

RESEARCH REPORT

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THE "LAST YARD"

One Further Step in Making Sure that Customers' Needs are Met

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Smeal College of Business

in conjunction with:



Research in collaboration with: Infosys® CONSULTING



Rental
Leasing
Logistics



KORN FERRY



ABOUT THE REPORT

The term “last mile” is commonly used today in the fields of logistics and supply chain management, and it generally refers to the final segment of a delivery process that spans from a point of fulfillment to the destination specified by a customer. However, the last mile doesn’t necessarily end when needed products are delivered at their designated destination addresses, but that value is created when those products are available at locations where they are needed within the customer organization. This year’s *Annual 3PL Study* explores some of the concepts and basic details pertaining to the last-yard logistics in addition to various other topics in the annual survey of users and providers of 3PL services. This report focuses on the special topic of “last yard” logistics. It presents findings from the study that explores the current understanding, challenges, and emerging practices. Such understanding is imperative to all logistics triads—sellers, buyers, and third-party logistics providers—since the capable execution of last-yard responsibilities will determine whether or not the customer’s needs are fully satisfied.

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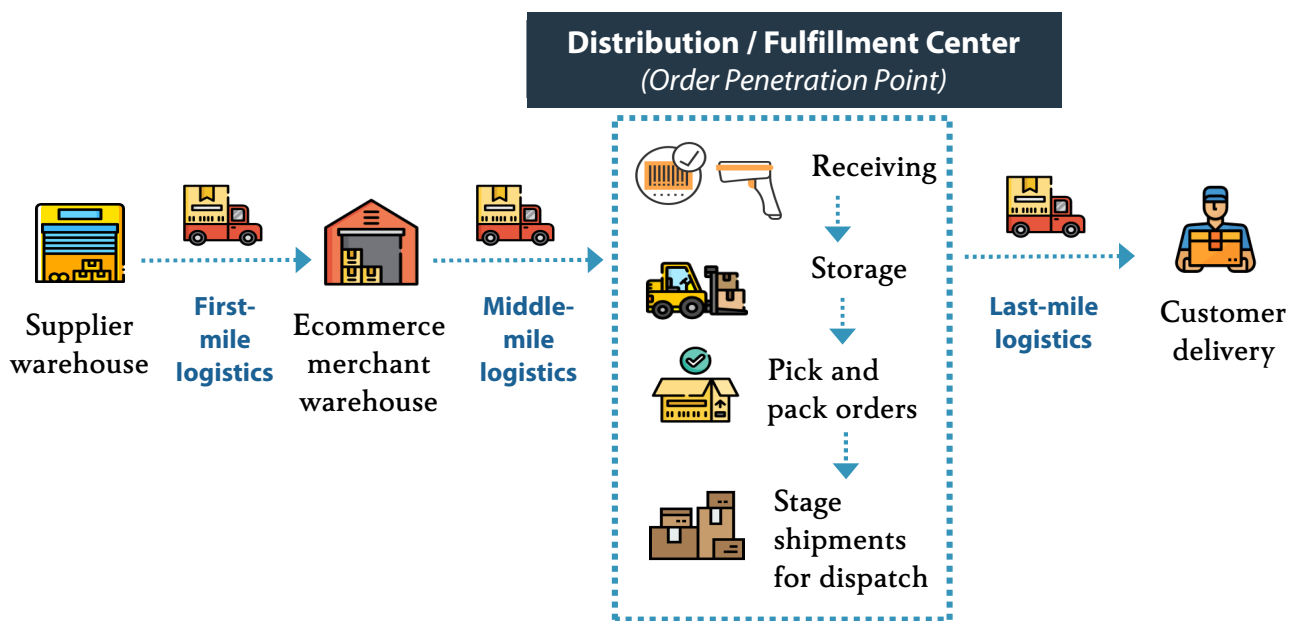
INTRODUCTION



Revisiting the Last Mile

The term “last mile” is in common use today in the fields of logistics and supply chain management, and it generally refers to the final segment of a delivery process that spans from a point of fulfillment to the destination specified by a customer. The length of the last mile may range from a few blocks to much longer distances, but it typically represents the last segment of a supply chain or order fulfillment process as depicted in Figure 1.

Figure 1: Last-Mile Logistics in the Context of Order Fulfillment and Distribution



While this concept has been relevant for many years, it has taken on an enhanced significance in today’s world of ecommerce and omnichannel distribution. Data collected by Statista (2018) show that in 2017, global e-retail (B2C) sales amounted to \$2.3 trillion and are projected to reach up to \$4.48 trillion by 2021. Strong growth can also be

observed in the B2B markets. In 2017, global B2B ecommerce sales was estimated at \$7.7 trillion, and are projected to reach \$1.2 trillion by 2021 in the United States alone, according to Statista and Forrester Research, respectively (Big Commerce 2018; Orendorff 2017). Operationally, this last mile can be the most expensive and most important part of the supply chain process, particularly to those logistics and transportation providers that are most involved in seeing that shippers’ delivery requirements are met.

There are B2B and B2C examples of the importance of last-mile capabilities, as both industrial buyers and individual consumers typically have preferences or requirements as to when and where shipments are delivered. Overall, last-mile capabilities have become recognized as essential to the growth and profitability of businesses and the success of their supply chains.

Introducing the Last Yard

The “last yard” concept refers to what happens to a shipment once it arrives at the designated address or location of the recipient and then needs to be routed to a specific customer’s or consumer’s point of use. The examples below suggest that the last yard is applicable to both business and consumer situations.

Last Yard in Business Situations	Last Yard in Consumer Situations
<ul style="list-style-type: none"> ■ Movement of repair parts needed for a manufacturing process from the receiving dock to the manufacturing location ■ Movement of shipments of weekly magazines, from the point-of-receipt to point-of-sale areas within the store where they are available to shoppers 	<ul style="list-style-type: none"> ■ Movement of consumer purchases from a central mailroom of a multi-family apartment or a university campus to the consumers (e.g. tenants, students) ■ Movement of consumer purchases from a hotel front desk to the guest room or a pick-up point within the hotel

Essentially, the capable execution of last-yard responsibilities will determine whether the customer’s needs are fully satisfied or not. For example, if the repair parts referred to above are not available at the manufacturing location when and where they are needed, it would

significantly diminish the extent to which “value” is realized by ordering such repair parts. Ironically, this failure may negate the value created by shippers, parcel carriers, trucking companies or 3PL providers that deliver shipments considered “on-time and complete” as per customer requirements but the items fail to arrive at the specific customer’s point of use.

This means that the last mile doesn’t necessarily end when needed products are delivered at their designated destination addresses (e.g. receiving location of a manufacturing plant, mailroom of an office), but that value is created when those products are available at locations where they are needed within the customer organization. While it would be logical to think of the last yard as a distinct step beyond the last mile in an overall supply chain or fulfillment process, there are situations where the term last mile might be interpreted to include last yard responsibilities.

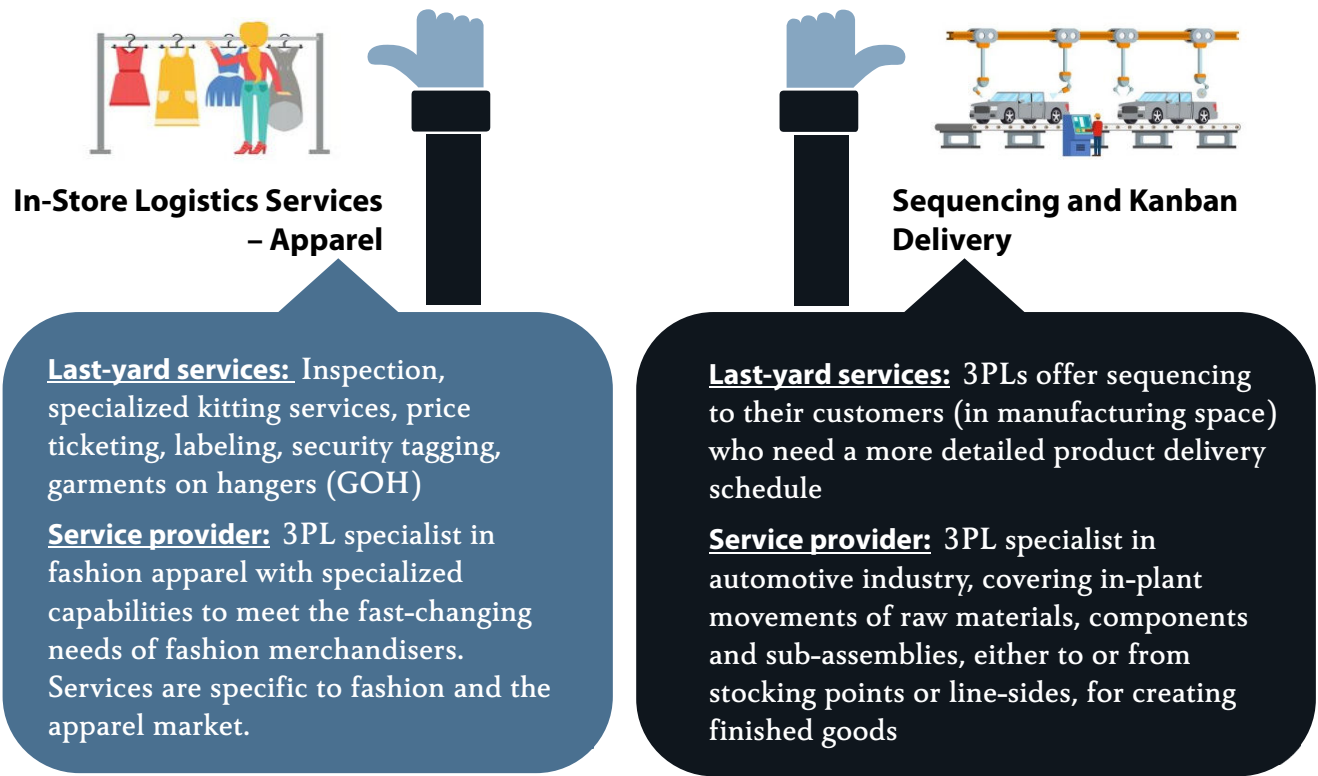
An interesting example is Frito-Lay, which is known for its “direct store delivery” (DSD) system, the largest DSD system in North America with more than 15,000 sales routes. A key element of Frito-Lay’s competitive advantage is that the company delivers its chips directly to retail stores to ensure freshness, accurately fill order levels, and to take responsibility for other activities such as stocking and refreshing shelves, etc. One of Frito-Lay’s corporate and supply chain strategies is to have control over its last-mile *and* last-yard responsibilities.

Figure 2 provides some additional examples of innovative last-yard services that pertain to both B2B and B2C supply chain environments. While it is true that there are some industries where last-yard failures may be more consequential (e.g. medical supplies, airline repair parts, fresh grocery items, etc.), in an overall sense, the critical nature of last-yard services is more situational than industry specific.

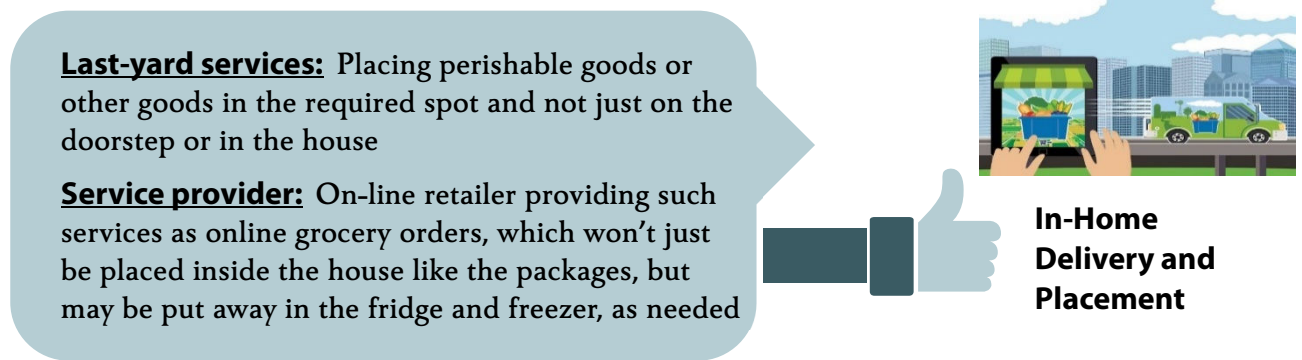
To help clarify the distinction between the last-mile and the last-yard logistics, Figure 3 provides examples in the B2B and B2C contexts. For the B2B parts supplier to assembly line example, the last mile concludes at the point of central receiving for the manufacturing organization, while the last yard extends to the assembly line where the part is needed. In a situation where a 3PL would provide delivery to the specific point where the item is needed, the last mile would extend to the assembly line. The second example is that of a consumer who needs to pick up a shipment at a package locker provided by the shipper or

ecommerce retailer from which it was ordered. In this instance, the last mile ends upon the packages being placed in the package locker, while the consumer would be the party who assumes last yard responsibility.

Figure 2: Examples of B2B and B2C Last Yard Innovations

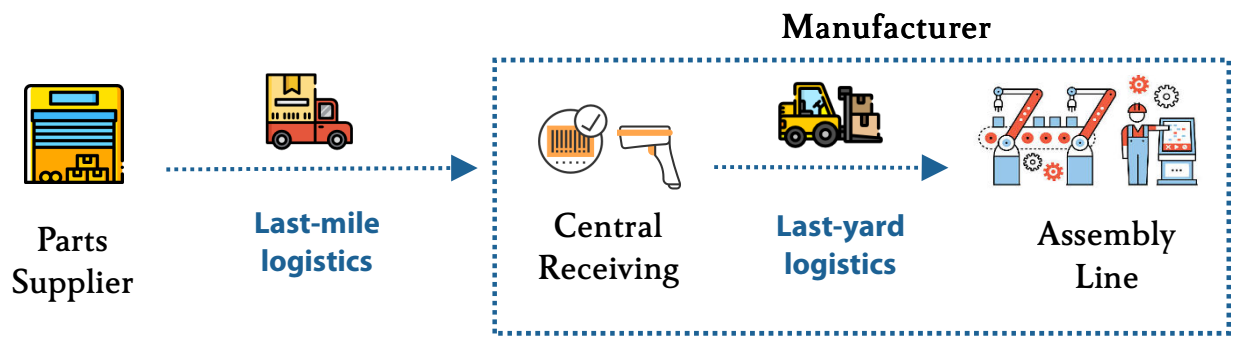


Examples of B2B Last Yard Innovations

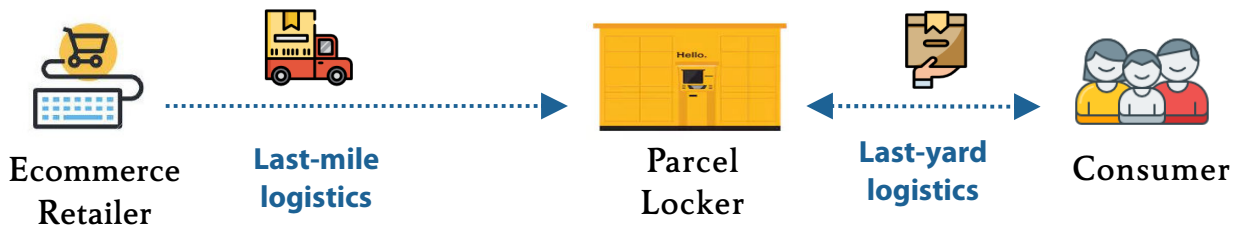


Examples of B2C Last Yard Innovations

Figure 3: Last Mile vs. Last Yard – B2B and B2C Examples



B2B Parts Supplier to Assembly Line Example



B2C e-Commerce Retailer to Consumer

Last-yard logistics operations can be quite complex. Inbound parcels need to be recorded, sorted and often put into a delivery system with the recipient notified that their package is available for pickup (Giles 2017). Typical processes of traditional last-yard package delivery systems¹ are summarized in Table 1.

Table 1: Typical Processes of Traditional Last-Yard Logistics

1	<p>Packages arrive at central receiving point. When a delivery driver shows up with a stack of packages, central mailroom or receiving staff is asked to sign only once or <i>single signature acknowledgment</i>. If the staff is signing for 45 packages but there are only 44 in the stack, problems of liability arise.</p>
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(Continued)

¹ Sources: Giles (2017), Hazel (2017), McKone (2017), Moreno (2016), Package Zen (2016), Weir (2016)

2

Packages are scanned in and sorted. Many mail and package centers still use pen-and-paper methods to log packages received. Traditional computer spreadsheets also in use are not much more effective. Individuals had to write down 20-plus-digit tracking numbers, carrier, and recipient names and dates. The likelihood of errors was high and the process is extremely time-consuming, which tends to create a gap between when the recipient receives delivery notification directly from the carrier (e.g. FedEx, UPS) to when the package is actually ready for pickup or delivered. Typical manual processes are as follows:

- (1) Arrange all packages next to a terminal
- (2) Scan each package using a tethered scanner
- (3) Type the recipient's name into a form
- (4) Choose the correct person from a long dropdown list
- (5) Create a new recipient record if they do not exist
- (6) Type the sender's information into a form
- (7) Save new package record

3

Pick-up notification is sent to recipient. Many mail centers have no automated way to notify recipients that they have received packages. Staff typically notify recipients by manually emailing them or putting slips of paper in individual mailboxes, the latter often leads to packages sitting in the mail and package center longer than they should. Having to generate an email manually to every recipient is also error prone and can become time-consuming and cumbersome as the quantity of deliveries increase.

4

Pick up procedure. After receiving pick-up notification (e.g. via email or paper slip in individual mailbox), recipients go to mailroom during operating hours and wait in line at mailroom. Recipients then check if package is ready. If it is ready, mailroom staff goes retrieve the package. Often, mailroom staff have to hunt for the package that frequently spent days lost in the mailroom or never arrived at all. Then, recipient must identify themselves or sign for package release.

BACKGROUND



Key Trends Driving Changes in Last-Yard Logistics Landscapes

In the last few years, the last-yard logistics landscape has changed greatly for all kinds of businesses and institutions. In addition to significant increases in shipment volumes, researchers have seen greater concerns for adequate security and control over shipments from point of origin to the ultimate destination and specific user. These changes have heightened concerns over how effectively, efficiently and securely the supply chain has been able to move shipments over the last mile and the last yard. The capabilities of historical receiving points are being scrutinized, and smart companies are looking to their logistics service providers for advice and capabilities as to how to improve.

Key trends that have been observed include the followings:²



Declining volumes of physical (“snail”) mail and rising package volumes

In the age of digital communication and commerce, physical mail volume is plummeting, while ecommerce package delivery volume is skyrocketing. To put this trend in perspective, collegiate mailroom statistics show that the number of packages being sent to college students has increased by 15 percent annually in recent years. Similarly, in the apartment industry, apartments that used to handle two or three packages a day now handle about 100 packages per week, according to a National Multifamily Housing Council (NMHC) and Kingsley Associates 2014 Package Delivery Survey.

² Discerned from: Bhattarai (2017), Blackwell (2014), Bohjalian (2016), Hazel (2017a, 2017b); Kulikowski (2014), Parcel Pending (2017)



Significant increases in seasonal shipments of all types

This trend is particularly evident during holiday seasons, and shippers have greater expectations of logistics service providers to take responsibility for the capable delivery and availability of these shipments.



Increases in personal packages shipped to work addresses

Frequently done to reduce the chance of theft while not at home, many consumers now have their packages sent to an address other than their home, increasingly work address. As a result, organizations have seen significant increases in the volumes of personal shipments that have been delivered to employees at their business locations. Aside from the resources needed by organizations to deal with these shipments, there also is an element of liability for the organization once possession is taken.



Increases in value and criticality of many shipments

The need for more efficient and effective last-yard logistics management is further driven by the growth in the number of critical items being shipped to organizations. Examples include medical equipment and supplies, repair/replacement parts, high-priority deliveries for senior executives, and a number of other types of shipments that must be delivered when and where they are needed to avoid organizational problems.



Growth in perishable consumables and non-consumables

There has been significant growth within the food and grocery sector, particularly with fresh and perishable foods that need prompt delivery and adherence to specific controls, such as temperature, etc. This trend also applies to non-consumables for which timely delivery is necessary to deliver the value created by the product itself. An example would be dated periodicals that need to be on the retail shelf and available for purchase by consumers in a timely manner.

Evolving Issues in Last-Yard Logistics

The changing landscape has led to traditional strategies becoming obsolete, resulting in a number of evolving issues that are putting pressure on mail and package centers. Last-yard logistics to get shipments or packages to the employees and residents who are the final recipients can be chaotic, particularly for companies with hundreds of employees across dozens of departments or a university with tens of thousands of faculty and students (Fink 2015; Giles 2017; Little 2017; Novitex 2017a). The pain points are driven by the increased package volumes, and the ways in which volumes impact the time and space constraints that are becoming more difficult to deal with every year (Bohjalian 2016; Derven 2016). Some of the impacted areas include the followings:³



Losses of staff productivity

The need to properly staff central receiving points has been exacerbated by rising package/shipment volumes. In turn, this new reality has placed additional pressures on staff to properly document shipments that have been received, notify intended recipients of shipment availability, sometimes deliver to recipients, and deal with status inquiries. In the traditional last-yard logistics system, staff can spend hours each day facilitating package deliveries and internal distributions. According to *Parcel Pending time-and-motion study*, it takes one hour of staff time per 15 packages received to accept the packages, carry them to the storage room, organize them, and then one by one, issue the packages to the recipients.



Storage capacity constraints

Also driven by increasing volumes of shipments/packages, the physical storage capacity of many receiving locations has been stressed. Further exacerbating the problems is the fact that intended recipients do not always pick up their incoming deliveries in a timely manner, and so the central location becomes more of a storage point than a “cross-dock” type of operation.

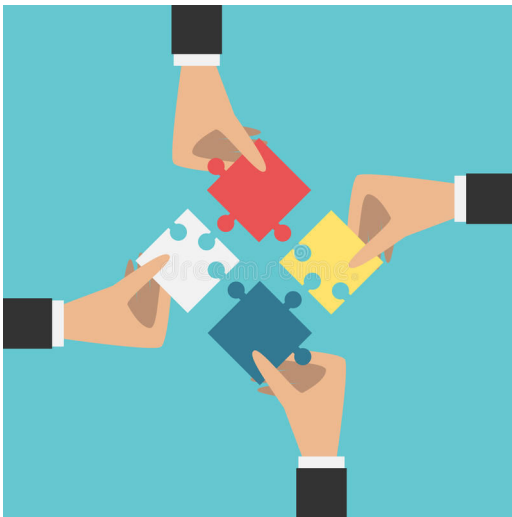
³ Discerned from: Bergeron III (2015), Bohjalian (2016), Derven (2016), Fink (2015); Gattoni (2016), Giles (2017), Hazel (2017), Little (2017), Novitex (2017), Pitney Bowes (2016, 2017), Schofield (2014)



Poor performance of mail centers

This rising issue may become evident through long pick-up lines and significant wait time experienced by recipients who go to pick up packages, and then find that they have been misplaced, delayed, or lost. When an important package is involved, an in-house last-yard delay in delivery or lost packages could negatively impact the organization. Pitney Bowes reports that 2.5 percent of incoming packages are misplaced or delayed every day, a number that increases to 3 percent in multi-site organizations. In addition, mail centers or central receiving locations may not be adequately equipped to provide suitable accommodations for oversize shipments or temperature-control deliveries.

Potential Solutions



As the key trends discussed earlier has increasingly overwhelmed traditional last-yard logistics strategies, 3PLs and organizations, both shippers and recipients, are reinventing themselves and beginning to explore different solutions to the last yard of package delivery (Bhattarai 2017; Bohjalian 2017; Daninhirsch 2017a, 2017b; Gattoni 2016; NMHC 2016; Novitex 2017). There are several example strategies that may help to eliminate or reduce the negative effects of last-yard logistics problems, as depicted in Figure 4.

Interested readers are referred to Appendix 1 for detailed discussion of alternative last-yard delivery models—*hand-delivery* model and *self-serve* model.

Figure 4: Potential Last-Yard Logistics Solutions



Shippers improving their internal processes to see that delivered items are transferred efficiently and effectively to point of use



3PLs to take part in developing capabilities that will facilitate shippers' last-yard needs



3PLs to take responsibility for executing shippers' last-yard services



Strategic consideration of alternative delivery models: *hand-delivery* model and *self-serve* model



● **Hand-delivery model**

● **Self-serve model**

Eliminates staff intervention when carriers/3PLs drop off shipments/packages that are subsequently accessed and retrieved by recipients. Typical forms of this model are *parcel lockers*, which range from traditional lockers to basic electronic lockers to smart electronic lockers; or *package closets*, which range from software-driven to smart systems.

Includes staff intervention when carriers/3PLs drop off shipments/packages and receiving or mailroom personnel physically make them available for recipients to pick up. This model can be in the form of basic or automated mail and package centers.

RESULTS: SHIPPER AND 3PL VIEWS ON LAST-YARD LOGISTICS



The 23rd 2019 *Annual 3PL Study* is the current version of a study that investigates leading trends in logistics and the supply chain and takes a deep dive into the ways in which shippers and 3PLs can collaborate to drive value. It looks at 3PL industry growth and development, what shippers outsource and what 3PLs offer, as well as why customers outsource to 3PLs and how well 3PLs respond. As part of the study, researchers investigate trends and issues that likely will be impactful for the future state of logistics outsourcing. Contributing organizations to the conduct and publication of the *Annual 3PL Study* are Penn State University, Infosys, Penske, and Korn Ferry International. Current and previous final reports for this study are available for download at www.3plstudy.com.

Survey responses show a clear signal that both shipper and 3PL respondents feel that significant last-yard business opportunities lie ahead for providers of outsourced logistics services.



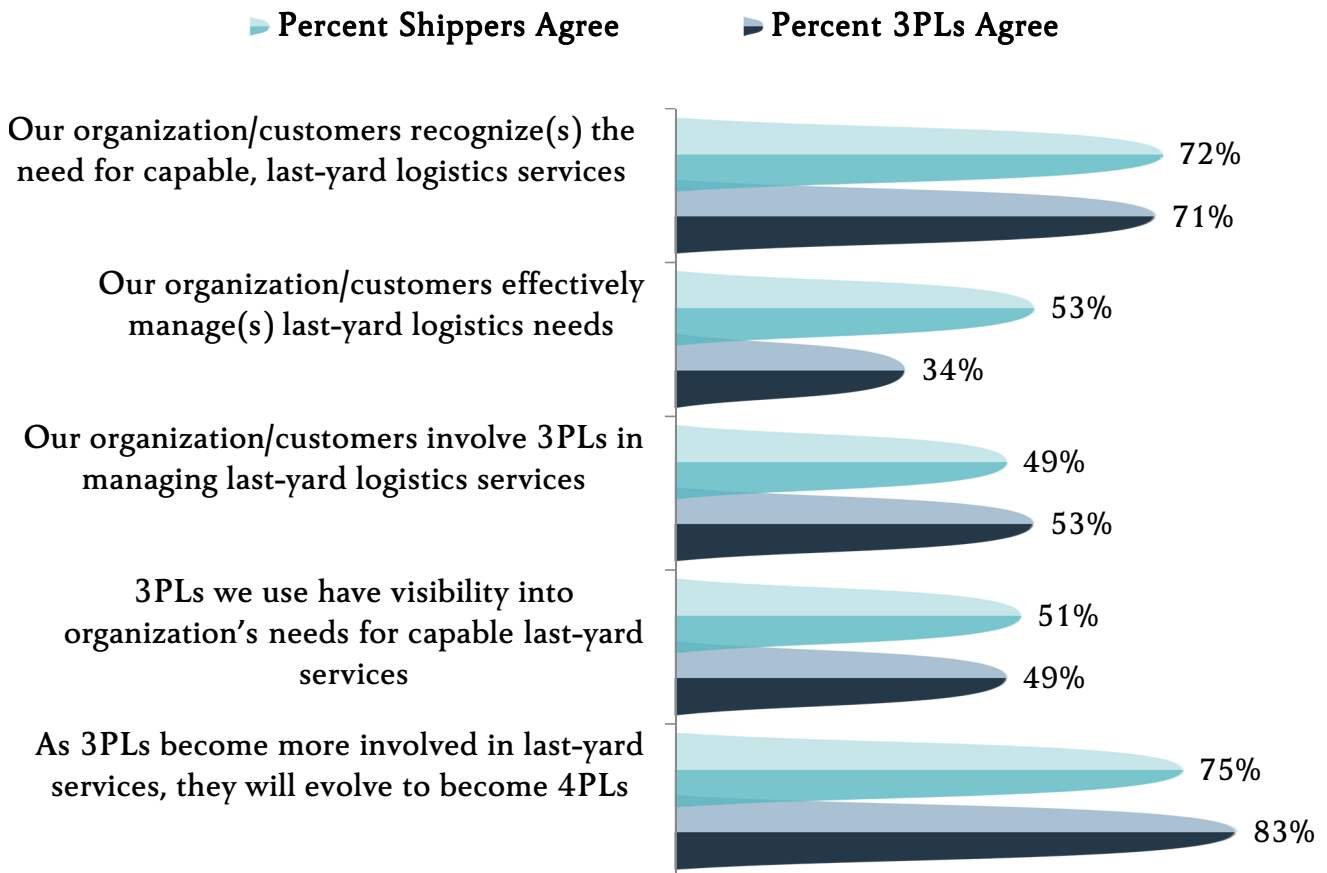
In addition to addressing various topics in the annual survey of users and providers of 3PL services, this year's *Annual 3PL Study* also explores some of the basic concepts and details pertaining to last-yard logistics as an area of opportunity for collaboration. Key results presented herein are based on a global survey of 436 respondents, 46 percent of which are self-identified as shippers, 38 percent as 3PLs (which may include some providers such as 4PLs, less-than-truckload carriers, parcel carriers, etc.), and 16 percent as other supply chain participants. Shipper and 3PL respondent organizations represent a wide range of sales revenue expectations for 2018. Of the current users of 3PL services, 67 percent are from North America, 13 percent from Asia-Pacific, and 9 percent from Europe.

Awareness and Involvement of 3PLs in Last-Yard Logistics

Figure 5 highlights some of the results of fundamental questions to learn more about shipper and 3PL perspectives on the last-yard logistics. Overall, 77 percent of shippers felt that last-yard logistics services will play a critical role in how 3PLs differentiate and add value for their customers. A slightly higher number of shippers (87%) felt that 3PLs can create a source of competitive advantage by extending their reach and fulfillment services beyond the receiving dock. Not surprisingly, 96 percent of 3PL respondents agreed with this latter comment. It seems to be clear that both types of respondents feel that significant last-yard business opportunities lie ahead for providers of outsourced logistics services.

Figure 5: Perspectives on Last-Yard Logistics Services

Please indicate whether you agree or disagree with the following statements



Specific key findings are as follows:



The need for capable, last-yard logistics services is widely recognized.

Seventy-two percent of shippers and 71 percent of 3PL respondents agreed that shippers/customers recognize the need for capable, last-yard logistics services. These findings are interesting in that they support the idea that both types of respondents are aware of the need for these types of services. Also interesting is that shippers and 3PLs generally agree on this point.



There is discernable room for improvement in last-yard logistics management.

Just over half of the shipper respondents (53%) feel that they effectively manage last-yard logistics needs, while only 34 percent of 3PL respondents agree that their customers effectively manage these needs. Approximately half of the shipper respondents and just over half of the 3PL respondents indicated that 3PLs were involved in managing last-yard logistics services. A pertinent question here is the extent to which 3PLs are meaningfully involved at present in helping to manage shippers' last-yard activities.



Visibility into customer's last-yard logistics needs that many 3PLs have render them to be in a good position to contribute helpful ideas for improvement.

Approximately half of shippers (51%) and 3PLs (49%) agree that 3PLs have visibility into customers' needs for last-yard logistics services. This suggests that given opportunities to make last-yard logistics suggestions for customers, 3PLs may have sufficient knowledge of customers' internal operations to contribute helpful ideas. One industry participant at the workshop held in San Mateo, California, said, "it is very important to manage [customers'] expectations, but also to adjust [our operations] to meet those needs better."



3PLs that expand into last-yard logistics services could evolve to become 4PLs.

Seventy-five percent of shippers and 83 percent of customers agree that as 3PLs become more involved in last-yard logistics services, they will evolve to become 4PLs. This is a logical step forward for providers of outsourced logistics services that are focused on expanding the scope of services in order to create additional value for their customers and consumers.

Last-Yard Logistics Issues

Listed in Figure 6 are several last-yard logistics issues that may occur at delivery or drop-off locations, and which may be of concern to shippers and receivers. Respondents were asked to check all issues that apply, and it is apparent that each of those listed are of moderate or serious concern.

The survey results show that among the most frequently cited issues were delayed, damaged, misplaced and lost deliveries. These are typical concerns for any fulfillment or delivery process. Others included inefficient package receiving and processing, package storage capacity constraints, and lack of capability to accommodate special shipments (e.g. security, perishability, size of shipment, special handling needs, etc.). These last three examples specifically pertain to operational capability and effectiveness at delivery or drop-off locations.

Figure 6: Potential Last Yard Logistics Issues



To the extent that 3PLs have responsibility for *last-mile logistics services*, they should be well-positioned to provide solutions to some of these problems that currently diminish the effectiveness of *last-yard capabilities*. Obvious solutions range from having 3PLs and customers collaborate to improve hand-offs and improve the capabilities of delivery or

drop-off locations to allowing 3PLs to take responsibility for actually managing these operations.

Implementation Priorities within Last-Yard Logistics

Figure 7 depicts top-ten value-added last-yard logistics services for which shippers would consider involving 3PLs.

Figure 7: Top Ten Value-Added Last Yard Logistics Services

For which of the following value-added last-yard logistics services would you consider use of a 3PL? (Check all that apply.)



These survey results suggest that shippers have a relatively positive reaction to using 3PL capabilities for a number of last-yard logistics services among a list of 16 services asked. In more general terms, the examples of last-yard services included in Figure 7 relate to a

number of key requirements that pertain to the availability of capable last-yard logistics services, including the followings:

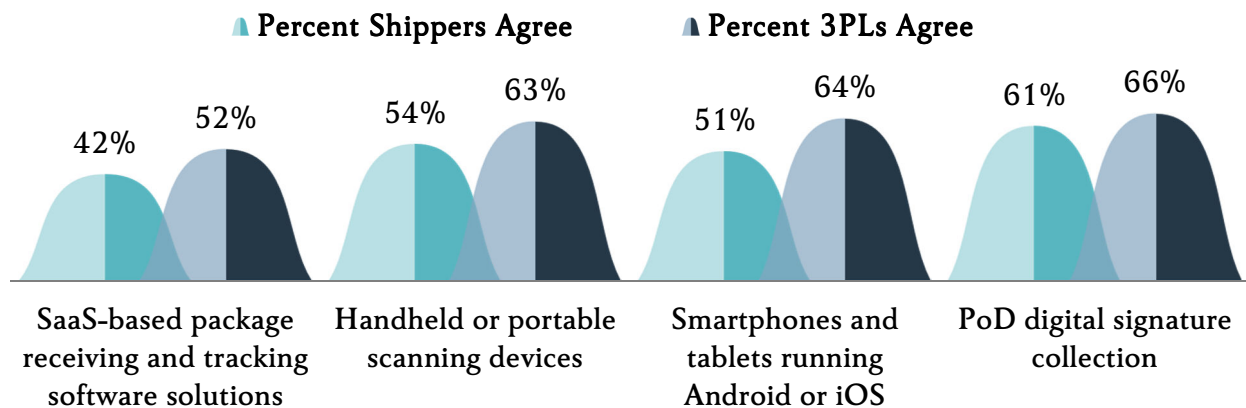
- ▣ Accurate shipment documentation
- ▣ Light assembly, kitting and returns management
- ▣ Value-added logistics services
- ▣ Effective management of receiving operations
- ▣ Moving items to the point of use
- ▣ Separating/segmenting product
- ▣ Technical support (e.g. appliance installation, medical device demos, etc.)
- ▣ Marketing and promotional services

Receiving and Tracking Capabilities in Last-Yard Logistics

Shipment receiving and tracking systems are increasingly observed to be cost-effective in terms of streamlining and automating last-yard logistics. Figure 8 highlights several resources and capabilities that were felt by shippers and 3PLs to be among the most likely to be involved.

Figure 8: Opportunities for Receiving and Tracking Systems in Last-Yard Logistics

Of the automation systems, tools, and functionalities listed below, please indicate which represent likely opportunities for your organization to become involved. (Check all that apply.)





SaaS-based package receiving and tracking software solutions. The survey results show that 42 percent of shippers and 52 percent of 3PLs indicated these capabilities would be very helpful to creating capable last-yard logistics services.



Handheld or portable scanning devices. This survey result speaks to the importance of capturing data related to incoming and outgoing shipments to facilitate downstream or upstream activities related to last-yard services.



Smartphones and tablets running Android or iOS. Conveniently available, these capabilities would provide real-time information regarding last-yard shipments, and also allow users to more effectively manage and make needed changes to last-yard services.



Point-of-delivery digital signature collection. This survey result is consistent with the overall priority on automating as much of the last-yard process as possible in order to eliminate the need for paperwork to document and validate completion of key steps in the process.

Other key areas of opportunity, not shown in the figure include: use of wireless barcode-label printers; automatic electronic notifications (typically through use of smartphones and tablets); and automated internal delivery routings. Interested readers are referred to Appendix 2 for further information on automated package center system components.

Emerging Self-Serve Model in Last-Yard Logistics

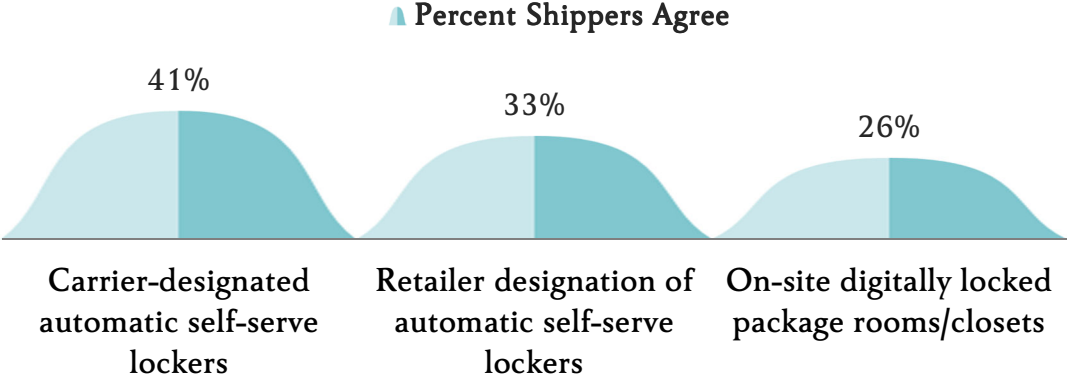
The “self-serve” alternative is increasingly receiving consideration as an effective solution for last-yard logistics. As a practical matter, this model eliminates staff intervention in the conduct of last-yard activities and relies instead on some form of locker or central location where shipments may be picked up by recipients. This advantage, however, takes away the opportunity for the shippers (e.g. e-merchants, brand owners) or delivery service providers to promote “customer experiences” at this touch point of last-yard delivery. Also, this model may not be easily scalable and could become a bottleneck as package volume

increases. In short, in order to be advantageous, companies need to address scalability and take into consideration the “customer experience” (e.g. customer needs and unique attributes of the shipments).

The survey question related to the “self-serve” model focused on a number of alternatives (see Appendix 1 for varieties of self-serve model) and assessed the likelihood that shippers might engage in partnerships (with 3PLs, for example) to create such capabilities. Figure 9 shows top three self-serve last-yard logistics alternatives considered by shippers.

Figure 9: Self-Serve Model in Last-Yard Logistics

Please indicate whether your organization is likely to provide or engage in partnerships to provide the listed varieties of self-serve model. (Check all that apply.)

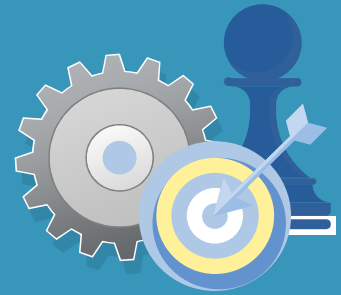


Specifically, the most popular of these ideas was that of “carrier-designated auto self-serve lockers,” such as UPS Access Point and USPS gopost, which was preferred by 41 percent of shippers. Others that seemed to spark interest among shipper respondents included: the retailer designation of automatic self-serve lockers, such as Amazon Pick-Up Points (Amazon Lockers), eBay, and Zalando (33%), and on-site digitally locked package rooms/closets (26%), such as Luxer Room, Butterfly MX, and Package Concierge Room.

It should be noted that in addition to the top three alternatives, there are various other self-serve varieties to allow access to shipments by recipients without the need for staff intervention. A smart carrier-agnostic parcel locker is one such alternative that has created a new, emerging sector of 3PL providers specializing in locker systems (Boyd 2016) and even attract the giant e-retailer, Amazon. This solution has two advantageous characteristics: “smart” and “carrier agnostic,” meaning that the lockers accept every package

from all carriers, unlike the Amazon lockers or the USPS gopost that only accept their own (Devon 2014). An increasing interest in this service can be observed among apartment firms and universities that are turning to these providers to provide a solution for automating package handling (Haughey 2014). Appendix 3 discusses key players in this new last-yard logistics sector, deployment challenges, and potential benefits for the last-yard logistics triads (sellers, recipients, and 3PLs).

CONCLUSIONS AND KEYTAKEAWAYS



Although the term *last yard* may be viewed as a logical extension of last-mile responsibilities, the essence of the concept is the critical need to manage the provision of capable supply chain services through to the point where the product or shipment is actually used and customer value is created. That is, supply chains do not end at the receiving dock or the central point where shipments are delivered but at the point of use where the intended value is actually created. Thus, the focus on last-yard capabilities is 100 percent consistent with the idea of structuring supply chains to create maximum value for its customers and consumers.

One of the most important perspectives from this special topic is to recognize the need for supply chains to focus on creating value all the way through to the ultimate recipient, user, or consumer.



Moreover, the concept of the last-yard logistics is also a reminder of the complexity of supply chains, and the need for supply chain participants, including 3PLs and their customers, to work together to identify and implement appropriate solutions. The good news is that based on the results of this exploratory research into the topic of last-yard logistics, both shippers and 3PLs agree that there are ways to work together in the interest of creating value for the ultimate recipients of products and shipments. Both recognize the importance of last-yard logistics services and are aware of the benefits that may arise from the capable execution of last-yard services, and many of the challenges and issues that must be recognized and understood, and then mitigated or eliminated.

Five Key Takeaways



Getting to know the concept

The last yard refers to what happens to a shipment once it is delivered to a customer, and then how it is routed within the customer organization to the specific location where it may be needed or used. The concept applies universally to both B2B and B2C and the true measure of success is how well incoming shipments or packages make their way to recipients who actually will use or benefit from receiving what has been delivered.



What's in the name

The concept of last yard may be thought of as an extension of the last-mile concept or perhaps a step or process beyond the conclusion of last mile. While either definition should be fine, the important point is that the capable execution of last-mile and last-yard responsibilities is essential to the creation of value for the customer and overall success for the supply chain.



Growing interest driven by a number of key trends

A number of key trends are responsible for significant interest in creating new and innovative last-yard capabilities. Of greatest consequence are changing business and consumer buying practices, declining use of physical mail and rising package volumes, as well as the enhanced value, criticality and uniqueness of many products being shipped today. Also, it has become apparent that traditional resources for managing last-yard services such as mailrooms, receiving departments, etc., are in need of improvement and modernization.



Shared perspectives

Overall, both shippers and 3PLs recognize the need for capable last-yard logistics services. Both types of survey respondents have a measurable level of confidence that there is a role for 3PLs to collaborate with their customers to develop and benefit from such capabilities.



Don't forget technology enablers

There will be significant needs for capable technologies to complement the development and successful execution of last-yard services. Included are shipment receiving and tracking software solutions, handheld or portable scanning devices, the use of smartphones and tablets, and “self-serve” alternatives that eliminate the need for staff intervention to facilitate the handoffs of shipments and products from 3PLs to customers, and then to intended recipients who ultimately will benefit from timely fulfillment of their needs.

APPENDICES



Appendix 1: Alternative Last-Yard Delivery Models

Last-yard logistics strategies can be categorized into two main models—*hand-delivery* model and *self-serve* model—each of which consists of a range of solutions that vary in technological sophistications and investment. In the essence:

- **Hand-delivery model** is characterized by staff intervention in the process of carriers dropping off packages and recipients picking them up. This model can be in the form of basic or automated mail and package centers.
- **Self-serve model** is characterized by elimination of staff intervention in the process of carriers dropping off packages and the need for mailroom personnel to physically hand a package to recipients. This model can be in the forms of *parcel lockers* or *package closets*.

Hand-Delivery Model



Basic Mail and Package Center

Basic mail and package center takes the form of a traditional mailroom, staffed with personnel to retrieve and manage packages for recipients. It is a dedicated, secure space for delivered packages to be stored until recipients can pick them up (or, in some cases, have them delivered directly to their units) (Malone 2017). Solutions implemented include the followings:

- **Create package rooms.** Some organizations that do not currently have package rooms are either constructing a package room, or converting/repurposing janitorial closets, basements, and even gyms into a package room (Bhattarai 2017; Kaufman 2015).

- **Expand and/or retrofit existing mailroom.** Some organizations that already have package rooms are expanding the space and/or retrofitting existing mailroom to make them more efficient (Kaufman 2015). Example approaches are:
 - **Add shelves.** This approach involves renovating the existing mailroom to add shelving and storage space for packages (Bhattarai 2017). This approach works well when building a new room just for package delivery was not needed (e.g. relatively small volume profile), nor was it physically possible because of space concerns (Bergeron III 2016). For example, a 6x10 room with shelves will work well for a 240-unit property that receives approximately 15 packages per day. A notable example is East Carolina University in Greenville, NC. It is one of the first colleges to remove dorm mailboxes entirely and turn that extra space into study lounges for students and made more room for packages by reconfiguring storage space and adding shelving (Kuta 2015).
 - **Add refrigerated rooms or lockers.** Given the proliferation of perishable deliveries, some buildings are starting to buy multiple refrigerators or incorporating refrigerated lockers in package rooms to keep them from spoiling until the recipients can come to claim them (Kaufman 2015; Malone 2017).
 - **Use barcoded shelving units on wheels.** Adopting this approach, companies replace old metal immovable shelves with shelving units on wheels. Those units have barcodes showing where particular packages are being held until recipients come to pick them up, making it easier for the staff to retrieve and serve the recipients (Daninhirsch 2017b).



Automated Mail and Package Center

Specialized track-and-trace applications have been in regular usage for the most efficient couriers for a few years. The efficacy of these applications is not exclusive to delivery companies, but can be used at front desk, mailroom, and loading dock to increase efficiency, reduce the margin of error, and create transparency and accountability (Fink 2015; Gattoni 2016; Hazel 2017a; Lewenberg 2015; Moreno 2016; Package Zen 2016). Typical automated mail and package center tools and processes are as follows:

1

Automated receiving and internal tracking system. When the packages come in, portable scanning devices read carrier package barcodes and digitally log each incoming delivery, creating a digital trail at every step from arrival in the mailroom to final delivery. The automated process helps to ensure that packages are recorded, sorted and entered into the delivery system without delay, while reducing the potential for human error (Fink 2015; Gattoni 2016; Giles 2017; Hazel 2017a; Hicks 2017; Lewenberg 2015; Moreno 2016). Since packages are logged quickly and *individually* as they arrive, it also eliminates the issue that *single signature acknowledgment* creates in traditional manual processes (Weir 2016).

2

Automatic electronic notification. Most incoming tracking systems can be configured to automatically email package notifications to alert recipients that their packages have arrived in the mail center (Lewenberg 2015). With this functionality, after being digitally logged in, the packages are automatically matched to the person or department to where they are addressed, and an automated email function alerts the recipients that their packages have arrived in the mail center or central receiving locations (Hazel 2017a; Lewenberg 2015; Moreno 2016). Most system also sends automatic reminder notifications to recipients who fail to promptly pickup their package until the delivery is picked up (Bergeron III 2015; *Facility Executive* 2017). Automatic electronic notification and reminder solves the “pre-call” problems where recipients call to check if a package has arrived, and helps packages leave the pick-up point more quickly, freeing up space in package rooms (Devon 2014; Kaufman 2015; Package Concierge 2017b).

3

Automated internal delivery routing. Some software such as Pitney Bowes SendSuite® Tracking also has functionality that defines *delivery routes* based on established routing rules, designed to make internal deliveries automatically, record status of delivery to defined end users (successful, attempted, refused, picked up), and send email alert to inform a recipient that their packages are en-route (Pitney Bowes 2016). One example is a hospital with central receiving that dispatches up to eight drivers to a range of locations. Their mobile devices with cellular connectivity allows them to re-route drivers if a

destination changes once the truck is dispatched. Cellular connectivity is also very useful for interoffice parcel tracking (Hazel 2017b).

4

Proof-of-delivery digital signature. Upon delivery, the recipient signs the portable handheld device that captures proof-of-delivery electronic signatures and remotely synchronizing records. Or, when the recipients pick up their packages at the mail and package center, they sign digital signature pad to confirm package receipt. If touchscreen tablet or smartphone are used, recipient can just use their finger and write on the tablet (DiMaria 2016; Hazel 2017b; Lewenberg 2015; Moreno 2016; Schofield 2014).

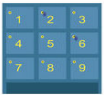
Automation is cost-effective and allows for near-immediate implementation (Package Concierge 2017). Key benefits of automation technology applications are as follows:

- **Improve productivity and faster, paperless process.** Automated processes improve productivity levels, eliminating manual parcel recording and significantly reduce package processing time from receiving to final pick up or internal delivery (DiMaria 2016; Lewenberg 2015). According to Package Zen, in the traditional manual processes, time per item is up to 4 minutes (6½ hours per 100 items) versus in the automated processes, time per item is under 10 seconds (16 minutes per 100 items) (Package Zen 2016).
- **Reduce human error.** There are no manual logbooks, no creating Excel files, and, therefore, no manual data entry, which help to reduce the occurrences of human error (DiMaria 2016; Hazel 2017b).
- **Improve process visibility and accountability.** Since a digital history of where packages move, or chain of custody, is automatically recorded, mailroom or receiving staff can easily look up tracking information by name, tracking number, date, or any other specs (Hazel 2017b). Stakeholders can track the collection of data from pickup to delivery, decreasing the probability of losing packages, make it easier to locate misplaced or lost items, and provide precise accountability of items from sender to receiver, thus relieving the central receiving point of liability (Bergeron III 2015; DiMaria 2016; Giles 2017; Hicks 2017; Novitex 2017b).

- **Shareable and scalable digital data.** Since all data is electronic, it is sharable, scalable, and easily searchable in a digital environment (Hazel 2017b), thus enabling quicker communication at all stages of shipment and delivery. Data can also be posted on a secure website where they can be accessed anytime, from anywhere, by any authorized user (Bohjalian 2016; Novitex 2016; Weir 2016).

The various benefits notwithstanding, it is conceded that automation technology application in the mailroom or central receiving point settings solves *some but not all* of the problems associated with last-yard logistics of package delivery. The automated processes still require that staff involvement in storing the package in a safe place and later retrieving it. Also, they do not allow for round-the-clock package retrieval and delivery (Derven 2014, 2016; Package Concierge 2017b).

Self-Serve Models



Oversized Mailbox or “Shared” Parcel Lockers

An intuitive locker-type system that enables carriers to drop off packages and recipients to pick them up without staff intervention is another effective solution that is being tested in some markets (Derven 2016; Maher 2017). The key characteristic is “*shared*” feature in that the parcel lockers are not individually assigned to specific recipients. These solutions can be *non-electronic* or *basic electronic* systems and can be *on-site* or *off-site* systems.

- **On-site lockers.** If space allows, organizations install an oversized, USPS approved mailbox either indoor or outdoor that accommodate packages (Bergeron III 2015; Maher 2017). A third-party parcel locker can also be used to accept non-USPS deliveries. For example, DHL have its own *residence-based* locker system called the Packstation as shown below (Lunden 2017).



Source: Trezek (2017)

- Traditional, non-electronic lockers. Oversized USPS approved mailbox typically falls in this scenario. USPS postmaster drops off packages in the shared locker and places a key to the locker in a recipient's individual mailbox along with a notification slip that there is a package for pick up. The recipient picking up mails from his/her mailbox can use the key found in the mailbox to access the shared parcel locker and retrieve the package. Lock mechanism is designed so that the key remains in the lock and can only be removed by USPS postmaster for next assigned recipients.
- Basic electronic system. Basic electronic lockers involve similar processes as the traditional counterparts. However, instead of using paper notification slips and traditional keys, the notification is *manually* sent via email or text message containing a code that the recipient can use to access the locker on a 24/7 basis (Derven 2016).
- **Off-site locker.** *Carrier-designated* automatic self-serve station such as UPS Access Point and USPS gopost, and *retailer-designated* automatic self-serve stations such as Amazon Pick-Up Points (Amazon Lockers), eBay, Zalando and others are also emerging as solutions (Kulikowski 2014; Lunden 2017; NMHC 2016; Palladino 2017; Trezek 2017).
- Example: USPS gopost (USPS deliveries only). The USPS is currently in a "test phase" with its *gopost parcel locker system* that is installed near post offices in grocery stores, pharmacies, transportation hubs, shopping centers. Launched in 2012, customers can send and receive packages through the USPS by using the locker

system. The Postal Service currently has 18 locations between the metro areas of New York City and Washington, DC, according to a spokeswoman (Kulikowski 2014).

- › Example: Amazon Locker (Amazon deliveries only). Amazon Lockers are self-service parcel delivery lockers that are located usually located in public spaces such as drug stores, convenience stores and parking garages to make delivering and picking up Amazon parcels more efficient. Amazon has been quietly installing its Amazon Locker Service in densely populated areas, like New York City, for deliveries of Amazon purchases, allowing its customers to designate an alternative pick-up location from the company's network so they can avoid missing a delivery and can pick up the packages at their convenience. The system is restricted to Amazon deliveries only. Many locker locations are open 24 hours, but others are not (Kulikowski 2014; Lunden 2017; NMHC 2016; Palladino 2017).



Smart Carrier-agnostic Shared Parcel Lockers

Two key characteristics of this category that distinguished from oversized mailbox or shared parcel locker are “*smart*” and “*carrier agnostic*.” An increasing number of apartment firms and universities are turning to these smart carrier-agnostic parcel locker providers to provide a solution for automating package handling (Haughey 2014).

- **Smart technology.** Electronic/digital smart locker solutions with *built-in sensors* and *Internet connections*, also sometimes referred to as intelligent locker, that enable delivery and pickup to be handled online are attracting a lot of attention (Blackwell 2014). These smart locker systems are available with varying degrees of sophistication (Maher 2017). When *tracking software technology* is combined with the smart locker system, it facilitates receipt of the package and enables an interface to the locker. So, when the package is deposited, data from the locker generates an email to the recipient, and the entire process from receiving to final delivery is automated; while reducing the number of times the package changes hands, resulting in a shorter, more accurate chain of custody (Bohjalian 2016; Giles 2017; Little 2017; McKone 2017). More advanced locker systems even come with *expiration date capabilities*, meaning if a package goes unclaimed it may be removed from the locker and handled appropriately by mailroom

personnel (Bohjalian 2017). *Temperature-controlled* lockers for the delivery of perishables are also available and growing in demand (Boyd 2016).

- **Carrier agnostic (accept all delivery carriers).** These smart lockers are carrier agnostic, meaning that the lockers accept every package from all carriers, unlike the Amazon lockers or the USPS gopost (Devon 2014).



Electronic Package Closet / Open Room

Digital/electronic closets or open rooms come in *software-driven* and *smart* system versions, the latter is a more technologically savvy version of the former. It is an affordable alternative to smart package lockers (Castenson 2017; Devon 2015; Dizik 2015), as well as a feasible solution for organizations in which building a new room just for package delivery is not needed (e.g. volume not high enough) or is not physically possible because of space concerns (Bergeron III 2016). The solution concept is similar to that of smart lockers that allow carriers to access and places packages on shelves in the open room/closet. Recipients receive a text and/or email with a one-time code that is used to access the package room/closet. Their signature is also required for entry into the package room. Smart system has camera system so that camera footage of those retrieving packages is available to assist with accountability (Bergeron III 2016; Package Concierge 2017b). The same concept is applied in other formats such as self-service, electronic locked *cabinets* or *drawers* (Gattoni 2016; Lowe's ProServices n.d.). Examples of providers and functionalities are as follows:

- **Luxer Room.** The Luxer Room from Luxer One is an affordable alternative to package lockers. The Luxer Room is a *locked closet* where Luxer One installs a control pad. Package carriers drop off all the packages using a code to enter the room and recipients are texted or emailed a one-time code to access the room when a package arrives. The control pad captures the one-time code, a signature, and a picture to show proof of pick-up (Devon 2015).
- **Butterfly MX.** Organizations using Butterfly MX as a package solution first assign a room to which packages are to be delivered. Whoever delivers the package is assigned a PIN to identify themselves and be allowed in to put the package on a shelf. Video

cameras keep the room and packages secure, in addition to records that track who used what PIN and when they entered. Recipients can scan themselves into the room at their convenience (Castenson 2017).

- **Package Concierge Room.** The Package Room provides a designated, secure space for oversized packages that are too large to fit into the lockers. A sleek surface-mounted kiosk that includes a 7-inch touch screen, barcode reader, still camera, and effortless technology is used to control the Package Room. Refrigerated capabilities are also available (Package Concierge 2017c).

Summarily, key pros and cons of this emerging solutions are the followings:⁴

Pros

- **More affordable than smart lockers and require less space.** For example, it costs JVM Realty Corporation \$7,500 and included installation, software, and code pad for one of its properties, which is more affordable than smart lockers that cost between \$10,000 and \$20,000 per locker.
- **Convenience and efficiency.** It reduces onsite staff involvement and creates efficiency for package carriers, allowing for easy drop-off or retrieval abilities. Recipients have round-the-clock access to self-retrieve and return their packages.
- **More storage capacity.** With an *open room* instead of lockers, there is the potential to store a higher volume of items.
- **Adaptable.** The system can be adapted later to handle other types of deliveries, such as adding a pole on which to hang dry cleaning or a refrigerator for temperature-sensitive packages.

Cons

- **Lower privacy and security than lockers.** Privacy and security are not as thorough as smart lockers since all packages are placed on shelves in one room instead of each one being in individually locked locker compartments. However, technology innovations are moving towards greater security.

⁴ Discerned from: Bergeron III (2016), Castenson (2017), Devon (2015), Package Concierge (2017b, 2017c)

Appendix 2: Automated Mail and Package Center System Components

Basic functionalities of automated mail and package center system are automated receiving, internal tracking, and pick up notification (Schofield 2014). In general, the system key elements combine software program loaded onto a PC with integrated reporting and tracking into email notifications and mobile-friendly tools to offer further flexibility for mail and package center employees (Hicks 2017).

Software Solutions

Software solutions can be deployed in three ways, including the followings (Giles 2017; Hazel 2017b):

- (1) **On-premise solution** where the software resides on the organization's servers on premise
- (2) **Hosted solution** where it is hosted remotely by an outside service
- (3) **Software as a service (SaaS)-based** where all applications and databases reside in the cloud and organizations pay for services as a subscription based on functionality

Comparatively, the on-premise option can be appealing to financial and healthcare organizations that want to manage data privacy themselves. The hosted choice saves an organization the investment in additional resources, as the hosting vendor provides all IT support and security. The cloud-based SaaS option is the easiest to deploy and the most economical in most cases. The SaaS provider takes care of upgrading them and supporting users, so the organization doesn't need any additional IT staff involved. In addition, cloud-based SaaS solutions let users readily access applications and data from the mail and package center, on the loading dock, or at any location where they have a mobile device and wireless or cellular service (Hazel 2017b).

Mobile-Friendly Tools

Commonly used tools are as follows (Hazel 2017b; Lewenberg 2015; Moreno 2016):

- ▣ Handheld scanners and signature pads
- ▣ Wireless scanners and belt printers
- ▣ Smartphones and tablets running Android or iOS operating systems.

However, organizations can extend functionality beyond the basics (automated receiving, internal tracking, and pick up notification) by upgrading to versions that enable custom fields, routing priorities, email receipt notifications, photographs, and personal branding (Schofield 2014). Examples of additional functionalities and their benefits are highlighted below:

- **Digital pictures of damaged items.** Many tracking systems can allow package center or receiving dock staff to upload digital pictures of damaged or suspicious packages. These pictures can be emailed to the final recipient to let them know their package came in damaged or to see if they were expecting an item that looks questionable. This functionality helps the organizations to avoid being held responsible for items that come in damaged (Lewenberg 2015).
- **Barcode printing.** The system can produce a barcode label for each package to be used for parcel organization (e.g. assigning storage location number) within the package center or warehouse if required, helping the staff to easily locate and quickly retrieve the appropriate packages (Hazel 2017a; Lewenberg 2015; Moreno 2016; Pitney Bowes. n.d.).
- **PO number tracking capability.** Increasing package volumes tend to correlate to an increase in purchase orders. Utilizing the PO line item receiving function in the tracking system not only saves time, but also closes the accountability gap completely. This functionality provides a single user interface for receiving, logging and closing purchase orders when integrated with the company purchasing system (Little 2017).

Appendix 3: Smart Carrier-Agnostic Parcel Locker Solutions

Key Players

Key players in smart carrier-agnostic parcel locker solutions market can be categorized into two groups, namely 3PLs and retailers.

Third-Party Providers Specialized in Locker System

- **CleverBox by Cleveron.** CleverBox is distributed and installed exclusively in North America by Bell and Howell, which also provides service and support, remote monitoring, and preventative maintenance for all Cleveron's smart-locker systems nationwide. With this system, mail and package center employees scan incoming packages into the system, and each package gets assigned to a specific locker based on size. The employee then takes the package to the CleverBox terminal and scans it in. The specified locker door automatically opens, the package is placed inside, and the employee shuts the door. Upon door closure, the system immediately notifies recipients via a text message with a unique code that their package is ready for pickup. The recipients go to the mailroom when it's convenient for them, scan their phone or type in the code, and the assigned locker opens with their package inside. Once the door is closed after pick up, the system updates the mail center database in real time that the package has been retrieved. The recipients also automatically receive an emailed receipt stating that their package was picked up (Bell and Howell 2017).
- **Luxer One.** Luxer One produces package lockers with an oversized locker option for extra-large packages (Bergeron III 2015). The lockers are operated by mail carriers and recipients, so there is no need for on-site staff to supervise or facilitate package delivery. Mail carriers simply deposit the package into a locker, enter their unique access code, and the system notifies the recipient and provides them with an individual access code (Bulman 2016). *Available locker notification* feature for carriers, if requested, can alert carriers' driver to the available number of lockers. If all the lockers are full, Luxer One can provide the driver or mailroom management with an update on available lockers through scheduled emails or drivers can text its automated system for a real-time report of the open locker count (Luxer One n.d.). Luxer One uses the individual package PINs. The system is equipped with security cameras and can accept signatures for packages

that need one. Luxer One also acknowledges the seven-day return period, meaning packages are made available for return if not picked up within seven days (Devon 2014).

- **Package Concierge.** Package Concierge's digital locker system addresses the challenges of package management by placing lockers in apartment complexes and university student housing. Deliveries via FedEx, UPS, Staples, the US Postal Service and others are accepted via the system (Kulikowski 2014). The lockers which come equipped with built-in cameras and digital touch screens notify residents when they have a package and give them a one-time pin code to access it (Bhattarai 2017). Package Concierge uses both a key fob and PIN code for access, but properties can choose if they want to use either one or both for added security. It also uses cameras for added security and packages are made available for return if not picked up within seven days (Devon 2014).
- **Parcel Pending.** Parcel Pending, package locker company, uses PIN codes individual to each package, which are emailed or texted to the recipient with a notification. The individual package PINs aid package tracking. The systems are also equipped with security cameras and allow for the seven-day return period (Devon 2014). *Refrigerated package lockers* are one important solution that Parcel Pending offers to protect temperature-sensitive packages. These types of electronic smart lockers allow deliveries such as food, flowers, medication and other perishables to not only remain chilled, but also remain secure until shoppers pick up their packages (Parcel Pending 2017).

Retailer-Branded Lockers

Internet-based retail companies are also looking with new-found interest in this area (NMHC 2016). Notable examples are:

- **Jet.com.** Jet.com, which is owned by Walmart, recently installed smart-lock technology in 1,000 apartment buildings in New York to allow delivery workers access to buildings when residents are not home (Bhattarai 2017).
- **Amazon Hubs.** Amazon quietly unveiled a new service called *The Hub*, lockers designed to be installed in *multi-tenant dwellings* so that residents can receive bulky packages and pick them up at flexible times (Bhattarai 2017). The e-commerce giant has already

begun installing locker systems for packages to serve more than 850,000 rental units from coast to coast, according to the *Wall Street Journal*. The Hubs come in indoor and outdoor versions, depending on the layout of the apartment structure, and the physical unit starts at 6 feet wide and includes over 20 compartments (Palladino 2017). The *in-residence locker* idea shifts the burden of dealing with all those packages from building management staffs to tenants. Amazon Hub will be a fully automated set-up that residents can access 24 hours a day. The Hubs are opened by way of a digital keypad designed for private residences. Tenants will be alerted to arriving packages via notifications on their phone. They can then use a one-time code to open up the locker and pick up their deliveries (Howard 2017; Lunden 2017). In 2016, for example, Amazon built a facility with 150 lockers on Purdue University's campus that will get packages to the school's 3,600 students (DiMaria 2016). Amazon Hubs underscore a bigger ambition that Amazon has to lock in a segment of the logistics and delivery chain that has largely been out of its hands: last-mile (and even more specifically last-feet) delivery. These efforts give Amazon more control over how packages arrive with customers and potentially cut down more of the costs of getting them there. The fact that Amazon is looking to provide the Hub not just for its own parcels but those of anyone also puts Amazon squarely into closer competition with erstwhile partners like FedEx, UPS and DHL (Howard 2017; Lunden 2017). Though for now it is installed mainly in multi-tenant dwellings, an online form to apply to get a Hub on the property also asks if the applicants are the owners of an apartment/condo, an office, or a house. Given the other options in the list, there may be some plans down the line to expand to other kinds of locations (Lunden 2017; Palladino 2017).

Deployment Challenges

Smart lockers ease the burdens associated with package handling and last-yard logistics, but they would require improvements to IT system connectivity and device standards (Barreiro 2017). In fact, smart locker systems raise some questions from industry executives about how many lockers and space are needed, who pays for the cost of installation and use, what levels of training are needed, and whether carriers will actually deliver to a locker (Bergeron III 2016; Castenson 2017; Haughey 2014; Package Concierge 2017a).

- IT system integration.** Finding smart package locker systems that can integrate with legacy management software is not always easy. For instance, the apartment industry’s major multifamily property management software providers have different processes for allowing third-party vendors to integrate (Bergeron III 2016).
- Costs.** The costs involved in installing a smart locker system are significant. Most units typically cost anywhere between \$10,000 and \$20,000 per locker (Maher 2017), and require ample space, wireless Internet access and electricity (Bhattarai 2017), plus a monthly fee for maintenance and tech support (Devon 2015). Specific examples⁵ are presented below.

Package Concierge	<p>Systems are available starting at \$20,000 for a 34-compartment system, which can be scaled up to a 102-compartment system for an incremental charge, since the main expense is in the kiosk technology. For a 100-unit property, Package Concierge recommends either a 34- or 54-compartment system, and for a 200-unit property, it recommends a 70- or 82-compartment system. There is an additional monthly service fee, which is quoted at \$2 per unit but is negotiable and covers 24/7 tech support and maintenance.</p>
Parcel Pending	<p>A 13-compartment base system costs \$6,980. Additional towers can be added to the base at \$2,180 each. The monthly service fee ranges from \$2.50 to \$5.50 depending on the number of compartments and tech support.</p>
Luxer One	<p>Parcel locker installations appear to cost between \$6,000 and \$20,000, plus service fees. For example, a 14-compartment base system costs \$6,900, and the 40-unit system costs about \$20,000. The monthly service fee is \$1.50 per compartment for comprehensive support including customer, software, and hardware.</p>
Amazon Hub	<p>The <i>Wall Street Journal</i> reports the installation of Amazon Hub lockers will cost between \$10,000 and \$20,000, which the <i>WSJ</i> said is roughly half the price other companies had charged for similar products.</p>

⁵ Sources: Devon (2014), Dizik (2015), Howard (2017), Lunden (2017), Sperance (2017)

- **Delivery carrier acceptance.** Before installing such devices, it's wise to check with package-delivery companies to be sure they are willing to deliver to them (Lowe's ProServices n.d.). Package Concierge founder and CEO Georgianna Oliver, for example, says her company is actively partnering with the US Postal Service and has key relationships within UPS to ensure the company has 100 percent *delivery carrier acceptance* at every Package Concierge installation (Haughey 2014).
- **Delivery personnel training.** Because the system is new, there are still some training issues to iron out (Castenson 2017). Not long ago, FedEx and UPS were responsible for most forms of package delivery. Today, there are even more carriers in the delivery race with the innovation of services like UberRush and Roadie. Training was a relatively simple task when there were only a few carriers to educate. Now it's becoming more challenging with the possibility of several different drivers arriving on a daily basis (Package Concierge 2017a).
 - **Large delivery companies.** Large delivery companies use the same drivers for the same routes each day, so once they're trained in the system they prefer it (Castenson 2017). Initially, package agents who were used to dropping off packages and quickly resuming their routes pushed back the smart locker system because parcels have to be sorted and placed in lockers. However, delivery personnel have since adjusted and packages come and go seamlessly without having to depend on onsite leasing staff for help (Blackwell 2014, 2016).
 - **Crowdsourced deliveries.** Crowdsourced deliveries mean different drivers work each day, and mail center staff might see a different driver every time a shipment is delivered. Guiding them to the package locker system and showing them how to operate it can become a repetitive task, thus it is best to have a streamlined training process in place (Castenson 2017; Package Concierge 2017a). Failing to provide training to a new delivery person who does not yet know the package locker system could result in the package likely be delivered somewhere other than the locker system (Luxer One 2015).
- **Space requirements.** There is also a problem of space. These smart locker systems are very large and most properties do not have the space to accommodate them in an older building. They are easier to accommodate as you build rather than to retrofit (Devon 2015).

- **Carriers / 3PLs: One-stop-and-drop last mile logistics.** Advanced smart locker system providers offer functionalities that enable one-stop-and-drop last mile logistics operations, reducing second delivery attempts, consolidating pick-up and delivery trips, and ensuring the security of all packages (Barreiro 2017; Parcel Pending n.d.).
 - › **Automated building and locker access.** Using unique codes, drivers have automated access to buildings as well access to the smart lockers, making deliveries quicker and more reliable. When a driver enters the code, the system will validate it and provide the driver with a delivery interface. The driver simply scans the package barcode using the built-in scanner; selects the recipient and required locker type (e.g. temperature controlled), size, and any required delivery services (e.g. signature); and then place the package in the assigned locker that opens. The tracking information is automatically updated when the package is scanned, so once the parcel is placed in the corresponding delivery box, the carrier's job is done. On average it takes a carrier about 10 to 15 seconds to deliver a package to smart lockers, compared to the 2 to 5 minutes it takes per package for an average delivery (Luxer One n.d.; Parcel Pending n.d.)
 - › **Proof of pickup with signature.** Smart locker providers can see who picked up every package through the locker surveillance system. The system logs every time the locker is accessed, by both drivers and recipients. The system can require a signature on every delivery or on just the ones specified by the shipper. When a recipient picks up his/her package, the system captures his/her signature and store the image, which the locker providers can post to the carrier Application Program Interface (API) (Luxer One n.d.).
- **Retailers.** The value for retailer-branded smart lockers like Amazon Hubs or Amazon Lockers is the ability to know with greater certainty that the delivery experience works as intended. Primarily, the smart lockers allow for a more flexible delivery window, address stolen package concerns, and enable ease of returns for e-retailers (Barreiro 2017; Bhattarai 2017; Feinberg 2018).

■ Mail and package centers

- **Simplified package-handling and pick up process.** Smart locker systems simplify processes and cut labor costs associated with handling packages (Bell and Howell 2017). They eliminate mail center staff's involvement in the cumbersome task of accepting, tracking, and distributing packages in the mail center (Blackwell 2016). In most case, the staff are only involved if a package is too large for the locker compartments (Devon 2014).
- **Improve customer satisfaction.** Smart locker systems enable mail centers to best meet recipient expectations (Bell and Howell 2017). Recipients have the convenience of picking up their packages 24 hours a day, giving them a peace of mind that they will not miss a delivery, have their items stolen, or miss picking up their packages before the mailroom closes (Bergeron III 2016; Blackwell 2016; Bohjalian 2017; Bulman 2016).
- **Security and accountability.** With smart/intelligent lockers, only the package recipient has the current code to the locker that contains his/her package which helps to keep the chain of custody controlled. Once the package is claimed, the locker resets with a new code, and the process can begin again. Other system's security measures that capture a signature, a photo, and a video for every transaction significantly raise the level of security and the level of accountability since locker system providers know who picked up every single package in their system, when they picked it up, and which locker they picked it up from (Bohjalian 2017; Bulman 2016).
- **"Share" benefits.** Because smart/intelligent lockers are not individually assigned, everyone in the organizations can have a safe, easily accessible place to pick up their packages, while easing the strain on mail center personnel at the same time (Bohjalian 2016, 2017). The system knows which compartment is empty and can randomly assign the locker as needed so that recipients can use a unique code to get the package (Blackwell 2014).
- **Mail data and metrics.** Gaining insights into workflows, peak pickup times, and more are essential for mailroom managers attempting to streamline and modernize their operations. Mail center managers can access analytics dashboard detailing operations throughout the day as well as built-in reports based on key performance indicators. Based on the real-time data, managers can also track deliveries, quickly and easily

assign tasks to employees to optimize performance, view the statuses of incoming service requests, and ensure the mail center is meeting all service level agreements (SLAs) (Bohjalian 2016; Little 2017; Novitex 2016).

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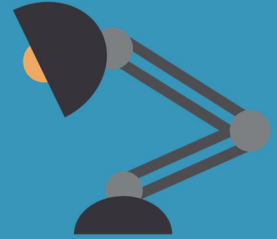
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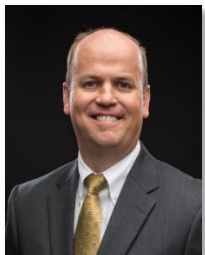
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