THE GLOBAL E-COMMERCE REVOLUTION

WHAT DOES ITS IMPACT ON LOGISTICS REAL ESTATE REALLY LOOK LIKE?

PROLOGIS.

SEPTEMBER 2016

The rise of e-commerce dominates retail headlines—however, what is its impact on logistics real estate? Where are we in the growth cycle? What is the impact on actual leases and developments? How do new e-fulfilment requirements change the shape and functionality of buildings? To address these questions, we analyzed the industry's growth, examined fulfilment strategies and studied e-commerce customers' latest leasing trends. The most notable themes include the following:

1	Still in early stages	Online shopping dates back more than two decades, and e-fulfilment has been a more visible share of the logistics industry for at least the last five years. However, supply chains are only now starting to modernize to keep up with dramatic volume growth. Currently, e-commerce comprises about 20 percent of new leasing, up from less than 5 percent five years ago. While it may seem like e-commerce is at the height of its growth cycle, it is still in the early stages of expansion.
2	Wide variety	Different e-commerce strategies and constant evolution drive a high variety of needs—spanning both new and older infill buildings, and there is no industry consensus on size or building features. Prologis has some 400 e-commerce customers occupying more than 50 million square feet (MSF) of logistics buildings. Across this portfolio, considerable variability exists in customer size, industry, geography and building requirements.
3	High intensity of use	Our research reveals online retailers need approximately 1.2 MSF per billion dollars of online sales on average, which is three times the distribution center space required for traditional brick-and-mortar retailers. We've identified four unique business characteristics of online order fulfilment, including extensive product variety, greater inventory levels, larger outbound shipping space requirements, and increased reverse logistics (process returns).
4	Location, location, flexibility	The old model of favoring tax-advantaged remote locations, sometimes with specialized facilities, is melting away as customers emphasize flexibility with requirements that are typically generic. Favored locations are adjacent to or within major population centers, driven by trends like faster delivery times, transportation cost and retailer scale. Competition for last-mile facilities has been particularly active, and we expect it to continue to grow.
5	Omni-channel experimentation	E-fulfilment models continue to evolve rapidly, as does the go-to-market strategy for retailers and their online offerings. Recently, brick-and-mortar retailers have expanded investments to execute "buy online and pick up in store" and "ship from store". It remains to be seen if these will be durable strategies as key challenges have yet to be overcome, such as addressing inventory tracking, unit economics or the scalability of these solutions. One thing, though, is clear: The flexibility to deliver for consumers across channels and whenever they want leads retailers to ask more of their supply chains.

What it means for investors: Industry demand will benefit as e-fulfilment expands. The recovery of occupancies and market rents occurred faster and in greater magnitude as a result. Looking forward, it's critical to recognize that e-fulfilment models remain fluid and continue to evolve. A more durable strategy seems likely to be the recent trend of favoring locations within and adjacent to major population centers.

What it means for customers: Growing e-commerce demand leads to increased competition for availabilities. Market vacancy rates have fallen to record-low levels in many markets. Forward-thinking businesses with thorough advance planning processes and the ability to act nimbly stand the best chance of meeting their real estate requirements at the best price and location.

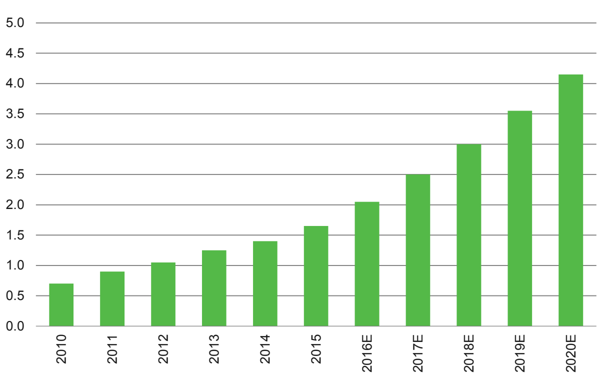
INTRODUCTION

This paper is organized into three main sections: (1) a discussion of industry growth around the world; (2) key findings from the latest trends of e-fulfilment; and (3) three themes poised to shape the next several years of e-commerce and logistics real estate.

1. A LOT OF GROWTH.

An explosion of online sales. Global online sales are poised to top $2.0 trillion in 2016, yet they account for just 8.6% of all retail sales. Even with such a small share, the industry seems to have achieved a critical mass. Global online sales were less than $1.0 trillion as recently as 2011, and they appear poised to surpass four times that level by the end of the decade, according to estimates from e-Marketer and Prologis Research. Market share is rising in lockstep; online sales will have risen from less than 5% in 2011 to a market share approaching 15% by the end of the decade. There are multiple catalysts for growth, including the emergence of Asia, cross border e-commerce, demographics (the growing spending power of millennials and their preference for online) and virtual reality (its ability to disrupt categories that once seemed impervious to competition from online).

Exhibit 1: E-Commerce Sales, Global
($, trillions)



Source: e-Marketer, Prologis Research

Logistics real estate is benefitting as e-commerce expands. Today, e-commerce represents approximately 20% of all new leasing, up from less than 5% five years ago. Growth is surfacing in multiple categories, from large dedicated facilities to smaller infill facilities and everything in between. In addition, logistics operations that serve both store distribution and e-fulfilment have become more visible as industry participants leverage their existing supply chain investments. These types of multi-use scenarios regularly transition toward dedicated e-fulfilment requirements as the requirement grows.

Prologis Research conducted a deep-dive review of supply chains. We first compared supply chain productivity between online fulfilment and brick-and-mortar distribution in 2014. Since then, data surrounding supply chains for e-fulfilment have only gotten better, both from financial filings and other industry sources. We assembled data covering more than 50 retailers, predominantly U.S.-based and amounting to more than $1.5 trillion in sales. Retailer categories included big-box, department stores, discounters and specialized retailers, and, of course, online only. The collective supply chain for these retailers is more than 800 MSF and 1,750 buildings.

Online retailers need three times the logistics real estate. Similar to traditional retail productivity metrics, we measured the productivity of supply chains by revenue per square foot. E-fulfilment supply chains support annual online sales of approximately $750-$1,000 per foot of logistics real estate, or about 1.2 MSF per billion dollars of sales. By comparison, supply chains that serve traditional brick-and-mortar retailers support annual in-store sales of $2,231 per foot of logistics real estate, or about 450,000 SF per billion dollars of sales. However, there is a wide range based on product type, variety, store format and other factors. These results indicate that e-fulfilment is a very logistics real estate intensive activity. Said differently, online retailers need three times the distribution center space compared to brick-and-mortar retailers for a given level of revenue.

Several factors drive intensity of use. The most important factor relates to how space is used. E-fulfilment is an intense use of logistics real estate. Unique factors drive this intensity:

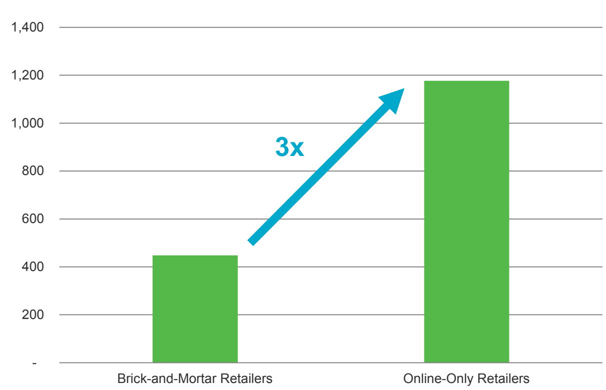
– wider product variety available versus than in-store

– greater inventory levels

– individual product picking and larger outbound shipping space requirements

– increased reverse logistics (process returns)

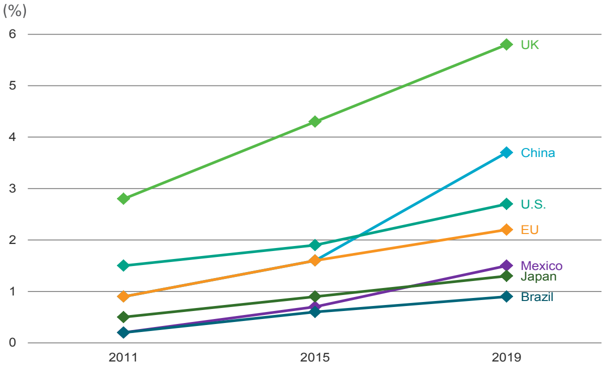
Exhibit 2: Supply Chain Productivity
(thousands, logistics square footage per billion of sales)



Source: Company Filings, Internet Retailer, Prologis Research

In less than a decade, e-commerce sales have risen to a considerable segment of GDP. In four years the share of e-commerce (B2C, goods only) in global GDP doubled to 1.3% in 2015 and is expected to grow to 3.2% by 2019. E-commerce adoption varies by market. Notably, the UK has remained and will continue as a key leading market with a forecasted share of almost 6% in five years. The strong forecasted e-commerce growth in China, reflected also in economic and consumption growth, will give it the second-highest share by 2019.

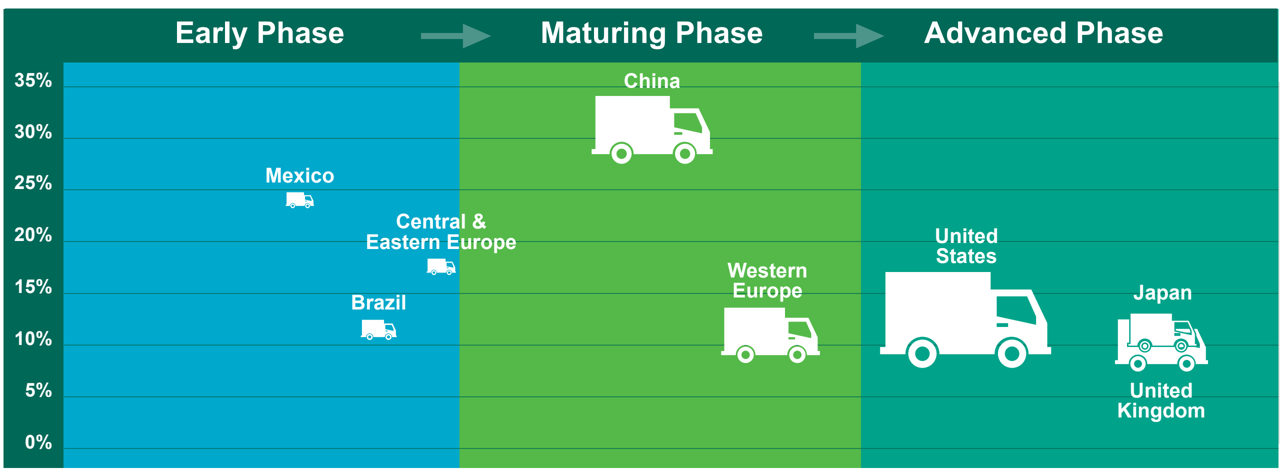
Exhibit 3: Share of E-Commerce in GDP



Source: Prologis Research, based on Oxford Economics, E-marketer, Ecommerce Foundation

Exhibit 4: Stages of Growth Across the Globe

(online sales growth, CAGR 2015-2019)



Impact on Logistics	Embracing e-fulfilment	Enlarging network	Drivers of Innovation
Location:	Focus on central locations	Increasingly infill locations	Focus on infill locations
Operations:	Mainly combined and shared facilities	Rise of dedicated facilities	Constant growth in distributed fulfillment
Requirements:	Mostly larger units and stronger focus on new developments	Gradual increase of smaller units, both existing and new	Broad diversity; emphasis on smaller units
Location:	International brands limited, increase in national retailers	Increase in international brands; number of national retailers expands rapidly	Both international brands and national retailers active

Source: Prologis Research, based on Oxford Economics, E-marketer, Ecommerce Foundation
Note: Size of trucks is total turnover of B2C goods, 2015

Pronounced activity exists around the world. There is no common global standard for e-fulfilment. The differences that drive divergent models are many, such as city size, geography and labor costs. The global leaders in online fulfilment include Tokyo, London, Shanghai and, to a lesser extent, New York. Population density clearly matters, but so too does the dispersion of consumers—Japan and the UK are islands, and inter-provincial distribution is rare in China. Proximity to population centers and supply chains in these regions do not need to change. In the case of Japan and the UK, inbound supply chains to the end consumer historically were already well in-place. By contrast, online retail fulfilment in the U.S. and on the continent in Europe must contend with an evolution in location strategies—e-retailers need to balance service levels, transportation costs and network diffusion. In the past, some retailers favored centralized and lower-cost locations, but that trend is reversing. (We discuss this in greater detail below.) In China and Southern Europe, rising to the next stage of e-fulfilment will require broader consumer adoption and a greater mix of namely international retailers. In Mexico, Central & Eastern Europe and Brazil, e-commerce has achieved only some critical mass, and in markets like the Czech Republic, the focus continues to be on centralized locations.

2. AN EVOLVING INDUSTRY.

E-commerce demand is high growth, but the specifics of customer needs can be broad. The most observable portion of the business has been major build-to-suit projects that have been routinely announced in recent years but which represent only a part of the business. The full e-fulfilment picture is much more diverse.

The Prologis portfolio reflects the broad spectrum of requirements. Prologis globally has more than 400 e-commerce customers leasing more than 50 MSF. An examination of our own portfolio, in addition to our work with customers and contacts across the industry, yields several insights about the requirements of e-commerce customers:

- <u>Critical locations.</u> We've observed a shift in geographic strategies. E-fulfilment models from 5 and 10 years ago emphasized low-cost labor and real estate—often in centralized locations within a country or region. This strategy included places in the middle of the U.S. that offered sales tax advantages, such as Indianapolis and Columbus. However, e-fulfilment requirements have more recently emphasized locations within and adjacent to major population centers (and, labor markets). Normalizing tax policies and faster delivery times have been important drivers.
- <u>Wide range of sizes.</u> News headlines surrounding e-commerce-generated demand have been dominated by build-to-suits. Indeed, requirements have generally been larger on average. However, the true customer footprint is diverse. Our e-commerce customer leases range from units smaller than 10,000 SF all the way up to more than 1.0 MSF, and are roughly 125,000 SF on average, a unit size not all that different from our customers not involved in e-commerce.
- <u>Variety of requirements.</u> The types of buildings are highly variable. Age is an imperfect measure of building features, but it is illustrative. Customers lease buildings that are brand new, and they also routinely lease buildings from the 1980s and 1990s. Within the Prologis portfolio, half of our e-commerce customers are in buildings more than 10 years old. For many customers, an infill location is more important to their supply chain than the most modern features.
- <u>Growth of localization.</u> The focus on infill, and the interest in smaller facilities, reflects multiple themes within the online retail industry, namely the diversity of retailers and the pressure to reduce delivery times. Growth has recently been faster amid the small and medium size categories, while demand for larger facilities holds steady. E-commerce customers have increased their focus on last mile and are seeking buildings close to end customers. Also, retailers with mid-sized and smaller online businesses have become more focused on building out their e-fulfilment capabilities.

Five distinct customer profiles drive e-commerce growth and diversity. Putting it all together, there are more e-fulfilment use profiles than appear at first blush. In turn, these profiles create the vast diversity in customer requirements now shaping the market (and the vast diversity we likely will continue to see).

Exhibit 5: E-Commerce Building Characteristics

E-Commerce Building Types		Building Features					
	Type	**Site Selection**	**Size (SF)**	**Clearance**	**Parking/Yard**	**Design Features**	**Principal activity**
Last Mile	**Last Mile**	Within major metro area, proximate to concentrations of consumers, higher-density submarkets	<100k	16' or higher	Yard area for truck-to-truck, small delivery van storage, crossdocks, end customer-accessible for pick up	Dock and grade-level doors, open floor space, potential showrooming	High velocity SKUs only, mainly transload operations, <24 hr storage, some offer value-add services
Last 50 Miles	**Metro Sortation**	Proximate to major metro area, less dense submarkets	<100-500K	24-36'	Truck court of 130'+, some trailer parking, employee parking	1 dock door per 5,000 SF	Storage, distribution, order fulfilment, reverse logistics
Last 500 Miles	**Regional/ National Sortation**	Proximate to transportation hubs or routes, established regional distribution locations e.g., IE (US), Atlanta (US), Southern Netherlands (NL)	>500k	36-40'	Truck court of 185'+, ample trailer parking, ample employee parking, security	1 dock door per 10,000 SF	Breaking bulk, diverse SKU storage, distribution, pick and pack order fulfilment, reverse logistics, often automated

Source: JLL, Prologis Research

- Megabrands. These are the world's largest online retailers, such as Amazon, JD.com and Walmart. All have online revenues above $10 billion, a level of revenues that can translate to shipping an average of more than 250,000 orders per day—a considerable fulfilment challenge that ramps up even higher during the holidays. These retailers have the scale for many diffuse major logistics facilities and the transportation costs to minimize distance to customers, but also the outbound volume to justify the most modern buildings. These customers tend to favor larger and more functional buildings, although this is not always the case. Good locations within cities, which tend to be smaller pre-existing facilities, are increasingly in demand.

- Large brands. These are often the world's, or at least a region's, largest retailers, and they include retailers like Tesco, Home Depot and Uniqlo. They are building major online businesses as customer needs change. They also have considerable fulfilment challenges. Many have experimented with leveraging their existing supply chains and store networks, but ultimately have opted to develop dedicated e-fulfilment networks. The scale and location of these requirements depends on the size of the online operation—these retailers are increasingly emphasizing proximity to major population centers and often have a combination of mid-sized and large facilities.

- New brands. Younger online retailers can experience dramatic growth and distribution challenges; for example, Wayfair, HelloFresh, Womai, Zooplus, and Ao.com. These retailers often will only need one or a handful of fulfilment centers. Location strategies vary. Some favor proximity to a major market, such as NYC (US) or Madrid (Spain), for shorter deliver times. Others may favor a centralized location although they are forced to cope with longer deliver times and higher transportation costs. Building requirements also vary; some of these retailers may only have a small requirement, but the largest of these newer brands can begin to have real estate needs that expand beyond 1.0 MSF, which may be satisfied by only one or a handful of locations.

- 3PLs with e-fulfilment capabilities. Outsourcing is commonplace to companies such as Panalpina and Nippon Express. 3PLs have expertise in a complex field and help online retailers execute e-fulfilment. These requirements vary widely depending on the 3PL customer's needs, which naturally follows from the mega-, large- and newer-brand requirements.

- Parcel delivery companies. The parcel post network is a critical partner to the online retailer community and includes companies like FedEx and UPS. These customers are enjoying sizeable growth as business-to-consumer shipping expands rapidly. These customers have a variety of needs. Hub locations are growing. However, the most pronounced demand appears to be for last-mile facilities and major ground sortation hubs to feed last-mile locations. These infill requirements are typically mid-sized and smaller facilities.

The expansion of small and medium sized retailers has become more visible. These may be 100% online retailers or existing brick-and-mortar retailers. The growth in their supply chains is consistent with the estimate that retailers need one logistics square foot for each $500-$1,000 of online revenue, or about three times the square footage of traditional supply chains. The supply chains of growing retailers tend to follow a natural evolution:

- Initial phase. Retailers with less than $100-$250 million of online revenue have small e-fulfillment supply chains. These operations either occur in the existing supply chain (for brick-and-mortar retailers) or they leverage third-party logistics providers and/or exist within a handful of smaller locations.

- Scaling online revenues. As annual online revenues rise from $100 million to $500 million, retailers tend to consolidate their fulfilment operations. Sometimes, that can mean a single 500,000 SF to a 1 MSF facility. Or, it may be achieved with a handful of sites.

- Growing e-fulfilment operations. As annual online revenues rise above $1 billion, e-fulfilment operations tend to require multiple major distribution centers, requiring multiple millions of square feet across several (or many) distribution centers.

3. WHAT MIGHT THE FUTURE HOLD?

Prologis Research anticipates an increased emphasis on locations within and adjacent to major population centers. Proximity to major markets has been a trend for several years, but we expect it to expand further. E-fulfilment operations must address a complex series of questions around balancing service levels, transportation costs and inventory levels (count of facilities). The answer to this question is increasingly leading operations within and adjacent to major population centers.

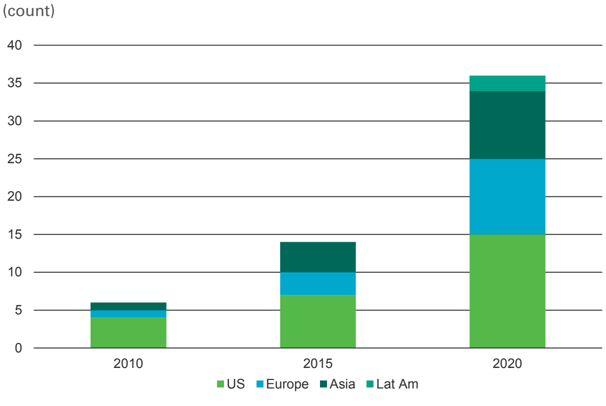
- Last mile. Current networks appear underdeveloped with respect to most infill locations, which facilitate last-mile delivery. Both industry growth and requirements within the real estate community have enjoyed explosive growth in the last years.

- Rising service level expectations. The debate surrounding delivery times is far from settled, be it same-day, next-day, two-day or longer. However, five-day, seven-day and longer is becoming less common and is considered non-competitive. This transition requires expedited shipping and/or greater proximity to end consumers.

- Managing transportation costs. Total fulfilment costs can amount to 15% or more of revenue and are growing rapidly—in some instances, faster than revenue. Pricing within the parcel post network is adjusting to ensure profitability, such as the shift toward dimensional pricing to more properly match price with cost. In addition, market watchers estimate that the average value per package seems to be declining, exacerbating the situation.

- Increased retailer scale and capabilities. The consideration to locate e-fulfilment operations and inventories closer to end consumers also is an issue of scale: Does the online retailer have sufficient scale to carry a quantity of inventories close to end consumers? Critically, the number of online retailers that are global or pan-regional in scale is exploding. Increasingly, more and more online retailers are making the choice to deconsolidate e-fulfilment operations to improve service levels and reduce transportation costs.

Exhibit 6: Count of Retailers with more than $5B in Annual Online Sales



Source: Internet Retailer, Prologis Research
Note: Forward estimates by retailer grown at the region's total online sales growth. Actual results could vary materially.

Third-party logistics providers are becoming increasingly important. Outside expertise can be critical. Many of our customers operating e-fulfilment are third-party logistics providers conducting order fulfilment on behalf of retailers. This is especially the case for our mid-sized and smaller size categories. E-fulfilment is a complex operation. For online retailers, this outside expertise can be a crucial value-add at a time when topline growth might be scaling quickly.

Expansion of omni-channel experimentation. For many brick-and-mortar retailers, having a store fleet offers the potential competitive advantage of allowing consumers to obtain their goods exactly when they want them and initiate returns. Consequently, omni-channel is an area of considerable investment among retailers with initiatives such as "click and collect" and "ship from store." Important challenges have yet to be overcome, ranging from store configurations to employee roles/responsibilities/capabilities, order mixing and unit economics. Incomplete inventory tracking adds complexity to the management of in-store stock. Consumers have favored the convenience of home delivery rather than traveling to a store. A successful omni-channel implementation asks a lot of a retailer's supply chain.

4. CONCLUSION

E-commerce is becoming an increasingly important demand driver for logistics real estate globally. The recovery of occupancies and market rents has occurred faster and in greater magnitude due in part to the scope of e-commerce demand. Today's wider breadth of demand among e-fulfilment operations, particularly for mid-sized and smaller requirements, puts them in greater competition with a broader swath of the marketplace for availabilities. Forward-thinking operations with a thorough planning process and the ability to act quickly stand the best chance of meeting their real estate requirements at the best price.

However, several trends seem likely to shape the next several years; these trends include the following:

- Growth. The industry continues to rise at about 20% globally and in the mid-teens in larger developed economies.

- Variety. There is a wide range of e-commerce concepts, sizes and supply chains, which in turn creates differing real estate needs.

- Infill locations. Higher service levels, rising transportation costs and increased retailer scale all are translating to greater demand for facilities located within and adjacent to major population centers.

- Fluidity. E-fulfilment and omni-channel supply chains will continue to evolve.

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Prologis' research department studies fundamental and investment trends and Prologis' customers' needs to assist in identifying opportunities and avoiding risk across four continents. The team contributes to investment decisions and long-term strategic initiatives, in addition to publishing white papers and other research reports. Prologis publishes research on the market dynamics impacting Prologis' customers' businesses, including global supply chain issues and developments in the logistics and real estate industries. Prologis' dedicated research team works collaboratively with all company departments to help guide Prologis' market entry, expansion, acquisition and development strategies.

ABOUT PROLOGIS

Prologis, Inc. is the global leader in logistics real estate with a focus on high-barrier, high-growth markets. As of June 30, 2016, the company owned or had investments in, on a wholly owned basis or through co-investment ventures, properties and development projects expected to total approximately 666 million square feet (61.9 million square meters) in 20 countries. Prologis leases modern distribution facilities to a diverse base of approximately 5,200 customers across two major categories: business-to-business and retail/online fulfillment.

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