent of organizations are using IoT to fundamentally improve their environmental sustainability" [15]. Yet, Manish Sharma and Kris Timmermans for Logistics Management, report only "4 percent of supply chain and logistics leaders believe they are 'future-ready'—the highest level of operational maturity a company can achieve—highlighting the urgent scale of the task as we recover in radically transformed post-pandemic markets." [47].

What is 'future ready'? It certainly may not look like the Jetsons, but traditional logistics and single-use packaging trap the supply chain in the Flinstone's age, despite the implementation of IoT in transportation industries, and the experimentation with IoT in retail. Reusable packaging, thus, is a driver of digital logistics across industries by way of scalability and circularity. To be 'future-ready,' leaders must follow through on the ideas no one else sees as possible, including sustainability, but to do that brands (both online and store-fronted), consumers, carriers, and 3PLs must work in tandem.

Digital logistics systems enabled with Blockchain, for example, "can help make logistics companies more efficient via a public ledger system that records the motions of each shipping container" [9]. Blockchain uses smart contracts meaning, "retailers no longer need brokerages, lawyers or other third parties to complete tasks," which enables "retailers and logistics companies to enter binding agreements that will immediately dissolve if all agreed-upon stipulations aren't met. These ledger-based contracts increase transparency and profits while decreasing delivery time and costly errors" [9].

This system applies to and operates at a larger-scale, of course. Companies using Blockchain logistics implement IoT driven devices and digital logistics platforms, which collect data, much the same as IoT in reusable packaging - a smaller scaled application, but, also, a more direct connection to the consumer; a connection, which, incidentally relies on the consumer's participation, as well as a brands' implementation of reusable packaging. Which becomes the perfect sustainable vehicle - environmentally, economically, and sociologically - for digital logistics in an e-commerce market.

In working with third party logistics (3PLs), where inventory and data are stored, brands gain access to digital platforms. Brands are, then, able to quantify and measure environmental savings, assisting with current sustainability initiatives; manage inbound and outbound inventory, including storage and fulfillment; track deliveries in real-time, securing packages and preventing loss; and use reverse logistics and predictive analytics in making decisive business decisions, improving consumer experience while saving the environment and economy.
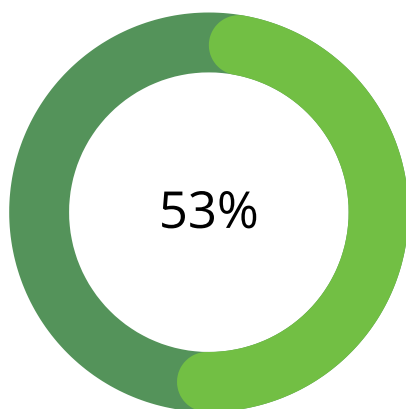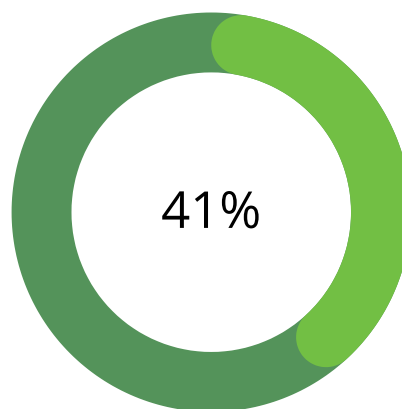
ENVIRONMENTAL SAVINGS

Sustainable outdoor clothing brand, Toad&CO implemented LimeLoop reusable shippers as an opt-in program with its consumers in 2018 after the partnership kicked off on April 20th.

The case study reads, "LimeLoop and Toad&CO worked closely to execute a quality control system that ensured all shippers maintained function and form," [2] from which a package loop was formed. Further, it reads "The customer, 3PL and Toad&CO gained visibility into the shipper's whereabouts, environmental tracking data and consumer label generation via the LimeLoop Platform" [2]:
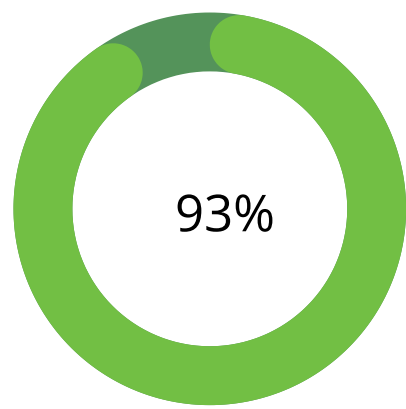
Toad&CO saw, as a result of implementing an opt-in program using reusable packaging and IoT technology driven logistics:

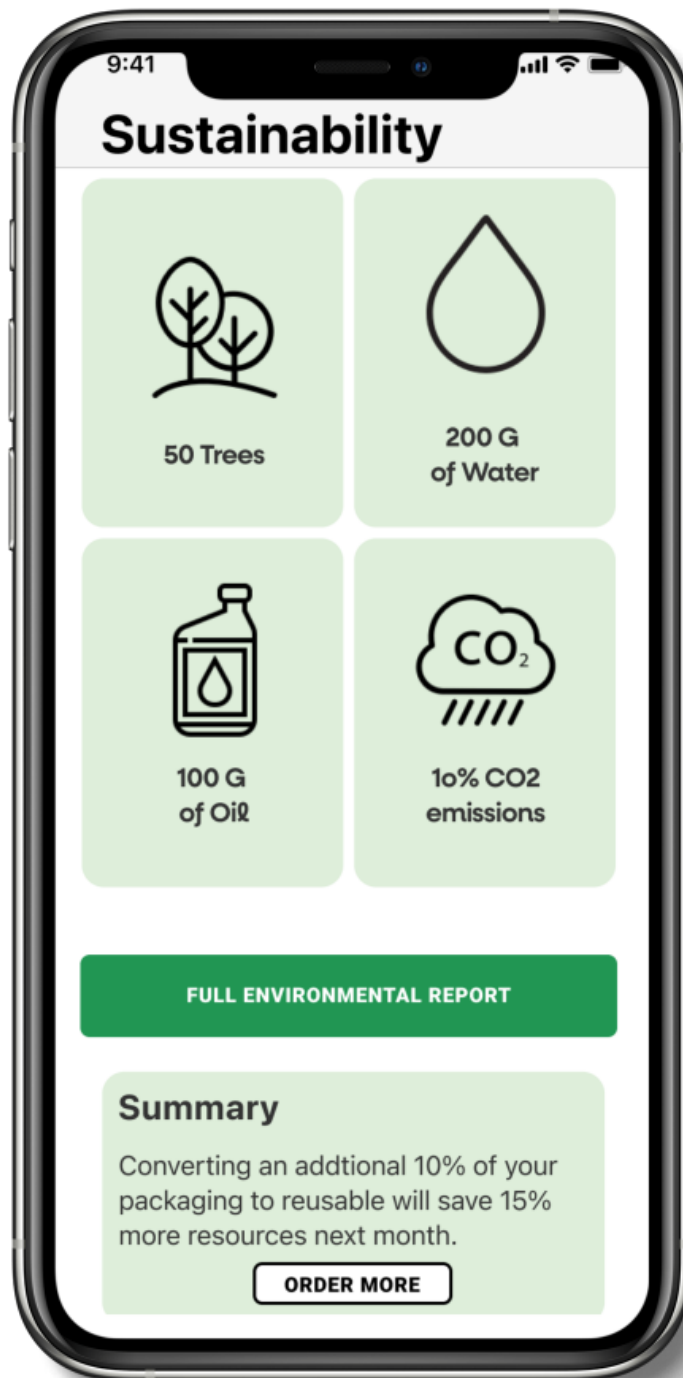| 53%	41%	93%
engagement increase	package savings	resource savings

Not to mention the resource savings with every 150 shipments using LimeLoop's reusable packaging [53]:

PACKAGE STATUS

Not only can brands gain better visibility into their inventory across 3PLs, fulfillment centers and warehouses, with IoT inside reusable packaging, but they can also track geolocation, temperature, and open-rate - the data that tells the real stories.

Geolocation

Tracking a reusable package's location throughout its journey allows insight into the package's location. This data can then be used by brands to make more informed decisions in allocating resources, targeting certain audiences, promoting events, and providing educational opportunities.

Temperature

Food spoilage is the number one contributor of food waste because it happens all along the supply chain. According to the USDA, "in the United States, food waste is estimated at between 30-40 percent of the food supply"[16]. They add, "In 2010 food loss and waste at the retail and consumer levels was 31 percent of the food supply, equaling 133 billion pounds and almost $162 billion" [16]. High demand stretches the supply chain's limits, and traditional logistics does little to inform brands of when temperature sensitive items, such as fresh produce, become unsafe and unsellable.

The sustainable initiative is to reduce food waste by 50 percent by 2030[16].
Temperature monitoring allows grocery brands to communicate within
warehouses and fulfillment centers when transporting perishable goods,
ensuring timely and accurate deliveries; while also providing consumers real-
time data on their package's temperature for when it needs their attention,
allowing consumers to better plan their days by narrowing the delivery time to
specific dates and times.

Open-Rate

There are 90,000 packages lost in NYC every day and growing[27]. Reusable
packaging is more secure and durable than most single-use packaging
because of the material used in manufacturing, and because the IoT
technology inside the package allows for brands to track open-rate data.

Open-rate data illustrates when a package was opened. Brands can use
this data to follow-up with consumers, capitalizing, again on post-
purchase experiences and, consequently, increasing customer loyalty. But
they can also use open-rate data in seeing if a package is opened before
its destination. This security expands customer service and aids in loss
prevention.

ASSET MANAGEMENT

With end-to-end visibility in digital logistics, brands can better communicate between fulfillment centers and storage warehouses on what's coming and what's going. Data sharing across a brand's supply chain is then key to managing inventory and fulfilling orders; directly impacting consumer experience.

Return Restock

In the last five years, there was a 95 percent increase in returns, which generated five billion pounds of waste[45]. Additionally, Amazon gave warehouse workers "a weekly target of 130,000 items to destroy," as reported by Isobel Asher Hamilton with *Business Insider*[21]. She adds, "This was corroborated by an internal memo viewed by ITV, which showed that during one week in April, 124,000 items were marked 'destroy'"[21]. Data collected from reusable packaging, equipped with IoT, allows brands to know when a package is opened, while gaining insight into the post-purchase experience. So, if a consumer must make a return, brands can then reshelf the return knowing it wasn't tampered with, used-up, or damaged.

Additionally, a brand's return process makes or breaks their relationships with their consumers. In fact, the easier the return process, the better the chance of retaining a consumer. In 2007, the *New York Times* reported 91 percent of consumers required a seamless return policy when considering purchasing from a brand[4]. And, over the years, that expectation remains. As Thomas S. Robertson, marketing professor at Wharton University in Pennsylvania, states:

"Consumers are coming to expect they can return things, and that it will be easy. They're coming to expect that returns will be free, that when something is delivered to them, there will be a return label or return envelope for sending things back. There is this major upward trend in terms of consumers returning and expecting to return"[44].

Reusable packaging equipped with IoT eases returns and creates a seamless process. The consumer need only place his or her returns back inside the package and print a new, prepaid shipping label from either the brand's own shipping management platform or a 3PL's platform, to then place the package in the mail for pick-up by a local carrier. From there, a brand continues to collect data on the package's journey, saving time, money, and waste, as they'll be able to distinguish between shipping an empty package or a package with returns.

REVERSE LOGISTICS & PREDICTIVE ANALYTICS

Because the packaging is reusable, the IoT remains with the package on its return to either a cleaning facility, a fulfillment center, or a returns processing facility. Unlike traditional logistics, digital logistics provides insight into consumer behaviors after the purchase is complete. This data tells brands insights such as how long consumers hang onto packages before opening or returning them, as well as other zero-party data strategies a brand may implement. This end-to-end visibility provides actionable insights for more circular business models. Overtime with robust data, these insights are proactively employed with predictive analytics and a better understanding of the total supply chain flows.

There are three categories of risk which brands must consider when implementing IoT technologies: administrative and operational risks, technical risks, and physical risks[22]. With data and visibility, these risks are mitigated with insight into what happens at each phase of fulfillment and return with visibility into the security and state of the package itself.

CONSUMER LTV

A Consumer Brands/Ipsos report found "84% of consumers are concerned about packaging waste" [11]. Brands are listening, but consumer loyalty is integral no matter the scale of a brand's circular business model. Thus, with reusable packaging and its IoT, educational content marketing serves as an extra touch-point to convert the consumer who directly impacts the collective circular loop. Consumer participation continues the loop of a reusable package, sending it back so that it may be recirculated again. Tangible cooperation between the brand and consumer signals shared values and actively mitigates consumer woes surrounding packaging.

NEXTSTEPS

It's one thing to speak and another to act, but shifting from a linear economy to a circular one is possible and actionable. Each persona in the supply chain - SMB, Enterprise, 3PLs, Storefronts, Carriers, and Consumers - has a role to play.

SMB - Implementation

Reusable packaging fits any phase of growth for small and midsize businesses. Start-up brands can inaugurate circular systems from the beginning with a sustainable start. And for those looking to upgrade, reusable systems are scalable from test, to segmentation, to total system implementation from linear to circular.

By partnering with reusable packaging pioneers using IoT, SMBs engage consumers, educating them on sustainability and reuse as a piece to circularity, at a localized, targeted level with the residual benefits of consumer LTV. Whether from the start or changing course, SMBs have the power to implement circular digital logistics.

Enterprise - Maintenance

Enterprises face added pressure to meet sustainability initiatives, particularly in plastic packaging because of their significant role in the supply chain. Reusable packaging is a clear-cut strategy to address sustainable circular models with the added benefits of data and systems for better business and visibility into existing logistics and supply chain.

Widescale maintenance is supported with visibility and insights into the macro system with zero-party data for predictive analytics and measurable environmental impact. Enterprise, then, maintains what SMB builds by applying reusable packaging and IoT technologies at a larger scale. Scale impacts the global economy beyond the necessary localized networks, demonstrating global circularity and sustainability. Further, "by 2022, 75% of enterprise-generated data is predicted to be processed outside a traditional centralized data center or cloud"[6]. Meaning, once SMB decentralizes data and scales reusable packaging at a more intimate, communal level, Enterprise may expand the digital footprint by scaling it up to meet more global and corporate needs, pioneering sustainability in tandem with SMB, generating a collective circular economy.

3PLs - Connection

3PLs are the source from which a circular economy flows. Because they provide a sleuth of services, including hostin and storing valuable data, 3PLs act as a resource in further transitioning from traditional logistics to digital. Moreover, with reusable packaging and IoT, 3PLs can provide more in-depth analyses to brands, from which then, brands may make smarter business decisions and disseminate provided information to consumers.

3PLs in tandem with SMB and Enterprise form a functionable and shareable data hub, either among brands or among industries for not just data but for distribution, transportation, and storage, which assist in ensuring a brand's needs for reusable packaging are met by managing the whereabouts of each package by way of its IoT. Additionally, decentralized data drives collective circularity and smarter supply chain systems with greater efficiency spilling over into the sustainable consumer experience.

Carriers - Transportation

As reusable packaging is a vehicle for IoT, local carriers are the vehicles for reusable packaging. Carriers not only keep goods in motion, they secure goods en route. While in good hands, the reusable packaging collects insights on the journey that typically go unnoticed. And in worst case scenarios, where the package has an unexpected detour, whether a logistics fumble or piracy, tracking insights can flag the occurrence, quickly auto-correct the journey, and inform the total system on best practices and future mitigation.

In the case of reusable packaging, carriers are the starting point of reverse logistics and recirculation. As consumer participation is one key to circularity, carrier transportation initiates the outbound and return route to close the circle. Carriers fit multiple pieces in the outbound transportation and reverse transportation puzzle. For reverse logistics at the consumer level, they initiate the journey from a hub or a consumer's home. - getting those reusable packages, and their tech, to where they're needed most.

Last Mile - Delivery

Consumer e-commerce extends "speedy fulfillment and distribution" to more than just customer service features; they are expectations and expensive ones, at least according to Shelagh Dolan, contributor for Business Insider[12]. When consumers track their packages, now, "out for delivery" means very little in an age of continuity. As open-rate data communicates a package's status, last mile logistics communicates its arrival. Delivering multiple small packages to consumers spread across rural and urban areas where traffic patterns and other factors potentially inhibit a package's delivery, requires carriers to travel more frequently, travel farther, and travel faster, particularly if first attempts at delivery are unsuccessful.
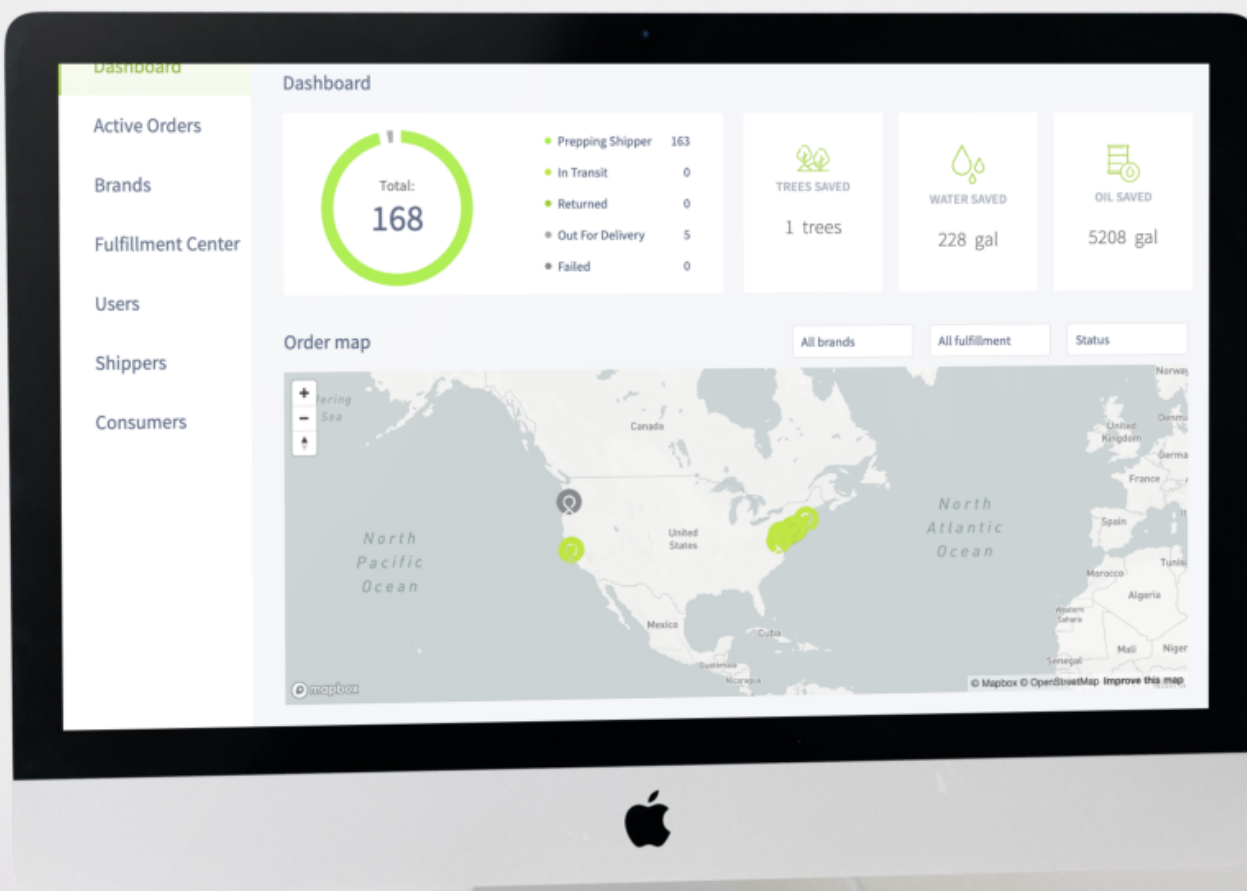
Retail Locations and Hubs - Collection

Despite e-commerce's popularity, storefronts are just as integral to circular sustainability; more significant are the storefronts fulfilling e-commerce orders from their brick and mortar stores. Reformation, a sustainable clothing brand offering vintage and signature fashion, not only has an online presence, but also has 21 storefronts across the US with three more planned[54]. Because Reformation keeps its operations in-house, including storage, order fulfillment, returns, and shipping, it can implement reusable packaging, equipped with IoT, to not only improve their operational functions, but provide online consumers with a sustainable packaging alternative and a hub to return the packaging for further circulation.

UpChoose and Toad&CO saw significant consumer response in the opt-in programs provided at check out, offering LimeLoop reusable packaging as an alternative to single-use. When their consumers returned the empty packaging for cleaning and recirculation, they simply flipped the shipping label and placed it in the mail for pick-up. If for whatever reason this option isn't available, perhaps in apartment complexes or college dorm rooms, storefronts such as Reformation's can act as collection hubs for consumers to continually participate in circularity, directing consumers back to brick and mortar.

Hubs, or drop-off centers, offer consumers a collective measure in returning reusable packaging and offer brands cost effective shipping. Bulk collection creates an economy of scale to ship and redistribute the empty packages with efficiency. And of course, the IoT continues to collect insights on the return system and how to improve it.

Consumers - Advocation & Education

What consumers want, consumers get - within reason, of course. But sustainability is well within reason. Thus, LimeLoop encourages consumers to continue advocating for sustainability, including the packaging their favorite brands use. Requesting reusable packaging, participating in reuse programs, and learning about single-use packaging strengthens consumer LTV and drives change from both sides of the supply chain. By using the collective consumer voice, brands might just be able to hear the message loud and clear.

CONCLUSION

If the world reused just 10 percent of plastic packaging, it would "half our annual plastic waste"[25]. Brands responded to e-commerce spikes the best they could, especially when the pandemic forced brands and consumers away from brick and mortar. But their response in packaging only worsened the problem further, and the demand made it impossible to ignore.

Moreover, further impacted by the pandemic, the shortcomings of the current linear supply chain and its traditional logistics systems created shortages which left brands closing doors and consumers scratching heads. Thus, highlighting the need for a logistical evolution, but an evolution driven by reusable packaging, equipped with IoT, versus simply changing policy and legislation, which convolutes sustainability initiatives and future progress.

Brands, both SMB and Enterprise are feeling the pressure to produce sustainable solutions as organizations, such as The Sustainable Packaging Coalition and The Ellen MacArthur Foundation create parameters around packaging, resource consumption, and waste management. Missed environmental, economical, and sociological opportunities in not implementing smart logistics by way of reusable packaging, further, leaves brands a step behind their consumers as Gen-Z progresses in sustainability and circularity at the community level.

Implementing reusable packaging, equipped with IoT, aids in reaching company and federal sustainability initiatives for SMB and Enterprise by providing end-to-end visibility, reverse logistics and predictive analytics throughout the supply chain. Thus, providing smarter insight into environmental savings, inventory management, package delivery, and e-commerce experience as consumer expectations continue to rise: "More than half of respondents (58%) said their customer service expectations are higher today than they were a year ago, according to a report from Talkdesk Research released Tuesday,"[59].

Of course, there are some risks in transitioning from traditional to digital logistics, but there are business decisions which must be made and must be smart, given our current climate crisis. With data sharing and decentralized digital logistics, keeping privacy and security in mind, brands can collect not only zero-party data, but data on traveling packages' statuses, geolocations, and environmental impacts, informing said smarter, effective business decisions. What's more, reusable packaging calls for collectivity and cooperation between brands, 3PLs, storefronts, carriers, and consumers, needing each to fulfill their roles in achieving a circular economy.

A tense urgency hangs around sustainability because the ways in which we've been consuming have been threatened and proven detrimental. The world, hopefully, will look different by 2025, and progressively more so as we approach 2030, 2040, and 2050. Perhaps circularity will become the new normal, or perhaps there will be more overlap across industries in realizing that circularity requires a collective effort. The current supply chain, and it's logistics, face a reuse revolution.

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