

Future Proofing the Global Supply Chain: How AI, Automation and Other Technologies Are Impacting Efficiency



Key Takeaways

- **Logistics real estate investments outpaced revenue growth by 57% during the past decade** despite automation and data analytics advancements. We call this the “supply chain productivity paradox.”
- **This paradox emerged because larger, decentralized logistics real estate networks unlock revenues and save on costs** in ways that were previously not possible or well-understood. We identify the top five drivers.
- **AI and data capabilities’ primary purpose is to increase supply chain adaptability to drive revenues**; efficiency investments are secondary and unlikely to reduce real estate requirements.
- **Logistics operations are incorporating new automated technologies at an increasing rate.** Use of Autonomous Mobile Robots (AMRs) is growing the fastest, with limited implications for real estate. We expect that up to half of all logistics operations could incorporate AMRs over the next 10-15 years.
- **Automation can increase throughput and is a catalyst to upgrade facilities.** Access to power infrastructure, especially renewable energy, is increasingly a top consideration in logistics real estate decisions.

This new study advances our past work in three ways.

- 1. Logistics real estate.** Prologis Research analyzed the supply chains of 25 leading U.S. retailers to determine how technology innovation has changed the logistics real estate utilization of supply chains.
- 2. Artificial intelligence (AI).** We assessed cutting-edge data analytics and their implication on supply chain design.
- 3. Automation.** We updated our assessment of automation’s implications for logistics real estate demand. Prologis Research [studied](#) the state of automation in 2020, concluding adoption was concentrated in e-fulfillment and unlocked previously overlooked infill locations, which still hold today.

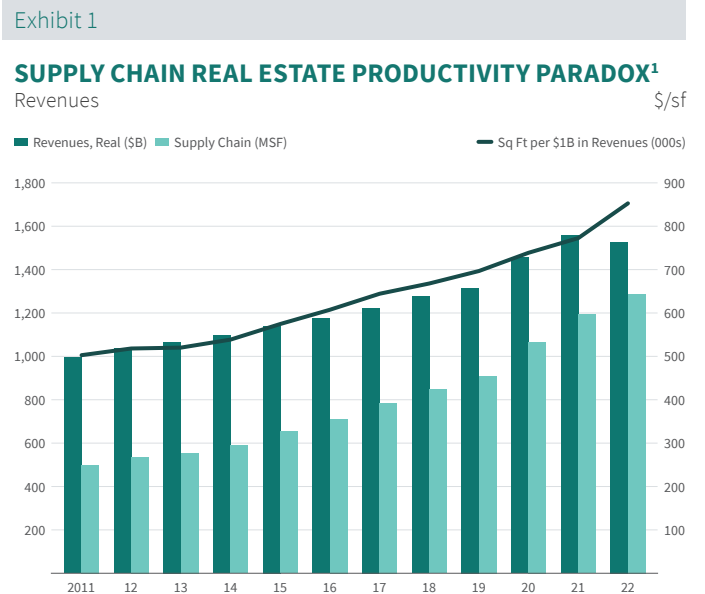
Logistics Real Estate and the Supply Chain Productivity Paradox

Logistics real estate used per unit of revenue has increased by 57% during the past 10 years (see Exhibit 1). We found logistics real estate footprints have grown more in the last decade (2.5B square feet) than in the prior two decades (2.1B square feet). Today, these supply chains amount to 1.2B square feet and support \$1.4T in retail sales (on 2022 dollars basis). The logistics real estate required to support \$1B in retail sales increased from 500,000 square feet 10 years ago to 800,000 square feet today, a 57% increase.

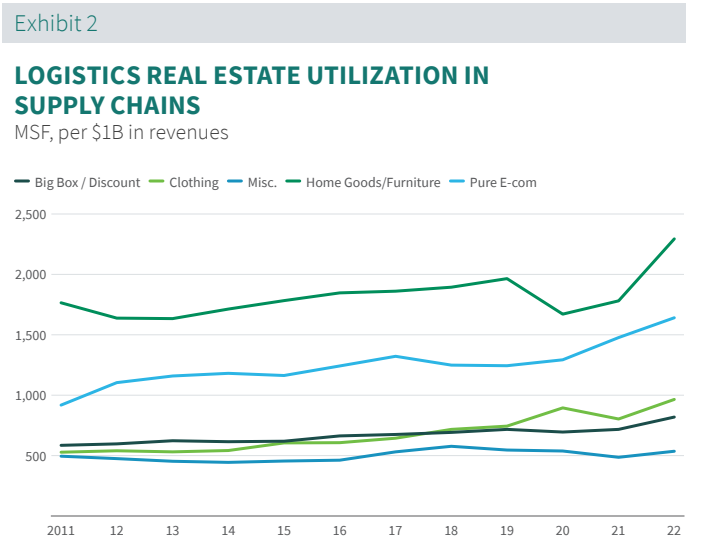
Why? A small logistics real estate footprint is not the goal. Supply chain professionals employ operational methods that dictate real estate decisions. Warehouse design, staffing levels, capital improvements and network strategies (e.g., building sizes, counts, and locations) are set to meet performance criteria (e.g., delivery times, in-stock rates). With logistics real estate at 5% of total supply chain cost—transportation averages 50% and labor averages 35%—retailing strategy, transportation plan, and labor/automation design dictate real estate decisions.

Five drivers increase logistics real estate use and fuel the supply chain paradox:

- 1. E-commerce.** [Prologis was the first to recognize that e-commerce requires three times more logistics space than brick-and-mortar sales](#) because of piece picking, product variety, direct-to-consumer shipping and the need to process returns.
- 2. Omnichannel operations.** Ship-from-store and click-and-collect models require bigger supply chains to pool inventories in large, centralized facilities, offer rapid replenishment to stores from local or regional facilities, and augment stores with online fulfillment operations.



Source: Public company filings, Prologis Research



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- 3. Product variety.** Retailers' pursuit of growth and market share requires increased product variety to adapt to rapidly changing consumer habits, which creates expansive upstream implications for warehouse operations.
- 4. Transportation cost management.** Network design that combines mother hubs, distribution centers, sort centers, and cross-docking facilities also generates significant warehouse requirements.

- 5. Regulatory compliance.** Expanding regulations and compliance necessitates additional space and specialized infrastructure, such as temperature-controlled areas, cleanrooms, or secure storage areas.

Prologis Research worked with automation with supply chain design firm, Fulfillment IQ, to identify data and automation best practices, as well as trends in current and future adoption.

Five technologies shaping supply chain operations today

- 1. AI and big data.** AI is not new to supply chain. For more than a decade, AI has been used to manage supply chains for workforce planning, dynamic inventory routing, network design, demand planning and simulation and warehouse design. Taken together, these tools are primarily focused on growing revenues and managing transportation and labor spend.
- 2. Basic IT and data analytics.** The integration of warehouse management systems (WMS), order management systems (OMS), transportation management systems (TMS), data visualization, integration platform as a service (iPaaS), and advanced analytics profoundly improved visibility and operational efficiency through dynamic inventory control, streamlined fulfillment processes and agile space management. While leading companies have employed these capabilities for years, adoption is now expanding to small- and medium-sized enterprises.
- 3. Legacy automation.** Warehouse operations employ several types of equipment—such as high-rise racking systems (over 40 feet), forklifts and wire-guided vehicles, and hand-held devices (e.g., scanners)—to enhance efficiency, increase throughput, and control costs. While these have been widely adopted, the pace of change is slowing.
- 4. Autonomous mobile robots (AMRs)** transport goods in logistics facilities and require modest infrastructure. AMRs are modular and can be introduced in any number, allowing for small installations and an ability to scale needed. They increase pick rates, safety, and employee morale and job satisfaction. Payback periods range from two to five years; ROIs of 30% and more are possible.

Our analysis finds that **half of logistics facilities are likely to have AMRs over time.** Adoption is facilitated partly



Automated robotics company Locus provides efficiency for picking and packing in a distribution facility.

by AMRs' ability to integrate with existing operations. Consequently, there are few implications for warehouse design or construction requirements beyond basic power and floor-flatness. Space requirements are unchanged in most applications, with ROIs justified through increased labor productivity. Some AMR installations require *more space* for charging and integration points, and add to the operational power load.

- 5. Automated sortation/retrieval (AS/RS)** can result in bigger efficiency gains, concentrated in the storage component of customer operations, but with bigger trade-offs: adoption rates for AS/RS are depressed by the long financial planning horizon and limited short-term operational flexibility. AS/RS increase pick rates and allow for greater storage density of sortable inventory. AS/RS are best applied to high velocity SKUs and complemented by other storage and retrieval equipment for lower velocity SKUs. Installations can cost \$25-50M or more. Payback periods can be 5-10 years with ROIs in the mid-teens. AS/RS tends to be installed in new facilities with ample access to power.

We expect 10-20% AS/RS adoption and a 3-5% industry-wide demand reduction from AS/RS over a 10-15-year horizon, based on the following:

- Only 35-50% of customers have inventories suitable for AS/RS (e.g., sortable versus non-sortable goods).
- Only 25-50% of these customers are within suitable industries (e.g., CPG versus hardware).
- AS/RS efficiency gains are highly concentrated with 33-50% savings for just storage.
- As a result, AS/RS adoption leads to 10-20% logistics real estate space savings across a retailer's distribution network.

However, changing business requirements, such as SKU mix and service times, could counter these gains.



AS/RS installation, Prologis Park at AIPO, Orlando, Florida.

Conclusion

Logistics real estate use in supply chains will continue to rise. Retailers will need to increase their use of logistics facility space to compete and win in the future of retail, supporting increased levels of e-commerce, omni-channel fulfillment, product variety and resilience.

- Advances in AI continue the evolutionary path of data analytics within supply chains and will support increased levels of service and resilience within supply chains.

- Automation adoption, led by AMRs, will see a meaningful expansion, increasing role quality, employee productivity, and compensation. Up to 50% of logistics operations could include AMRs over the next decade.
- AS/RS can reduce logistics real estate space needs, however we expect adoption will have a low ceiling of 10-20% reached gradually over the next 10-15 years.

Endnotes

1. This study focuses on a portion of the customer base. 'Retailers' represent one-third of customers within supply chain functions and demand drivers. Other categories of demand drivers include wholesalers, transportation companies and light manufacturers. Network size and location for these customers are a function of their own structural drivers. Further, while third party logistics providers (3PLs) are a critical and large customer base, they typically work on behalf of these categories of demand drivers, rather than a category unto themselves.

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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, 2023, 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 1.2 billion square feet (111 million square meters) in 19 countries. Prologis leases modern logistics facilities to a diverse base of approximately 6,700 customers principally across two major categories: business-to-business and retail/online fulfillment.

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