

BEYOND BUILDINGS

THE HOLISTIC FUTURE
OF LOGISTICS



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The world is changing — and logistics is changing along with it

We are at a pivotal turning point in the logistics sector. While logistics has long been primarily characterized by scaling up and cost efficiency, it is now increasingly driven by social, economic, ecological and technological changes. This calls for a fundamental shift in the way we design logistics processes and infrastructure.

The era of isolated solutions is over. The future demands a holistic, integrated approach in which all aspects of logistics and the supply chain reinforce and connect with one another. This is the essence of the 360° approach.

This whitepaper was co-authored by Heylen Warehouses, Heylen Energy and Smart 21, drawing on our combined expertise and practical experience in the sector. We were also fortunate to incorporate the advice and insights of Prof. Dr.-Ing. Johannes Fottner (Technical University of Munich).

As J. Fottner emphasizes, we must approach logistics processes holistically: the power of innovation lies not only in new technologies but, above all, in the multidisciplinary perspective with which we tackle processes and challenges. "In the past, specialists were in high demand; today, a broad, integrated approach is often strategically the best choice," states Fottner, who deliberately integrates his academic work with practical experience from his time as COO in the logistics sector.





Workforce shortages as a structural reality

The logistics sector has been struggling with a severe labor shortage for quite some time - a challenge that has evolved from a temporary bottleneck into a structural problem. This trend is likely to intensify in the coming years due to three underlying factors:

- **An aging workforce:** In many Western European countries, large cohorts of employees are reaching retirement age. In Belgium, for example, it is estimated that more than 25% of the current logistics workforce is over 55 years old. There is an insufficient influx of younger employees to compensate for this outflow.
- **Declining interest among younger generations:** Young people tend to prefer sectors that offer more opportunities for personal development, autonomy or technological innovation. Repetitive and physically demanding warehouse work is less appealing to them - especially when it involves shift or night work.
- **A negative image of the sector:** The perception that logistics jobs are tough, monotonous, or poorly paid deters potential employees.

→ THE RESULT:

warehouses are becoming increasingly difficult to staff and companies are forced to reorganize their operations. As a consequence, automation is no longer a future option - it has become an urgent and necessary reality to ensure business continuity.



PRACTICAL EXAMPLES

- Supermarket chains such as Colruyt and Lidl are investing heavily in automated distribution centres featuring shuttle systems and Automated Guided Vehicles (AGVs). These systems reduce dependence on manual labor, ensuring operational continuity even in times of high absenteeism or recruitment challenges.
- In port logistics, such as at the ports of Antwerp and Rotterdam, more and more tasks - including container stacking and truck scheduling - are being taken over by AI systems and autonomous cranes. This not only improves efficiency but also helps offset the shortage of skilled workers.
- In last-mile delivery, major cities are experimenting with autonomous vehicles and delivery robots, for example through initiatives by Starship Technologies and DHL. This shift is also partly driven by the growing difficulty of finding enough drivers and bike couriers.

Fottner, however, does not see automation as an end in itself, but as a means that must continue to serve humanity.

**“ WHOEVER AUTOMATES
INEFFICIENT PROCESSES CREATES
AUTOMATED INEFFICIENT PROCESSES**

he warns. That's why he advocates for a careful assessment where technology remains supportive and humans retain control – just like in hospitals, where automation creates space for more patient care.



Energy: the often overlooked factor

In the logistics sector, everything revolves around efficiency, reliability and scalability. And although energy literally powers every automated movement, robot, forklift or sorting system, the topic of energy is strikingly often only considered late in the design and development process of logistics infrastructure. This is a fundamental mistake.

Logistics hubs aiming for advanced automation and electrification require an energy infrastructure that is just as smart and scalable as the processes it supports. Without thoughtful energy logistics, even the most advanced technologies can become sources of delay, inefficiency or even operational failure.

WHY ENERGY MUST BE A TOP PRIORITY

Automation demands a constant and stable energy supply. Shuttles, conveyors, AGVs, robotic arms, sorting lines and high-speed lifts require enormous amounts of power - often running 24/7. Fluctuations in voltage or power shortages can lead to downtime, equipment damage or safety hazards.

Digitalization further increases energy requirements. Beyond physical systems, logistics operations increasingly rely on data centers, cloud-based WMS platforms, real-time tracking systems and connected sensors. This digital infrastructure requires a continuous power supply, often with built-in redundancy.

Electrification of transport adds another layer. Not only does the warehouse itself consume power, but incoming and outgoing traffic must also be considered. For example, a site with 20 electric trucks may require several megawatt-hours daily, with peak consumption adding extra megawatts at specific times of the day.

In certain environments, energy is indispensable and critical. Consider cold storage warehouses, where refrigeration units run around the clock to maintain temperatures as low as -25°C. A brief power outage can result not only in product loss but also in complex restart procedures or equipment damage. Similarly, in pharmaceutical storage, high-tech cleanrooms or food processing facilities, a stable and reliable energy supply directly determines product quality and safety.

→ EXAMPLES

- **Lidl Belgium operates new distribution centres with a microgrid that integrates solar energy, battery storage and combined heat and power (CHP) systems. This enables the company to achieve autonomous energy supply for core operations.**
- **PostNL is testing the use of hydro-buffering at several locations - a system that stores heat and cold in water reservoirs, powered by renewable electricity. This helps distribute energy consumption throughout the day and avoid peak loads.**
- **Several developers have already begun creating energy-positive warehouses, where buildings generate more energy over the course of a year than they consume, through solar panels, advanced insulation and intelligent energy management systems.**



02. The Catalysts of transformation

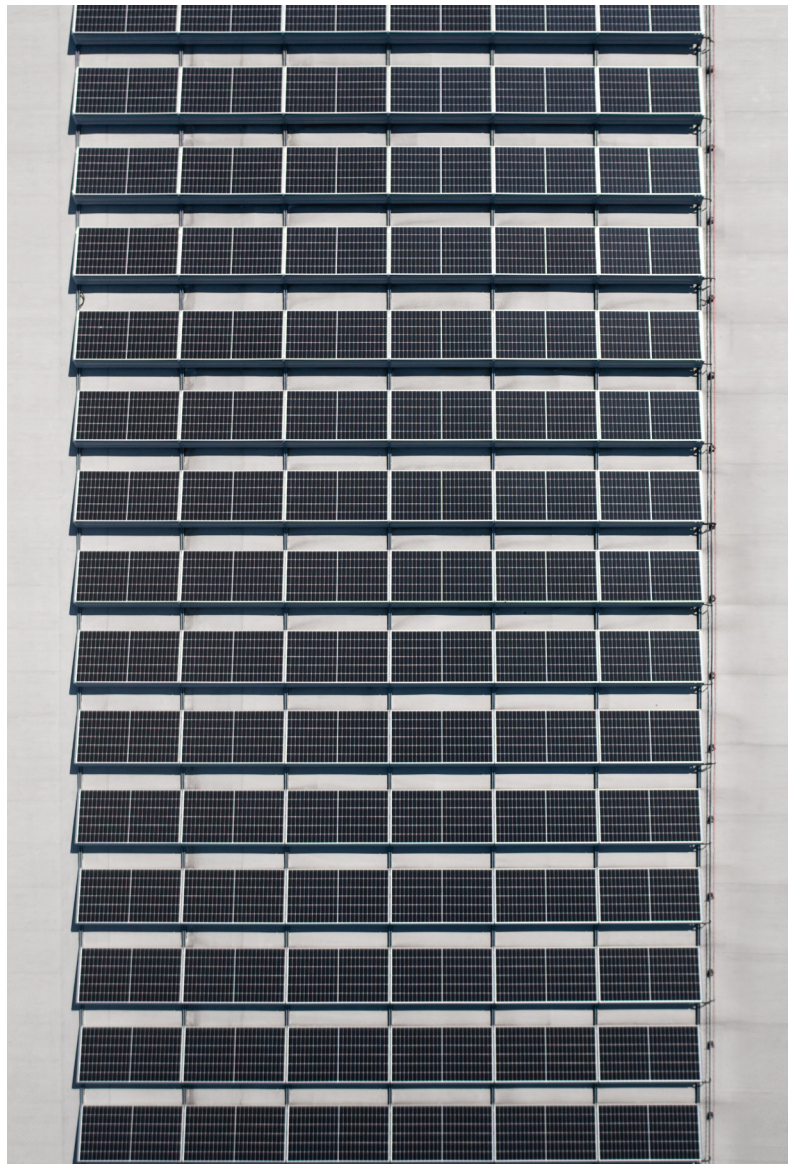
THE CHALLENGE OF GRID CAPACITY

In many regions, such as the Netherlands and certain areas of Flanders, there is currently a capacity issue on the electricity grid. This means that companies requiring new large connections - often several megawatts - sometimes have to wait years or settle for a limited connection. This poses a direct threat to automation plans.

As a result, companies are increasingly looking for self-sufficient solutions:

- Solar and/or wind energy combined with battery storage to smooth peaks, maximize self-consumption, or create operational flexibility.
- Demand management using smart software that charges machines and vehicles during low-tariff periods, negative pricing, or high solar production.
- Collaboration in energy hubs, where multiple companies locally share energy or jointly invest in infrastructure.

Sustainable energy sources are the right choice both ecologically and economically. Investments in local generation and storage - such as solar panels, wind turbines, or batteries - not only reduce the ecological footprint but also make a site less dependent on peak loads from the grid.



In times when grid costs are skyrocketing - and expected to continue rising - local optimizations become increasingly valuable. They provide more predictable energy costs and give companies a competitive advantage in an energy-intensive sector.

FUTURE-ORIENTED APPROACH

Those aiming to operate a future-ready, automated, and sustainable supply chain must integrate energy as a structural element of design today, rather than treating it as an afterthought. This entails:

- Early collaboration with grid operators
- Provision for decentralized generation, such as rooftops or walls with solar panels or wind energy
- Reserving physical space for transformers, batteries, and charging infrastructure
- Integrating energy management systems (EMS)

A new investment logic

The way companies and investors view logistics real estate is undergoing a fundamental transformation. Whereas the focus used to be primarily on floor space, location, and rental value, attention is increasingly shifting toward technology, scalability, and digital integration. The traditional warehouse - a static concrete box - is giving way to a dynamic, modular platform that supports processes and automation. This platform is a flexible structure that can grow alongside technological advancements and evolving logistics flows.

In the traditional approach, the building was developed first — often with a generic structure — and processes, flows, and technology had to be fitted in as best as possible. Today, this model is reversed. Operational processes, automation requirements, and digital infrastructure form the starting point. The building follows.

This gives rise to a new type of real estate: flexible, data-driven, ready for rapid evolution, and designed to fully support technology. Examples include reinforced floors, adapted column structures, increased clear heights, and dedicated spaces for servers or robot maintenance.

Real estate and technology become a single ecosystem

As a result, we increasingly see real estate developers and automation suppliers collaborating on designs. The line between “construction” and “technology” is blurring.

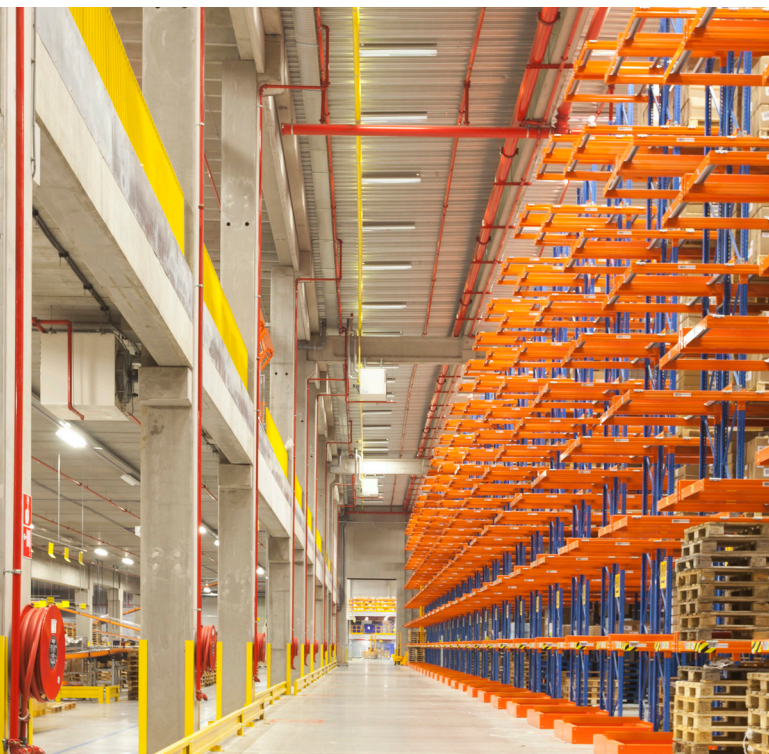
REAL ESTATE AND TECHNOLOGY BECOME A SINGLE ECOSYSTEM

Logistics real estate is increasingly being viewed as part of a broader technological ecosystem. Investors recognize that the future value of a warehouse will depend more and more on questions such as:

- How well is the building prepared for automation?
- Can it handle peak loads from robots or an electric fleet?
- Has adequate IT infrastructure been provided?
- How scalable is the layout for future flows?

The ability to expand energy capacity in the future is often seen as a decisive factor, but in practice, it is largely a utopia. The future is not about simply increasing capacity, but about flexibility and intelligent energy infrastructure. The most advanced systems combine automated energy management, storage, decentralized generation and real-time demand optimization. This smart approach allows energy demand, peaks and fluctuations to be managed efficiently, making the building both economically and operationally successful - without relying on retrofitted megawatt expansions.

As a result, we increasingly see real estate developers and automation suppliers designing together. The line between “construction” and “technology” is blurring.



02. The Catalysts of transformation

NEW INVESTMENT CRITERIA

This shift is also reflected in the investment criteria of institutional investors and real estate funds. They no longer evaluate logistics projects solely on returns, but also on:

- **Reusability of the shell:** Is the building adaptable to changing processes?
- **Future-proofing:** Will this building still be able to operate with the technology in use ten years from now?
- **Digital and energy infrastructure:** Data cabling, 5G antennas, etc.
- **Multi-tenant potential:** Can the building accommodate different automation strategies?

In addition, Total Cost of Ownership (TCO) is becoming increasingly important. The cheapest square meter is not necessarily the most profitable if the building later requires thousands of euros in technical modifications or suffers downtime due to insufficient energy supply.

NEW ROLES IN THE DEVELOPMENT PROCESS

The changing investment logic is also giving rise to new roles and collaborations. Architects, developers, logistics engineers, and IT specialists must work together from the early stages of a project.

REAL ESTATE AS A STRATEGIC ASSET

Finally, this evolution transforms logistics real estate into a strategic asset rather than merely an operational necessity. Companies that invest in high-performance, technologically prepared buildings can respond more quickly to market changes, labor shortages, sustainability requirements and customer expectations.

In a world where supply chains are under pressure and technology evolves rapidly, the warehouse of the future is not built for the next few years, but for the transitions to come.



From mass production to mass customisation

For decades, the classical industrial economy was built on mass production - the efficient manufacturing of large volumes of identical products to maximize economies of scale. In that world, everything revolved around standardization, low costs, and long, stable production runs. But that paradigm is under pressure.

In an era where consumers increasingly value personal experience, fast delivery and unique products, the market is evolving from mass production to mass customization - the ability to deliver tailored products with the efficiency and speed of a mass production system.



What is mass customisation?

Mass customization is the process by which companies offer products or services tailored to individual customer preferences — without sacrificing economies of scale or cost efficiency. Thanks to technological advances such as automation, AI, modular production, and digital platforms, it has become possible to introduce product variation without causing exponential cost increases or slower lead times.

A few examples:

Nike By You: Customers can choose the colors and materials of their shoes, while the production process remains largely automated.

BMW Individual: Cars can be personalized with unique interiors, colors, and features — without requiring a reconfiguration of the production line.

Bleckmann: A logistics service provider specializing in fashion and lifestyle, is fully committed to customer-specific customization. For example, the British luxury brand DeMellier offers a refined customer experience with handbags delivered in personalized gift packaging. Dries Van Noten relies on careful shipment processes where garments remain on hangers. Meanwhile, Gymshark focuses on speed and efficient returns management, ensuring that orders placed before midnight are delivered the next day.

03. Evolution in production and supply chain

THE IMPACT ON LOGISTICS PROCESSES

This evolution has a profound impact on the logistics chain. Instead of working with a fixed assortment and predictable volumes, warehouses, transport networks and order picking systems must respond in real time to dynamic, customer-driven variation.



In concrete terms, this means:

- **Faster turnaround times:** Customers expect customization within days, not weeks. This requires flexible inventory management and fulfillment strategies.
- **Greater complexity in storage:** More SKUs (Stock Keeping Units) means greater variation in storage requirements, packaging, and order profiles.
- **Smart picking technologies:** Automation with goods-to-person systems, voice picking, and AI-driven planning software helps to keep the margin of error low.
- **Decentralized storage and micro-fulfillment:** In order to deliver close to the customer, smaller fulfillment centers are emerging closer to urban areas.

TECHNOLOGIE AS ENABLER

The shift to mass customization would be impossible without advanced technologies. Consider:

- **Warehouse Management Systems (WMS)** that can reconfigure orders in real time.
- **Modular robots** that can quickly switch between different order profiles.
- **Predictive analytics** that can predict which products will be needed in which configurations, based on history and behaviour.
- **Cloud platforms** that connect suppliers, warehouses and customers.

03. Evolution in production and supply chain

STRATEGIC IMPLICATIONS FOR REAL ESTATE

These trends are forcing real estate developers and logistics players to think differently about space utilization and building flexibility:

- Hubs must be reconfigurable, with zones that can quickly be adapted to new processes or flows.
- Picking zones are becoming more important than bulk storage zones because the last steps of personalization take place here.
- Proximity to end customers or assembly centers is becoming a critical location criteria, which offers new opportunities for urban logistics and light industrial real estate.

WHY IT HAPPENS NOW

It is no coincidence that mass customization is now gaining momentum. This is partly due to:

- Digital platforms (such as bol.com, Zalando, or Amazon) that measure customer preferences in real time and translate them into logistics flows.
- Customer expectations that have been accelerated by e-commerce, where “personal” and “fast” have become the norm.

Close to the customer: nearshoring and reshoring

The globalization of recent decades has shifted production to low-wage countries, with the aim of reducing costs and maximizing economies of scale. Asian countries such as China, Vietnam and India have grown into production hubs for the entire world. But that model is faltering. Increasingly, companies are choosing to bring production closer to home - a trend known as reshoring (bringing production back to the home country) and nearshoring (moving production to nearby countries).

“RESHORING IS NOT ABOUT RETURNING TO THE PAST, BUT ABOUT BUILDING RESILIENT SUPPLY CHAINS FOR THE FUTURE.”

Harry Moser, Reshoring Initiative

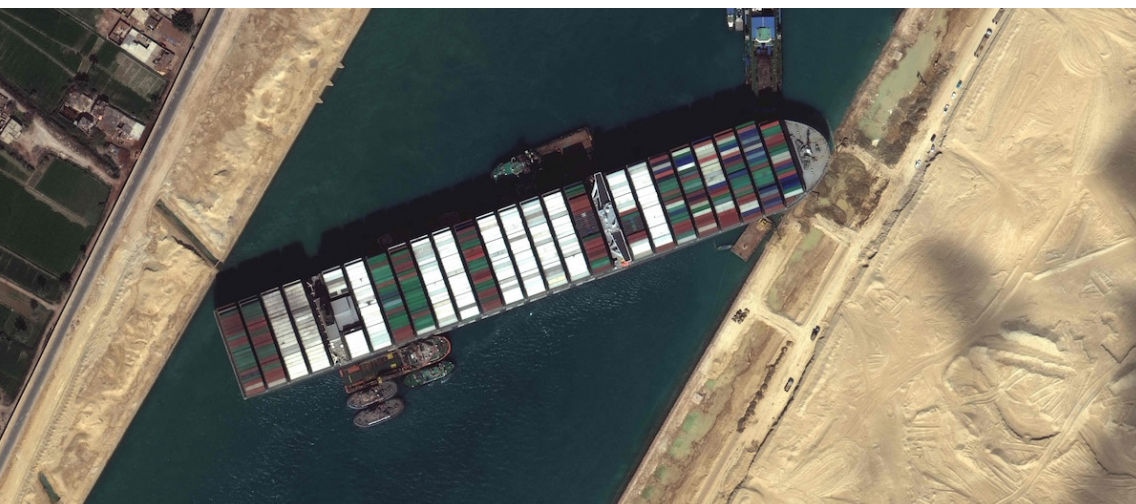


03. Evolution in production and supply chain

WHY THIS SHIFT?

The drivers behind this movement are both strategic and by necessity:

- Geopolitical tensions: Trade conflicts (such as between the US and China), Brexit and unstable political regimes are causing uncertainty and unpredictable supply chains.
- Rising transport costs: Since the COVID-19 pandemic, the costs of container transport and air freight have risen sharply, with fluctuations making long-term planning difficult.
- Disrupted supply chains: Lockdowns, port congestion and raw material shortages forced companies to take notice. The vulnerability of just-in-time supply chains became painfully visible. Consider the problem with the Suez Canal in March 2021, when the container ship Ever Given blocked the main trade route between Europe and Asia for six days. Every day, goods worth approximately \$9.6 billion were held up, leading to delays for hundreds of ships and significant economic damage.



WHY THIS SHIFT?

- Sustainability requirements: Local production means lower CO₂ emissions from transport and greater control over environmental standards and social conditions.
- Customer demands for speed: In a world where "order today, delivered tomorrow" has become the norm, long lead times from the Far East are no longer competitive.

EXAMPLES

- For years, Zara (Inditex) has been producing most of its collection in Spain, Portugal and Morocco in order to respond quickly to fashion trends.
- Bosch and Siemens Hausgeräte have opened factories in Eastern Europe to reduce their dependence on Asian suppliers.

03. Evolution in production and supply chain

THE ROLE OF LOGISTICS REAL ESTATE

This shift towards proximity has important implications for the development of logistics infrastructure. Because producing closer to the customer also means:

- More decentralized hubs: Instead of one central distribution center supplying Europe, multiple regional hubs are needed, closer to major markets.
- Short chains but higher complexity: Local production requires flexible storage and transport capacity for smaller volumes, greater variety and faster turnover.
- Acceleration of urban logistics: More deliveries within urban areas, requiring smaller, accessible distribution points and zero-emission solutions.
- Integration of production and logistics: Factories are increasingly integrated with fulfillment centers to enable rapid switching from production to delivery.



NEW HOTSPOTS

Nearshoring and reshoring are leading to the formation of new logistics hotspots, including in:

- Eastern Europe: Countries such as Poland, the Czech Republic, Hungary and Slovakia combine lower labor costs with a favorable location close to Western Europe.
- Southern Europe and North Africa: Spain, Portugal, Romania and Morocco are growing in importance, partly due to improved infrastructure and stabilizing economies.
- The Benelux: Thanks to its central location, multimodal accessibility and technological advantage, this region remains attractive as a distribution hub for reshored production.



STRATEGIC IMPLICATIONS FOR COMPANIES

For companies, this shift means that their entire operational model needs to be rethought:

- Capacity planning: Instead of long-term bulk production in Asia, companies need to be able to flexibly scale up capacity in local factories.
- Investments in automation: To compensate for higher labor costs in Europe, reshored production lines are often highly automated.
- Partnerships with local logistics players: Collaboration with parties who know the regional market is becoming more important than ever.

The rise of the logistics ecosystem

The days when logistics was viewed as a simple, linear chain - from manufacturer to distributor to customer - are long behind us. Today, a complex, dynamic ecosystem is taking shape, where multiple stakeholders are tightly interconnected. This new model goes far beyond collaboration: it entails shared responsibility, shared data and even shared infrastructure. Sector boundaries are increasingly blurred, with logistics emerging as the backbone of an extensive network of partners, technologies and systems.

FROM CHAIN TO NETWORK

Traditional supply chains followed a predictable, hierarchical structure. But in a world that is changing ever more rapidly - due to digitization, geopolitics, sustainability and consumer behaviour - such a structure no longer works. Logistics is therefore evolving into an adaptive ecosystem, with multiple nodes, feedback loops and real-time interaction between players.

In this ecosystem, shippers, carriers, software developers, warehouse operators, infrastructure managers, energy companies and real estate developers work together in a flexible and integrated whole.

03. Evolution in production and supply chain

FOR PILLARS OF THE LOGISTICS ECOSYSTEM



Shared data and digital integration



Shared energy infrastructure



Shared physical infrastructure



Increased linkage between internal and external logistics

SHARED DATA AND DIGITAL INTEGRATION

Transparency and speed are crucial. That is why partners in an ecosystem share data in real time via platforms, API links and AI-driven dashboards. Examples include:

- Track-and-trace information shared with customers and suppliers.
- Stock levels coordinated with carriers for optimal route planning.
- Predictive analytics that inform the entire network about potential disruptions.

Example: The European Digital Transport and Logistics Forum (DTLF) is working on standardization for data sharing across the entire logistics value chain.

SHARED ENERGY INFRASTRUCTURE

The energy transition requires cooperation. Logistics hubs are increasingly investing collectively in renewable energy and storage capacity, enabling them to produce locally and distribute smartly.

- Solar roofs are linked to battery storage and charging stations for electric trucks.
- Hubs share energy surpluses via smart grids (microgrids).
- Logistics real estate is becoming an energy supplier rather.

Example: In innovative business parks such as Eco-factorij (Apeldoorn), surplus solar energy from one company is used by another.

SHARED PHYSICAL INFRASTRUCTURE

Spatial scarcity and the need for flexibility are giving rise to shared facilities:

- Multiple companies share a single automated warehouse or return hub.
- Intermodal terminals are shared by logistics clusters.
- Urban consolidation centers combine deliveries for inner-city distribution.

Example: In Amsterdam, logistics players are collaborating through the Smart City Hub initiative to combine deliveries in the city and reduce CO₂ emissions.

INCREASED LINKAGE BETWEEN INTERNAL AND EXTERNAL LOGISTICS:

Modern logistics processes show that internal warehouse operations and external transport flows are becoming increasingly intertwined. Delays at suppliers or in ports have a direct impact on internal systems such as production planning, warehouse occupancy and order processing. Conversely, an internal bottleneck, for example in automated warehouses or distribution centers, can delay external deliveries and jeopardize contractual agreements with customers. This increasing interdependence calls for an integrated approach to logistics, focusing on real-time information exchange, flexible planning and accurate capacity coordination.

Example: When a container arrives late, not only do warehouse staff need to know where the goods are going, but transport partners, production units and customers must also be informed immediately to limit further disruptions.

03. Evolution in production and supply chain



NEW ROLES AND PLAYERS

The emergence of the ecosystem is leading to the creation of new roles within logistics:

- Orchestration platforms that act as digital directors of the ecosystem.
- Logistics-as-a-Service (LaaS) providers that deliver complete, modular logistics solutions.
- Real estate developers are more than just builders: they contribute ideas about energy management, connectivity, automation and even job satisfaction.

THE ADVANTAGES OF AN ECOSYSTEM APPROACH

- Resilience: Networks are more resistant to disruptions than linear chains.
- Economies of scale: Shared investments in technology, infrastructure, and energy reduce costs per player.
- Speed and agility: Thanks to real-time information, the ecosystem can respond more quickly to unexpected fluctuations in supply or demand.
- Sustainability: Sharing resources reduces waste and lowers CO² emissions.

BUT ALSO NEW CHALLENGES

An ecosystem requires trust, transparency, and interoperability. Companies must be willing to:

- Sharing data with competitors or other players
- Distributing investments and risks
- Complying with new standards and governance agreements



The rise of blockchain

Blockchain as a technology has existed for more than ten years, with origins dating back to 2008–2009. In 2008, Satoshi Nakamoto published the Bitcoin white paper, introducing the concept of a distributed, immutable ledger. The following year, in 2009, the first Bitcoin network went live, marking the first practical application of blockchain. In the early years, from 2009 to 2013, the focus was primarily on cryptocurrencies.

Starting around 2014–2015, experimentation started with applications beyond the financial sector, including supply chain and logistics.

In recent years, from 2020 to the present, we have seen a clear rise in enterprise applications of blockchain, such as food traceability, pharmaceutical logistics, energy and international trade.



There are several ways in which blockchain can add value to supply chains:

Transparency in the
supply chain

Traceability

Smart contracts

Efficiency and cost
reduction

Reliability

Practical examples



TRANSPARENCY IN THE SUPPLY CHAIN

Blockchain makes it possible to record transactions and the movement of goods in a permanent and transparent manner. All parties - producers, carriers, warehouses, and end customers - can access the same immutable information. This reduces fraud, errors, and misunderstandings.

TRACEABILITY

Goods can be fully tracked from origin to end user. This is essential for food safety, pharmaceuticals (where counterfeiting is a major risk), and high-value goods. In the event of incidents, the cause can be identified quickly.

SMART CONTRACTS

Blockchain enables automatic contracts that execute themselves once predefined conditions are met. For example, once a shipment is scanned at the port, payment is released automatically. This reduces paperwork and saves time.

EFFICIENCY AND COST REDUCTION

By reducing intermediaries and streamlining administrative processes (such as documents, certificates and customs procedures), logistics chains can operate more efficiently and at lower cost.

RELIABILITY

Because data on a blockchain cannot easily be altered, trust between parties increases, even if they do not know each other well.

PRACTICAL EXAMPLES

- Maersk uses blockchain for container tracking through TradeLens.
- Walmart traces the origin of food using blockchain.
- DHL is experimenting with blockchain for pharmaceutical traceability.



CYBERSECURITY, GDPR AND NIS2

Although blockchain offers many advantages in terms of transparency and traceability, it also presents challenges and risks regarding data protection and cybersecurity. The GDPR requires that personal data can be modified or deleted at the request of data subjects. This conflicts with the immutable nature of blockchain, where data is often permanently recorded. This can lead to legal tensions, especially when personal data (such as customer information or medical data) is stored on the blockchain.

In addition, the NIS2 Directive*, which has been in force in Belgium since October 2024, imposes stricter requirements on the cyber resilience of organizations in critical sectors. Blockchain networks must therefore not only be secure but also comply with incident reporting obligations, risk management and supply chain security.

* The NIS2 Directive is the successor to the European Union's original NIS Directive (Network and Information Security) and aims to strengthen cybersecurity within the EU.

From generic to function-oriented design

The way logistics real estate is designed is undergoing a fundamental transformation. A building is no longer the leading factor; instead, it adapts to the user's specific logistics processes and technologies—especially to the requirements of automated systems.



The classic warehouse: standardization above all

Traditional warehouses are often designed with maximum leasability in mind. The focus is on:

- Fixed grid structures for pallet racks
- Uniform clear height (e.g., 13.70 m)
- Manual picking zones
- Standard docks and loading bays

Although this approach offered flexibility for different users, it overlooked the operational efficiency required today in a world of just-in-time, e-commerce, and automated fulfillment.

NEW REALITY: PROCESSES DICTATE DESIGN

Today, the focus is shifting toward designing tailored to processes and technology. This means that the logistics flow - and its level of automation - takes center stage in the development of the building concept.

Examples of this approach are:

- Automatically guided vehicles (AGVs) require flat, seamless floors without slopes, pits, or obstacles. The floor design is subject to higher tolerance and flatness standards (e.g., DIN 15185 or TR34).
- Shuttle systems and high-bay warehouses require different building structures, such as extra-high spaces (>20 m) with minimal columns, reinforced floor loads and floor flatness. Automated VNA trucks require extremely flat floors. A few mm below means a few decimeters at high altitudes.
- Robots for goods-to-person picking require a layout with optimal routing, space for sensors and connectivity facilities (such as Wi-Fi mesh networks and 5G coverage).
- Automated sorting systems influence the width and height of transport zones, the power supply and the positioning of docks.

INTEGRATED DESIGN: COLLABORATION BETWEEN DISCIPLINES

A function-oriented design requires a multidisciplinary approach from day one. Architects, engineers, automation specialists, and the end user must jointly develop a design vision. This is achieved, among other things, through:

- Simulations and digital twins to virtually test the logistics flow in advance
- BIM models* where engineering, architecture, and processes converge
- (BIM model: Building Information Modeling, a digital 3D representation of a building containing all relevant information about the building, its management, and design)
- Design for automation principles, where technology and the building are designed simultaneously rather than sequentially

This multidisciplinary collaboration aligns seamlessly with Fottner's belief that the gap between academia and industry must disappear. Buildings and processes can only function seamlessly as one cohesive system when knowledge, experience and technology are woven together from the start.

NOT ONLY INSIDE BUT ALSO OUTSIDE

The external environment also evolves alongside the processes. For example:

- Spacious staging areas are being provided for autonomous trucks or yard automation
- Charging infrastructure for e-trucks is being integrated into the facade structure or parking infrastructure

Example

Imagine a fulfillment center where 80% of orders are processed by automated picking robots. Instead of manual picking zones, there are compact mezzanines with lift connections and robots operating in a matrix. The floor is extremely flat, and there is enhanced electrical infrastructure to support the robotic systems. The building's height is tailored to the shuttle system and the IT center is located centrally within the hall. In this way, the building becomes a custom fit for the operation rather than a one-size-fits-all model.





THE BENEFITS OF FUNCTION-ORIENTED DESIGN

- **Maximum operational efficiency**
By aligning the building with the process, lead times are shortened and errors are reduced.
- **Long-term cost optimization**
Although the initial investment may be higher, operating costs are reduced due to lower staffing requirements and higher speed.
- **Future-proofing**
A building is future-proof when it is designed to evolve with technological, operational, and market changes without requiring major renovations or high costs. It is not a final product, but a platform prepared for growth, change, and innovation.

Example: Provisions for future automation – Consider floors with enhanced flatness and load-bearing capacity, prepared for AGVs or shuttle systems, even if these are only installed at a later stage.

Flexibility = future value

In an era in which technology is evolving at a rapid pace, flexibility in logistics real estate is no longer a luxury but an absolute requirement. The extent to which a building can adapt to new technologies, processes or business models increasingly determines its value and lifespan.

A building is future-proof when it is designed to evolve with technological, operational, and market changes without requiring major renovations or high costs. It is not a final product, but a platform prepared for growth, change, and innovation.



FROM STATIC TO ADAPTIVE

Traditionally, logistics real estate is constructed for a lifespan of 20 to 30 years, based on the assumption that its use will remain largely the same. But today we see that:

- Technology cycles are becoming shorter
- User needs are evolving faster
- Legislation and regulations are changing (think of energy consumption or mobility)

A building that is not prepared for this will become obsolete not in decades, but sometimes in as little as five years.

MODULAR CONSTRUCTION AS A STANDARD

In order to be flexible, buildings must be designed and constructed in a modular way. This means:

- Column-free spans and a regular grid that is easily adaptable
- Mezzanine floors that can be expanded or moved
- Preparations for additional docks, loading points or installations
- Floors that allow for extra load capacity for future automation

For example, a warehouse may initially be equipped for manual picking but designed in such a way that it can later be automated with shuttles or AGVs without major renovations. Floor flatness, network infrastructure, and electrical capacity are already in place.

ENERGIE-INFRASTRUCTURE: PREPARED FOR GROWTH

Flexibility also means that the building's energy infrastructure:

- Is scalable (e.g., heavier transformers or space for battery storage)
- Is smartly controlled (smart grid ready)
- Is ready for electric vehicle charging infrastructure, even if it is not installed immediately

This ensures that the building remains relevant, even after the electrification of freight transport or the integration of energy-intensive systems such as cooling installations or automation robots.

INTERNAL RECONFIGURATION

A flexible building is not only adaptable on the outside, but also on the inside. This means that the internal layout can be easily modified:

- Switch between storage types (bulk, rack, mezzanine)
- Adding new zones for return logistics or value-added services
- Easy move of offices or social areas thanks to prefab modules

A good example is an e-commerce warehouse that makes room for seasonal peak picking stations during peak periods, which are then converted back into storage space during quieter periods.



Flexibility ≠ inefficiency

FLEXIBILITY ≠ INEFFICIENCY

A common misunderstanding is that flexible buildings are inherently inefficient. In reality, a well-designed modular and adaptable warehouse can even be cost-saving and operationally efficient in the long term, as it reduces the need for expensive renovations or downtime. Studies and practical examples show that flexibility and efficiency can go hand in hand.

Balance is key. Too much flexibility leads to over-investment in features that are never used, while too little flexibility causes a building to become outdated quickly, resulting in high costs for modifications. The optimum lies in targeted flexibility. A future-proof building is a matter of strategic choices aligned with anticipated developments in processes and technology. Finding this balance is essential to ensure both cost efficiency and adaptability over the long term.

THE INVESTMENT VALUE OF ADAPTABILITY

For investors and developers, this means that adaptive capacity equals value creation:

- Higher long-term occupancy rates
- Less chance of vacancy when changing functions
- Greater appeal to innovative tenants

In due diligence processes, investors are therefore increasingly looking at future-proofing: is the building easy to adapt and is there room for technological growth?

Real estate vs. operational asset

The traditional distinction between real estate (the physical infrastructure) and operational assets (the installations, technologies, and machines inside) is rapidly disappearing. Whereas buildings used to be regarded as fixed entities, independent of the processes taking place within it, we now observe a clear shift towards an integrated platform approach. In this approach, the building is no longer merely a static backdrop, but an active part of an adaptive ecosystem in which real estate and technology are fully aligned.

FROM BUILDING TO PLATFORM

A warehouse or logistics center is increasingly seen as a technological platform:

- A place where data, energy, machines and people come together.
- An infrastructure that can be continuously adapted and updated.
- A carrier of smart technology, rather than just "square meters of storage space."

OPERATIONAL ASSET: FLEXIBLE, SCALABLE AND DOMINANT

Operational assets refer to all flexible technological solutions located in and around the building that are easy to move, upgrade or replace:

- AGVs (Automated Guided Vehicles) and AMRs (Autonomous Mobile Robots)
- Automated picking stations
- Goods-to-man systems
- Plug-in sorting machines
- Charging stations for electric trucks
- Battery packs or solar installations

These systems are designed to be scalable and movable, which means they can be easily adapted to changing volumes, processes or user needs. They can also be easily moved to another building, making them attractive for companies with a high degree of innovation or rapid growth curves.



04. The building of the future

CONVERGENCE: MERGING DESIGN AND OPERATIONS

In the future, the line between real estate and operations will continue to blur. This has major implications for the design, financing, and use of logistics real estate:

- When valuing real estate, investors will not only assess the building itself, but also take into account the technological infrastructure and the plug-and-play capabilities of automation and energy solutions, so that systems can be easily integrated, adapted or replaced.
- Owners and tenants will agree on hybrid models in which buildings and technology are operated together.

For example, instead of simply leasing a building, a developer can also offer a turnkey solution in which real estate, automation and energy supply are delivered as a single integrated package.

Instead of simply renting out a building, a developer can also offer a turnkey solution.

NEW FINANCIAL MODELS

This shift also has consequences for financing structures. This creates room for:

- Asset-as-a-Service models, in which technology is leased in the same way as software (owner-tenant relationship)
- Combined investments, in which buildings and movable property are financed together (owner-external financier relationship)
- Performance contracts, in which both buildings and technology contribute to output targets such as picking efficiency or energy consumption (tenant-end customer relationship)

STRATEGIC ADVANTAGE

or logistics players, this approach to real estate as a dynamic platform offers a strategic advantage:

- Ability to respond more quickly to changes in the market
- Spreading costs over time through flexible technological assets
- Ability to 'scale up' or 'relocate' infrastructure with minimal disruption

It also means that real estate parties that think in terms of functionality—and not just square meters—become more attractive as long-term partners.



Integral project approach: from design to total maintenance

Designing the building of the future does not stop at the drawing board. A truly functional, flexible, and future-proof warehouse requires an integrated project approach that extends from concept to realization, delivery, and full operation.

04. The building of the future



WHY INTEGRAL COLLABORATION IS ESSENTIAL:

Design phase: Architects, engineers, automation specialists and end users work together from day one to optimize both the building and its processes simultaneously. Digital twins and BIM models ensure that flow, infrastructure, and energy supply can be tested in advance.

Realization: Multidisciplinary coordination remains crucial during construction and installation. Construction teams, installation partners, automation suppliers, and energy experts must work closely together to precisely meet tolerance requirements (floor flatness, dock positions, energy grid capacity). Small deviations can have a major impact on the efficiency of automated systems.

Completion: An integrated approach guarantees that the building is delivered turnkey, including operational technology, energy supply and IT infrastructure. Testing, calibrating and coordinating automation systems is done in conjunction with the building installations.

Total maintenance and service life: The concept of “total maintenance” means that the building and loose goods are continuously maintained and updated as a single ecosystem. Predictive maintenance of installations, energy management, software updates for robots and AGVs, and adjustments to the internal layout are planned from an integrated perspective. This ensures that the warehouse remains flexible, efficient, and future-proof throughout its entire life cycle.

Design phase

Realization

Completion

Total maintenance and
service life

Vision for 2035: what will logistics look like in 10 year's time?

By 2035, the logistics sector will have undergone fundamental changes. The traditional world of boxes, forklifts and distribution centers is evolving into a high-tech, connected and sustainable environment in which efficiency, circularity and collaboration are key. Five dominant trends will shape the logistics landscape in 2035.

Fewer people, more intelligence

By 2035, automation will be so widespread that human labor will only play a supporting role in logistics processes. Not only will repetitive tasks such as picking, sorting, or loading be taken over by robots and autonomous vehicles, but processes will also be controlled by AI-driven decision-making systems.

Example: Whereas today a single operator controls multiple AGVs, by 2035 a single AI system will orchestrate an entire warehouse based on real-time demand, stock levels and traffic flows.

Consequence: The role of humans will shift to that of system administrators, process optimizers and exceptional problem solvers. Technical profiles will become scarcer and more important.

In line with Fottner's prediction, the role of humans will remain variable and context-dependent: sometimes controlling, sometimes complementing technology. According to him, acceptance of this dynamic is a key condition for successful collaboration between humans and machines.

Full Electric: Everything runs on electricity

Electrification will have fully taken hold by 2035, not only in the last mile, but throughout the entire supply chain. From warehouse vehicles to long-distance transport, everything will run on electricity from renewable sources. Fuel engines will be a thing of the past.

- Vision of the future: A 100,000 m² logistics hub runs entirely on solar and wind energy, supplemented by battery storage. Charging infrastructure is built into the floor as standard.
- Impact: Energy becomes a central factor in both design and daily operations. Those who do not have a stable, smart energy solution will lose their competitive edge.



By 2035, net zero will no longer be an ambition, but a legal requirement and market standard.

CO²-neutral is the new minimum

By 2035, net zero will no longer be an ambition, but a legal requirement and market standard. Logistics real estate will not only be built to be CO²-neutral, but also operated in this way, supported by smart grids, real-time monitoring, and CO² compensation platforms.

- Smart networks: Hubs share energy with each other via local grids and dynamically exchange capacity based on need and availability.
- Carbon credits are replaced by concrete performance: tracking and optimizing your CO² emissions is an integral part of supply chain dashboards.

Circular becomes mainstream

The linear “build-use-demolish” cycle is giving way to a circular approach to both buildings and technology. By 2035, buildings will be designed with modular elements that are reusable or relocatable. Stand-alone technology such as robotic arms or sorting systems can be easily moved to another building or upgraded without major renovations.

- Practical example: An automated sorting center from 2030 will be moved to another location in 2035 and rebuilt there, thanks to the standardization of building components and installations.
- Materials become data sources: Every component in a building carries a “material passport” that provides insight into its origin, circularity value, and potential reuse.

Interconnected ecosystems: boundaries are disappearing

The boundaries between production, logistics, energy and infrastructure are blurring. By 2035, these domains will be fully integrated into smart ecosystems in which data, goods and energy flow freely and in real time.

- Industry 5.0: Production is moving closer to the customer (through 3D printing and mass customization), and logistics hubs are becoming assembly and distribution points.
- Energy is a shared service: Logistics buildings produce energy not only for their own use, but also for the local network, third-party electric vehicles or surrounding industry.
- Digital twins simulate the entire ecosystem - from demand to delivery - to make predictions and optimize scenarios.

LOGISTICS AS THE NERVE CENTER OF THE ECONOMY

By 2035, logistics will no longer be a passive link in the value chain, but the nerve center of a hyperconnected economy. Logistics hubs will be dynamic, intelligent, CO²-neutral and agile. They will anticipate changes in market demand, energy availability, geopolitics and technology, forming an indispensable backbone for industry, e-commerce and services.

The challenge for today? Start building now with 2035 in mind. Because if you wait for this future to arrive, you'll be too late.

Conclusion: the future starts now

The logistics sector is on the verge of a radical transformation. Whereas concrete, square meters and forklift trucks used to be at the heart of the industry, automation, energy infrastructure and data-driven ecosystems are now taking over. This evolution is not hype, but a structural, irreversible reality that is unfolding at a rapid pace.

Staff shortages, the need for flexible and customer-focused supply chains, geopolitical pressure on global chains and the compelling ambition to operate CO²-neutrally are forcing the sector to fundamentally rethink its infrastructure and investment logic.

Technology is becoming the heart of logistics, energy the blood and collaboration the nervous system.



06. Conclusion: the future starts now

The logistics buildings of the future will no longer be static boxes, but adaptive platforms - designed around processes, tailored to technology and powered by sustainable energy. Real estate is evolving from a generic product to a strategic tool that accelerates business models, enables CO² reduction and offers resilience in a world of change.

By 2035, we will see a logistics landscape in which people are scarce but valuable, electricity from renewable sources is the driving force and buildings are circular in design and flexible in operation. The boundary between 'real estate' and 'technology' is blurring. Only organizations that anticipate this future today will remain relevant tomorrow.

The future of logistics is not just a story of robots or solar panels. It is a story of vision, courage and collaboration. Those who choose future-proof, adaptive and energy-intelligent logistics infrastructure today are not only building buildings - they are also building resilience, efficiency and long-term value.

In short: **the future does not begin in ten years, it begins today.**

From vision to action

The future of logistics requires decisive action today. Are you ready to make your logistics strategy future-proof?

Contact us for a no-obligation discussion about the logistics of tomorrow.



About Heylen Warehouses

Heylen Warehouses develops, leases, and invests in high-quality logistics and semi-industrial real estate in Belgium, the Netherlands, France, and Spain. Since 2002, we have developed over 2.4 million m² of logistics real estate. Our multidisciplinary and experienced team handles the entire development and management process in-house.

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About Heylen Energy

Heylen Energy is the center of expertise for sustainable energy solutions and energy ecosystems. We develop, optimize, and finance integrated energy projects where production, storage, flexibility, and consumption are intelligently coordinated. We provide these solutions both for group companies and external clients.

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About SMART21

Within the Heylen Group, SMART21 is the ecosystem of companies active in intra-logistics automation and technology. We serve as the center of expertise, supporting the group, the companies within the group, and clients with their internal logistics automation challenges.

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