

# CHANGE AT THE SPEED OF THE CONSUMER:

HOW E-COMMERCE IS ACCELERATING  
LOGISTICS INNOVATIONS





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## THE INNOVATION IMPERATIVE

Mention the word “innovation,” and what’s likely to come to mind is some sort of consumer electronic device: a smart phone, a smart watch, a virtual reality headset. But while it’s understandable that most of us would associate these and other revolutionary products with innovation, that’s an overly narrow view.

In his book *The Innovator’s Dilemma*, Harvard Business School professor Clayton Christensen described two types of innovation. One is *disruptive*, which redefines a market or value proposition. But innovation does not have to produce something that has never existed before, nor does it have to turn an industry or market upside-down. The other type of innovation, *sustaining*, brings about improvements in the performance and value of existing products or processes, either through incremental change or big breakthroughs.<sup>1</sup>

In today’s hyper-competitive, constantly evolving business environment, innovation is no luxury; it’s an imperative for any company that wants to successfully compete for and retain loyal customers. The arena where this battle is being fought most fiercely: e-commerce. Whether B2C or B2B,

e-commerce strategies continue to be driven by ever-changing customer expectations for fast, on-time delivery; uninterrupted product availability; and always, convenience. Increasingly, buyers also want to do business with companies that are socially and environmentally responsible.

As the pace of change continues to accelerate, logistics—the bedrock on which superlative service is built—must innovate with new technologies and solutions. Yet in the fluid world of e-commerce, logistics innovation cannot focus solely on individual tools and tactics. The agile, competitive supply chain of tomorrow will require an ecosystem of innovations made up of smart and appropriately chosen technologies enmeshed with people, whether in management or on the frontlines. Harnessing the intelligence of machinery, software, and humans, and enabling them to truly work in concert, will eliminate the siloes that have long separated those realms and stymied profitability. This ecosystem integration will be key to meeting customers’ always-changing expectations. Importantly, it will also drive agility, profitability, and competitive advantage.



### I BELIEVE INNOVATIVE IDEAS ARE KEY FOR OUR FUTURE SUCCESS.

OUR FOCUS ON CUSTOMER-CENTRIC INNOVATIONS AND THE DEVELOPMENT OF PRODUCTS AND SERVICES THAT OUR CUSTOMERS NEED MOST WILL HELP US TO REMAIN THE LOGISTICS LEADER.

— Frank Appel, CEO, Deutsche Post DHL Group (2015)



## E-COMMERCE LOGISTICS: PRESSURING PROFITABILITY

The explosive growth of e-commerce is putting companies under pressure to change their logistics processes and approaches to problem solving while still keeping their eye on the profitability prize. This is true for every e-commerce model: pure-play or omnichannel, direct to consumer or business-to-business. Sellers must be certain their logistics operations will enable them to respond with speed, precision, and agility to rapidly evolving trends, including:

### **Customers' expectations for a perfect buying experience.**

Online buyers base their purchase decisions—often with just a moment's thought—on ease of ordering, product cost and immediate availability, multiple options for quick, low-cost delivery, track-and-trace capability, and flexible returns policies. And they expect a painless, even flawless, experience from start to finish. The pressure to perform is intense: The shipper and third-party logistics (3PL) executives who responded to one industry survey ranked customer demands for lower delivered cost/pricing; demand for faster response/delivery times; and rising customer service expectations among their top five business challenges.<sup>2</sup>

### **Consumers' desire for “anytime, anywhere.”**

Particularly in B2C, buyers expect to be able to order, pay, and receive their purchases whenever and wherever they prefer. That's the idea behind omnichannel fulfillment, where companies manage inventory to fulfill orders through an array of sales channels and delivery choices: online, mobile, or brick-and-mortar store; home delivery, pick up from locker, buy online/fulfill from store, and more. But it's expensive and technically difficult to maintain the right amount of inventory in the right place at all times, and to have the necessary infrastructure, people, and processes in place for each fulfillment and delivery option. Despite years of experience and the development of sophisticated supporting technologies, companies still struggle to profitably manage the logistics aspects of omnichannel.<sup>3</sup>

### **Exploding demand for urban delivery.**

Urban areas are attracting growing populations of young professionals, and their limited access to storage, parking, and physical stores, together with their propensity for online ordering, make them a prime audience for e-commerce fulfillment. However, “[I]t can be difficult to profitably serve demand in highly congested areas when order profiles trend toward small quantities, high frequency, and high velocity,” note the authors of the 2018 State of the Retail Supply Chain study, conducted for the Retail Industry Leaders Association (RILA) by Auburn University's Center for Supply Chain Innovation. Study participants said their biggest challenges in urban fulfillment include ensuring inventory availability, having enough last-mile capacity and labor to meet delivery-time commitments, and the high cost of last-mile delivery.<sup>4</sup>

### **Labor shortages and rising costs.**

A 2018 report by commercial real estate brokerage CBRE estimates that U.S. warehouses and distribution centers will need an additional 452,000 workers by the end of 2019.<sup>5</sup> Continuing growth in e-commerce demand and the tight labor market in the U.S. and Europe are major contributors to the labor shortage. Logistics operations are being challenged to ensure they have sufficient “hands on deck” to meet stringent service commitments, especially during seasonal peak periods. The shortage, together with rising minimum wage rates, is rapidly pushing up costs for both warehouse and transportation labor.



### New online sales models.

New models for selling products online are increasingly determining what is being sold, when, and by whom. “Social commerce,” where shopping is influenced by user ratings, referrals, and advertising on social media, can create shifts in consumers’ preferences and cause spikes in demand for specific products. Virtual marketplaces, such as eBay and Alibaba, allow third parties to reach buyers through the marketplace’s website. Typically, marketplaces collect orders and payments, track deliveries, and pay the sellers after deducting a fee. The sellers, meanwhile, are responsible for maintaining inventories and delivering the goods.<sup>6</sup> With more players involved in (and trying to make a profit from) online sales, logistics organizations must be able to respond to unanticipated demand while keeping costs down.

### The environmental impact of e-commerce.

With its profile of frequent, small shipments that often consist of just one or two items, last-mile B2C delivery generates more carbon emissions and packaging than truckload deliveries to brick-and-mortar stores. And while consumers say they’re concerned about the environmental impact of the products and services they use, they still want their orders delivered to their doorsteps—and fast. This creates a conflict for logistics operations. Eighty percent of respondents to the 2018 State of the Retail Supply Chain study said their greatest business tension comes from trying to balance customer demands, supply chain objectives, and sustainability goals.<sup>7</sup>

These trends raise an important question: How do you meet ever-more stringent service requirements while simultaneously carrying out the logistics imperative to optimize efficiency, cost, and profitability? The old, standard approaches won’t work. Leadership in the constantly changing world of e-commerce calls for innovative solutions that challenge conventional business models.





## INNOVATION: THE NEW ENGINE OF E-COMMERCE PROFITABILITY

To meet—and stay ahead of—those and other challenges to profitability, companies engaged in e-commerce must innovate more aggressively. Logistics innovations that will have a lasting impact on the profitability of e-commerce will unite the once-separate worlds of machinery, people, and software. More than that, they will form an ecosystem in which innovations interact with and augment each other, resulting in a borderless whole whose impact will be far greater than the sum of its parts.

While that scenario is still to be realized, we are already beginning to see how companies that embrace innovations – hard and soft technology cemented to new management thinking and processes – can better tackle the profitability challenges that have plagued e-commerce logistics from the start.

Here are four examples where this new approach is making a difference.

## MEETING CUSTOMERS' EXPECTATIONS FOR A PERFECT EXPERIENCE, ANYTIME, ANYWHERE

From the time a consumer selects and pays for an order to the time the merchandise is in her hands, the expectation is that each transaction and its associated information will be accurate, timely, and exactly as promised. A merchant's ability to fulfill those expectations has a direct impact on profitability. For example, a global survey about e-commerce by the consulting firm Capgemini found that 53% of customers who are satisfied with a vendor's delivery services purchase paid memberships for delivery, and 74% increase their spend with that retailer as a result.

Satisfied consumers are also willing to pay more for fast delivery. This offers an opportunity for e-commerce companies to offset expensive last-mile delivery costs.<sup>8</sup>

To meet customers' expectations every time, each transaction in an order's journey must fall exactly into place, in sequence... yet merchants must be able to immediately pivot when customers change their orders or delivery preferences. This can best be accomplished by integrating people, software, and equipment automation.

In part, that's because e-commerce activities do not happen in isolation; instead, they are integrated and cumulative. Order processing and inventory deployment decisions affect the way orders are picked, packed, and shipped. Those actions and decisions, in turn, can make or break an efficient, cost-effective

final mile delivery—and determine whether a customer will be both loyal and profitable.

There are many areas where the triad of people, software, and automation can collaborate to ensure that consumers get exactly what they want, when they want it. One is speed of delivery; people, processes, and technology must pick up the pace when it comes to order fulfillment and time to the consumer.

Near real-time data collection, analysis, and execution is becoming a “must have”. One tool for achieving this blended analytics input is advanced warehouse execution systems (WES). WES receives sensor inputs from connected warehouse equipment, evaluates and processes them using artificial intelligence (AI) and business intelligence (BI) data mining agents, to orchestrate in near real-time the subsystems that provide instructions to people and machines to make optimal labor, logistics and delivery decisions.<sup>9</sup>

And finally, there is the fast-emerging technology of goods-to-person automation – e.g., work-alongside-human-robots. These robotics take many forms, such as storage-and-retrieval shuttles and order-picking robots. All improve order accuracy while maintaining the fast pace needed to keep up with high-service, burgeoning e-commerce order volumes.

## FROM REACTIVE, TO PROACTIVE TO ANTICIPATORY AND PREDICTIVE

Online information has the power to instantly reach millions of people around the world. This has profound implications for e-commerce logistics. User ratings, referrals, and advertising on social media can create demand spikes for certain products, taxing merchants' ability to fill orders and deliver them on time. Or they can lead to precipitous drops in demand, unexpectedly leaving warehouses and stores with unsold merchandise. Both scenarios hurt profitability. The ideal solution for managing such uncertainty would be something that might seem impossible: "read" consumers' minds and accurately predict what they will do. This would allow companies to foresee demand surges or declines and proactively make adjustments to minimize their impact on profitability. Thanks to artificial intelligence this is now becoming feasible.

Artificial intelligence (AI) mimics human thought patterns or behavior. The algorithm-based technology intelligently interacts with its environment much as humans do. AI includes machine learning, which uses iterative processes to correlate structured and unstructured data, recognize patterns, and use what it has "learned" to improve its predictive or decision-making model. Rather than replace human decision makers, AI augments their knowledge and expertise and guides decisions.<sup>10</sup>

Based on its analysis of historical and current data, AI can predict what is likely to happen and suggest appropriate actions. Here's a hypothetical example: When a movie star with millions of social media followers posts photos of herself wearing a flattering dress and says it's her all-time favorite, the number of online searches for that dress immediately jumps. AI could detect both of those developments, correlate them, and predict a short, sharp spike in demand for the dress. The technology would then suggest actions, such as ordering more of the dresses and air freighting them, so they arrive before the demand spike subsides. But shipping by air is expensive; if margins on the dress fall below a set threshold, the solution would then suggest less expensive options.

Inside the warehouse, AI can help companies dynamically adjust their utilization of equipment and storage to more efficiently handle demand variability. A home furnishing chain with a rapidly growing e-commerce business used AI to analyze real-time demand and order patterns, and then instruct warehouse robots to dynamically reposition inventory in the most efficient locations for filling incoming orders. The retailer was able to increase storage efficiency by 15%, increase throughput by 4x, improve inventory accuracy and on-time shipping, and substantially lower labor costs from reduced walk time, wait time, and space optimization.<sup>11</sup>



**THE PIVOTAL FORCES OF DIGITALIZATION AND GLOBALIZATION ARE RESHAPING OUR WORLD, AND DHL IS COMMITTED TO FACILITATING INNOVATION THAT PREPARES US FOR THESE CHANGES.**

— Matthias Heutger, Senior Vice President,  
Global Head of Innovation & Commercial Development,  
DHL Customer Solutions & Innovation (2017)

## MITIGATING THE TWIN CHALLENGES OF LABOR

Labor poses a twin challenge for e-commerce operations. In the U.S., it typically represents 40–60% of warehouse operating costs<sup>12</sup> and is the largest segment of motor carriers' operating costs.<sup>13</sup> For both, it's increasingly difficult to hire and retain qualified, reliable employees. Yet they also need to boost productivity. The most promising solutions for these problems exemplify the integration of people, technology, and machines.

One, augmented reality (AR), has been proven to increase productivity and accuracy. AR overlays computer-generated information on what a person sees. In the warehouse, AR is delivered through either “smart glasses” or head-mounted displays. One application is a vision-guided order-picking system that integrates with the warehouse management system (WMS) to show workers a digital version of the pick list. This application uses indoor navigation capabilities to identify the most efficient travel path, and bar-code scanning and image-recognition software to identify and direct the worker to the item to be picked.<sup>14</sup>

A labor-related technology that is experiencing extraordinary growth is robotics and automation. On the transportation side, a number of technology firms and their shipper partners are testing autonomous (“driverless”) tractor-trailer trucks on long-haul routes and delivery vans and automobiles for last-mile delivery in urban and suburban areas. Some tests have been quite successful, and advocates believe autonomous vehicles offer the best solution to a worsening shortage of qualified truck and delivery drivers. But they are a long way from widespread adoption, which will depend on the development, installation, and management of a complex network of infrastructure, such as sensors for data collection, and systems for traffic management and monitoring the safe operation of vehicles.<sup>15</sup>

In fulfillment centers, adoption of warehouse robots is accelerating. Their purpose is not explicitly to replace humans, but to supplement them and to reduce humans' exposure to physical burdens and repetitive motion that can lead to injuries. Because they can work around the clock, at a predictable, uniform pace, robots can boost productivity and throughput. Most of the development right now is in autonomous mobile

robots (AMRs), such as those that bring individual items, cases, racks, or totes to conveyors or packing stations. Some are collaborative robots, or “cobots,” that work safely alongside humans, such as burden carriers that direct and accompany workers to the proper location in aisles or deliver items to humans for selection and packing, to name just a few.

Advances in object-detection, vision, navigation, and sensor technology are making warehouse robots safe and efficient, while AI is bringing their capabilities ever closer to those of humans. One robot designed for fulfillment centers has human-like grasping capabilities for separating multi-SKU batches into individual customer orders. It uses computer-vision algorithms to assess shapes and sizes, grasp algorithms combined with a special gripper for picking accuracy, and motion-planning algorithms to properly place items in their final destinations. Machine learning allows the robot to improve its accuracy and decision making as it works.<sup>16</sup>

Although warehouse robotics solutions are expensive, there is already a strong return on investment (ROI) case. “Automation and robotics that weren't cost-justified or producing profitability just two to three years ago are now able to produce a significant ROI due to changes in the labor-force wage rate and the tight availability of labor in most U.S. markets,” says Steven Johnson, Managing Principal, Johnson Stephens Consulting. In some cases, e-commerce fulfillment centers using robot-assisted picking are saving 30% to 40% on rising labor costs, he says.<sup>17</sup>





## THE “BRASS RING”: COST EFFICIENCY AND SERVICE AT THE LAST MILE

Last-mile delivery may offer the greatest profitability challenge for e-commerce logistics. The Capgemini survey estimated that the cost of providing last-mile services accounts for 41% of overall supply chain costs. The survey also found that last-mile deliveries are eroding profits: Respondents reported that last-mile delivery costs them an average of \$10, but the customer only pays on average \$8.<sup>18</sup> With consumers unwilling to pay the full cost of delivery, making last-mile profitable will require reducing the cost to reach the customer. The greatest rewards will accrue to those who most effectively apply innovative solutions that integrate people, technology, and machines.

One approach is to offer alternative locations for customers to take delivery. Making orders available in strategically located lockers (including “smart” lockers that can be unlocked with smartphones) instead of delivering to the customer’s door could reduce delivery costs by an estimated 10 percent, if they are more widely adopted, says Johnson.<sup>19</sup> The advantage for logistics service providers is that they can deliver many shipments at one stop, reducing the risk of costly failed deliveries to almost zero.<sup>20</sup> Providers of last-mile delivery are also piloting other technology-aided options, including delivery directly to the trunks of customers’ cars, delivery inside the home (even when the customer is not there), and crowdsourcing delivery to provide on-demand service without having to expand a fleet or recruit more drivers.

Testing of automated solutions such as driverless delivery vans, unmanned aerial vehicles (UAVs, better known as drones), and street-level delivery bots are underway around the world as companies seek solutions for the cost and efficiency challenges inherent in last-mile delivery. With labor representing an estimated half to 60% of last-mile costs,<sup>21</sup> automation is likely to quickly gain traction as volumes grow.

A 2016 McKinsey report on the future of parcel delivery in Europe forecasts that by the middle of the next decade, autonomous ground vehicles (wheeled robots) with parcel

lockers on board have the potential to play a significant role in parcel delivery in urban areas. The researchers estimated that savings of as much as 40% and a margin increase of 15–20% could be achieved by deploying these vehicles.<sup>22</sup>

Parcel delivery by drones has received considerable attention. They have proven cost-effective in specific circumstances, such as in rural areas where order density is low. But they have limitations, including short battery life and small payloads, as well as regulatory challenges, that will need to be overcome.

Matthias Winkenbach, director of the Megacities Logistics Lab at MIT’s Center for Transportation and Logistics, sees potential in combining autonomous vehicles with drones. Driverless vans traveling through a city could launch drones that would make deliveries to consumers and then return to the van. “That would minimize the number of drones and the distance they fly, and because the van never stops, it speeds delivery and alleviates congestion,” he says.<sup>23</sup> It’s important to note that autonomous delivery vehicles of all types will still need human supervision; the labor savings comes from a single human directing multiple vehicles rather than multiple people making the same number of deliveries.

Artificial intelligence and augmented reality could help to make last-mile delivery more efficient. For example, AI could identify and correct inaccurate delivery addresses, and dynamically identify the most efficient route based on real-time conditions.<sup>24</sup> This would speed deliveries, increase productivity, and reduce a delivery vehicle’s environmental impact. A driver wearing an AR device could see information about a parcel, such as its weight, delivery address, special handling requirements, and dimensions. At destination, the AR device could indicate the correct parcel to deliver, eliminating the need to remember individual parcels’ locations and greatly reducing the time required at each stop.<sup>25</sup>

## TIME AND COMMERCE DON'T WAIT: THE FUTURE BELONGS TO THE INNOVATORS

With online sales continuing to grow around the world, the pressures on logistics operations will only increase. Logistics organizations must step up their game to keep their many promises to B2C and B2B customers. But they cannot do so at the expense of profitability. Innovations like those discussed in this paper will help companies achieve their goals, yet innovation by itself does not guarantee profitability. Just consider the subtitle of *The Innovator's Dilemma*: "When New Technologies Cause Great Firms to Fail."

Innovation itself represents a profitability challenge for e-commerce players. Important questions for them include how quickly they should innovate, and where they should focus their attention. For most, the answer will be the "sustaining innovation" mentioned in Christensen's book, which improves the performance and value of existing products or processes through incremental change or big breakthroughs.

To assure a profitable future, e-commerce companies will have to do three things. First, they should focus on innovations that differentiate them from competitors, in terms of service, technology, and products. Second, they should adopt a long-term, strategic view of innovation. While at first they may have to invest in expensive solutions and process changes, the goal is for those investments to eventually pay off in greater agility and competitiveness that translate into profitability.

And third, the future ultimately will belong to those who create the agile supply chain of tomorrow by breaking down the siloes that have long separated technology, people, and machines. Integrating these three realms to create an innovation ecosystem—not simply optimizing individual functional areas or solving specific problems, but applying them holistically, so that each adds to and amplifies the benefits of the other—is both the challenge and the goal.





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## Where logistics innovation comes to life.

For logistics innovation to be impactful over the long term, it must be globally relevant while also meeting region-specific needs. It must enhance customers' competitiveness and profitability by helping them to solve problems and improve performance. And it must combine entrepreneurship, creativity, social awareness, and vision with deep technical expertise.

All of those characteristics are on full display at DHL's three Innovation Centers. Located in Cologne, Germany; Singapore; and Rosemont, Ill., USA, the state-of-the-art facilities showcase technologies that will transform logistics operations, including robotics and automation, artificial intelligence, self-driving vehicles, the Internet of Things, and virtual and augmented

reality. Special exhibits include the Solution Sphere, where visitors can experience an array of Deutsche Post DHL Group's capabilities and solutions, such as parcel lockers, sensor technology, and warehouse pick and pack using voice and lighting technologies; the Trend Curve, which highlights future trends and their applications in the logistics industry; and Vision Wall, which gives visitors a peek at what logistics might look like in the year 2050.

DHL's Innovation Centers aren't just about looking and learning, though. They're also designed to serve as regional platforms for collaborative innovation on new products and services with customers and partners, and as a home base for DHL's Trend Research initiatives.



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