Designing for What's Next: Modular, Software-Orchestrated Automation for Retail

SWISSLOG

TABLE OF CONTENTS

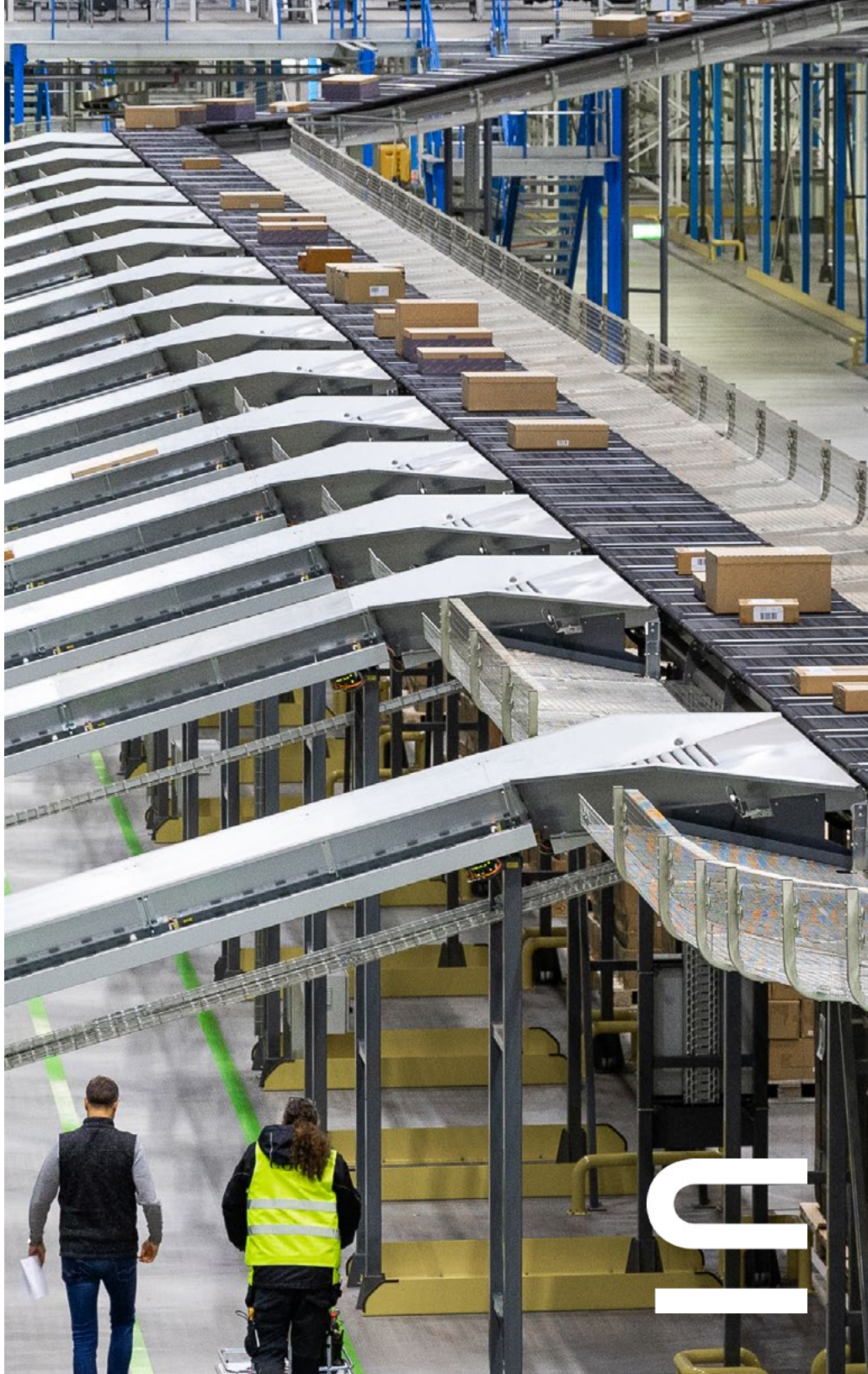
AUTOMATING THE EVOLVING RETAIL SUPPLY CHAIN

To succeed in retail, relevance is everything. And to remain relevant to their targets, retailers must adapt to customers' changing needs. This often leads merchandising leaders and buying offices to make primarily consumer-focused decisions – often leaving supply chain as an afterthought. As a result, retail supply chains often inherit new business conditions with little or no warning – and if they are to succeed, they must be flexible and resilient. Warehouse automation must be optimized not only for speed, efficiency, and service, but also to accomplish those things under a wide spectrum of business conditions. With constant change now a given, overly rigid automation systems come with as much risk as reward. Flexibility in automation has become paramount for retailers who need solutions that can keep pace with business and market evolution.

The changing retail landscape

Retailers have had to navigate a flurry of supply chain changes over the past five years. Those have included disruptions in supply that led to stockouts and backorders, massive SKU proliferation, increased demand volatility requiring rapid scaling of labor, and persistent labor challenges that threatened service levels.

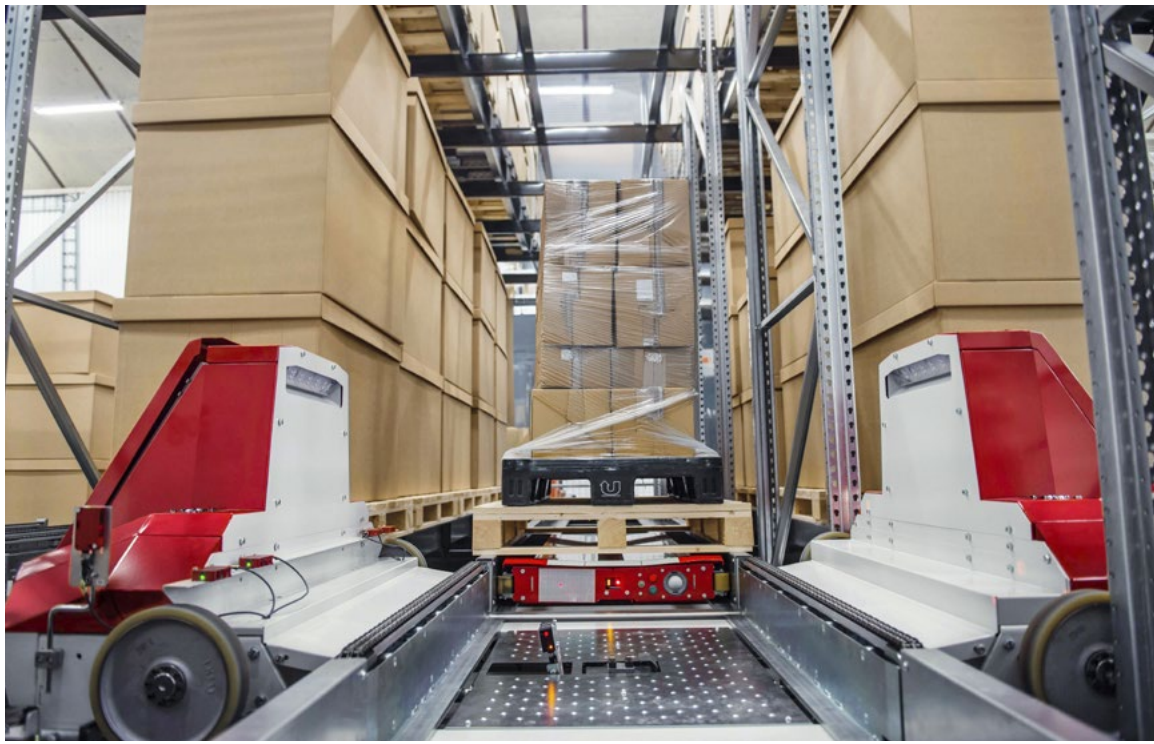
One of the major drivers of this change has been the sharp rise in e-commerce sales, which has fundamentally reshaped fulfillment in the retail warehouse. Rather than larger sellable quantities, such as a case of product, being sent to stores for consumer purchase, the sellable quantity can now be as low as one, with individual items sent directly to the consumer.



One immediate impact was the need to scale up item picking, which exacerbated existing labor challenges. Order cycle times were compressed as consumers expectations for delivery times continued to shrink. And newer delivery options like in-store pickup created opportunities for brick-and-mortar outlets to directly support e-commerce but added complexity to fulfillment operations.

Even store replenishment processes were not immune to e-commerce's impact: reductions in store inventory have led to smaller, more frequent replenishment orders and increased demand for mixed-case pallets.

In addition to these external forces, retailers must also continually adapt to shifting internal demands created by growth, retail network expansion and contraction, and SKU proliferation.



Automation as a solution to changing requirements

These challenges have made automation an essential strategy for retailers seeking to use the supply chain to create a competitive advantage. Automating processes from pallet storage and retrieval to item picking can significantly improve productivity, accuracy, and fulfillment speed, enabling timely and reliable order fulfillment even during periods of peak demand or workforce constraints.

Warehouse automation also enables retailers to alleviate challenges related to SKU proliferation and inventory growth by dramatically increasing both storage capacity and pick face quantity without expanding the physical footprint of the warehouse. In addition, well-designed automation solutions improve day-to-day operations through enhanced inventory management, increased visibility, and enhanced orchestration of materials and resources across processes.

The integration of automation into a facility can make it significantly more efficient, enabling a much higher throughput with the same fulfillment node for a comparable headcount. In other words, automation isn't about reducing headcounts; it's about using your headcount to its fullest potential. By maximizing throughput with automation, a retailer may be able to defer building an entirely new node, for example. Additionally, automation "flattens the curve" of the peak staffing ramp-up: Full-time staff can more gradually increase to greater volume without onboarding thousands of seasonal associates. When seasonal labor is required, automation also drastically shortens the time it takes to make new associates productive.

In short, as the demand for speed, productivity, and efficiency increases, so too does the value of warehouse automation. Yet despite automation's compelling value proposition, operators today understand that investments must do more than address immediate challenges—they must also adapt to future change.

Flexibility emerges as a top priority

Warehouse leaders have just been through a period of rapid and dramatic change and understand that more change is coming—whether driven by external market forces or internal business changes. As a result, flexibility has become just as important as throughput or productivity when evaluating technology investments.

The central question they face today is no longer whether to automate, but how to deploy automation in ways that address current needs without sacrificing future flexibility.

DESIGNING FOR FLEXIBILITY

It isn't unrealistic to expect automation solutions to be designed for the needs of today and tomorrow. But shortcuts in the solution design process can compromise performance and adaptability. The best practices outlined in this chapter help ensure solutions will meet current needs while retaining the flexibility to adapt to future changes.

Understand current and future requirements

Clear business objectives should always be defined at the front end of the process. A well-designed automation solution can typically achieve multiple objectives, but defining and prioritizing objectives early helps guide decisions—including technology selection—throughout the remainder of the process. This is why partnership is so important: an integration partner and a retailer should seek to understand each other's business, experience, and capabilities as deeply as possible to identify the best-fit solution for a retailer's current and future needs. The better the integration partner can understand the nuanced business of the retailer, the better the automation solution will be.

With objectives in hand, solution designers should then take the time to gain a detailed understanding of current material flows and facility limitations, such as available space, ceiling height, and other structural considerations that can influence technology selection.

On the other side of the partnership, the solution designers should seek collaboration and feedback from engineering, operations, and leadership teams to gain a holistic picture of current pain points, lessons learned, and future priorities. Most importantly, designers should thoroughly analyze current and historical data—including inventory levels, order profiles, SKU characteristics, and order patterns—to tailor solutions to operational requirements. For true flexibility, this analysis should also factor in projections for future volume growth, throughput, and storage needs. Some leading automation technologies today provide the ability to decouple throughput and storage when scaling the solution, providing an additional level of flexibility.

Build with modular technologies

Legacy automation technologies built around fixed hardware and rigid configurations struggled to adapt to changing requirements when e-commerce volumes spiked. For example, early-generation pick modules picking to tilt-tray sorters are difficult systems to change to accommodate massive swings in order profile. Modular and robotic automation technologies are inherently more flexible.

Modular designs allow hardware and software to be configured, expanded, or upgraded more cost effectively and with less disruption to operations—giving retailers more options to respond to growth or new fulfillment models. This trend is present in automation technologies that extend across the warehouse:

- Goods-to-person automation solutions bring orders directly to pickers via modular storage and robotic delivery systems, making it simple to add or reconfigure modules and pick stations for greater capacity and faster throughput. Light-goods cranes and shuttles, cube-based storage systems like AutoStore, and mobile robotic systems all support goods-to-person picking, depending on varying facility and performance requirements. These goods-to-person solutions can also be paired with downstream sortation, such as push-tray sorters, pouch sorters, or robotic sorters like T-Sort, to unlock batching potential and to further increase resilience in the face of changing business conditions.
- Pallet storage and retrieval solutions feature scalable modules that enable operators to add capacity or increase throughput as facility needs evolve, accommodating growth without major rebuilds. Stacker cranes and pallet shuttle systems efficiently handle pallet storage and retrieval in diverse temperature environments. Cranes are well-suited for facilities with a wide range of SKUs, while shuttles are ideal for high-density, high-throughput operations with fewer SKUs.
- Robotic palletizing cells for layered or mixed-case palletizing and depalletizing can be added to shuttle systems to enable the transition from manual to automated palletizing and can be incrementally expanded or reconfigured to support higher SKU counts, faster picking, and new order profiles.

By building solutions around modular components and configuring those solutions to enable expansion, automation can be sized for current needs without compromising future growth.

Goods-to-person picking

Pouch sorter system

Shuttle storage and retrieval system

Leverage digital simulations early in the process

Solution designers today have access to virtual tools that allow them to model and stress-test warehouse automation designs in ways that weren't possible in the past. Using digital simulations early in the process enables design teams to analyze proposed solutions, test how a system will respond to growth or operational disruptions, and pinpoint areas of vulnerability in complex workflows.

With the ability to accurately model precisely how the solution will respond to various scenarios, designers can both optimize performance and availability under current conditions while running "what-if" scenarios focused on future flexibility.

Optimize the solution lifecycle

From an operator's perspective, it can be difficult to look beyond installation and commissioning when considering an automation partner's support capabilities, as these represent the first real-world test of a solution. However, planning service requirements beyond this phase is essential to ensure the solution meets expectations for long-term performance, availability, and adaptability.

Beyond rapid-response software support and a full range of maintenance options, automation providers should have the expertise and resources to deliver a full suite of services for phased implementations, upgrades and retrofits, and equipment expansions. Integration partners can best serve their customers long-term by dedicating customer support resources to guide them through analysis, optimization, and, if necessary, the quoting and deployment of physical improvements to their system. Strong integrator support is one of the best ways to ensure a long system life—and a long-lasting partnership. By providing a suite of services to meet varying customer needs, such as hotline support, escalation support, recurring field visits, resident expert technicians, and full-blown onsite resident maintenance staff, integrators provide customers with options for support when and how they need it.

TRANSFORMING FLEXIBLE DESIGNS INTO REAL-WORLD SOLUTIONS

Today's automation solutions often bring together multiple technologies into a comprehensive solution spanning processes, amplifying the need for flexible and configurable hardware and modular software. This chapter presents three such projects designed and integrated by Swisslog.

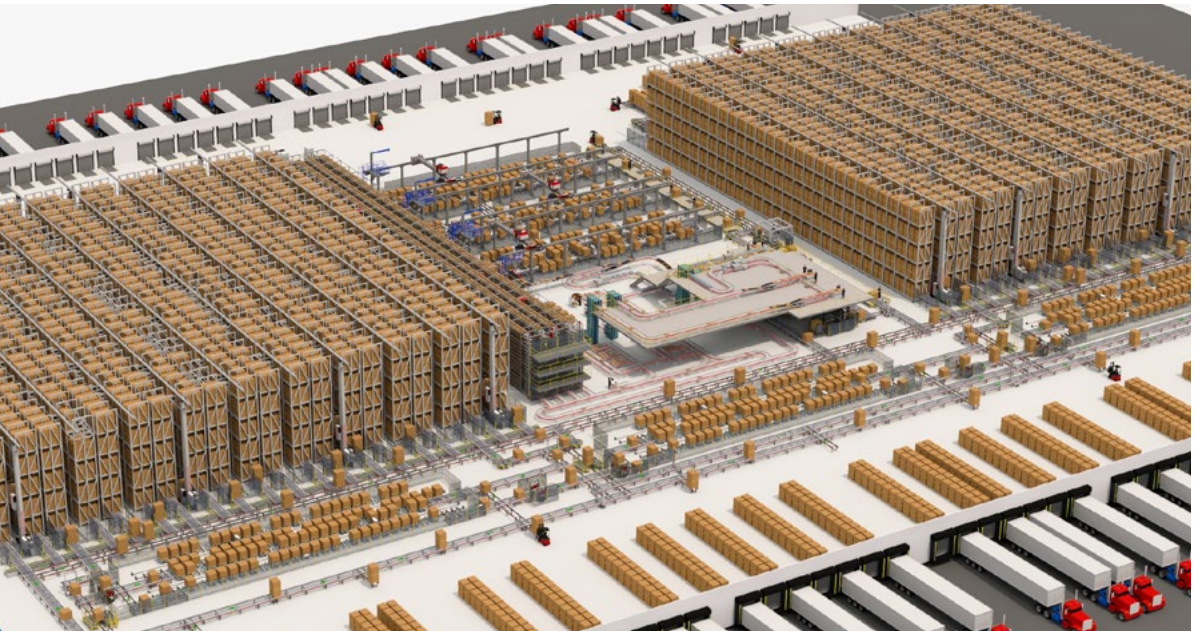
Designing in scalability for fast-growing wholesale club

Solution Summary

Designed-in expansion paths (e.g., adding robotic palletizing later) and centralized orchestration via SynQ ensure the system adapts as replenishment mixes change.

Requirements

BJ's Wholesale Club needed to expand distribution capacity to support rapid club and membership growth and ensure reliable inventory availability and replenishment for its network. This greenfield project needed to replenish 110 clubs with full pallets, layered pallets, and mixed-case pallets while also supporting e-commerce operations.



Key Design Considerations

- Optimize density and distribution of full pallets, which account for majority of replenishment orders
- Enable automated production of mixed-layer pallets, which account for a growing percentage of replenishment orders
- Optimize manual production of mixed-case pallets, which represent a small percentage of current replenishment orders
- Enable streamlined integration of robotic palletizing if volume of mixed-case orders grows
- Prepare for future growth in capacity and throughput and changing order profiles
- Enable timely and frequent store replenishment to optimize store inventory

Swisslog Solution

For this project, Swisslog integrated its Vectura stacker cranes, ProMove pallet conveyors, CycloneCarrier case shuttle, and layer picking cells under the centralized control of SynQ software. The Vectura-powered pallet ASRS optimizes storage density and throughput while supporting automated layer picking. CycloneCarrier buffers and sequences cases to optimize manual production of store-friendly pallets, with the option to add robotic palletizers at a later date. The entire project was designed to ensure flexibility for future expansion and evolving supply chain demands.

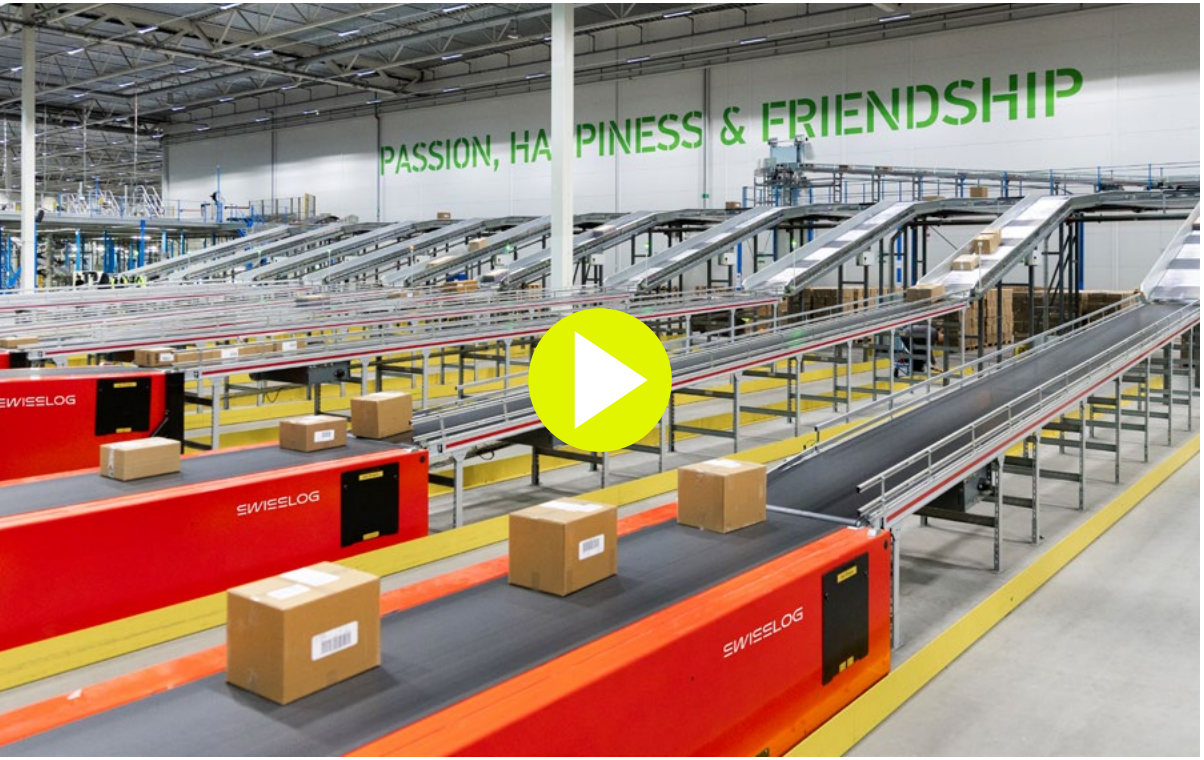
Building on success to support e-commerce growth for fashion retailer

Solution Summary

Separating store replenishment and e-commerce under one software spine demonstrated how throughput can be scaled without compromising flexibility.

Requirements

More than ten years ago, Varner AS, one of Scandinavia's largest fashion retailers, centralized its logistics into a highly automated warehouse to improve competitiveness and support omnichannel fulfillment for stores and e-commerce. As both overall order volumes and e-commerce orders have grown rapidly, Varner identified the need to separate store replenishment and e-commerce fulfillment so both could be fully optimized.



Watch to see Varner's automated fulfillment center in action.

Key Design Considerations

- Support omnichannel growth with dedicated automation for store and e-commerce fulfillment
- Increase order processing speed and delivery precision for both stores and online customers
- Enhance product availability, delivery accuracy, and service quality while reducing lead times
- Provide flexibility and scalability to manage demand fluctuations and future growth
- Leverage ergonomic and energy-efficient design for sustainable operations
- Ensure efficient handling of returns and hanging garments alongside cartons

Swisslog Solution

The original Swisslog solution featured high-bay pallet warehouses, conveyors, mini-load cranes, and an AutoStore system for goods-to-person item picking for store replenishment and e-commerce. As e-commerce demand surged, Swisslog worked with Varner to expand the facility, adding a second, larger AutoStore system and additional mini-load cranes—all managed by Swisslog SynQ software for seamless material flow and process orchestration. The first AutoStore now serves 1,200 stores, while the new grid is dedicated to e-commerce, empowering Varner to process up to 7,500 order lines per hour and adapt operations dynamically to future business needs.

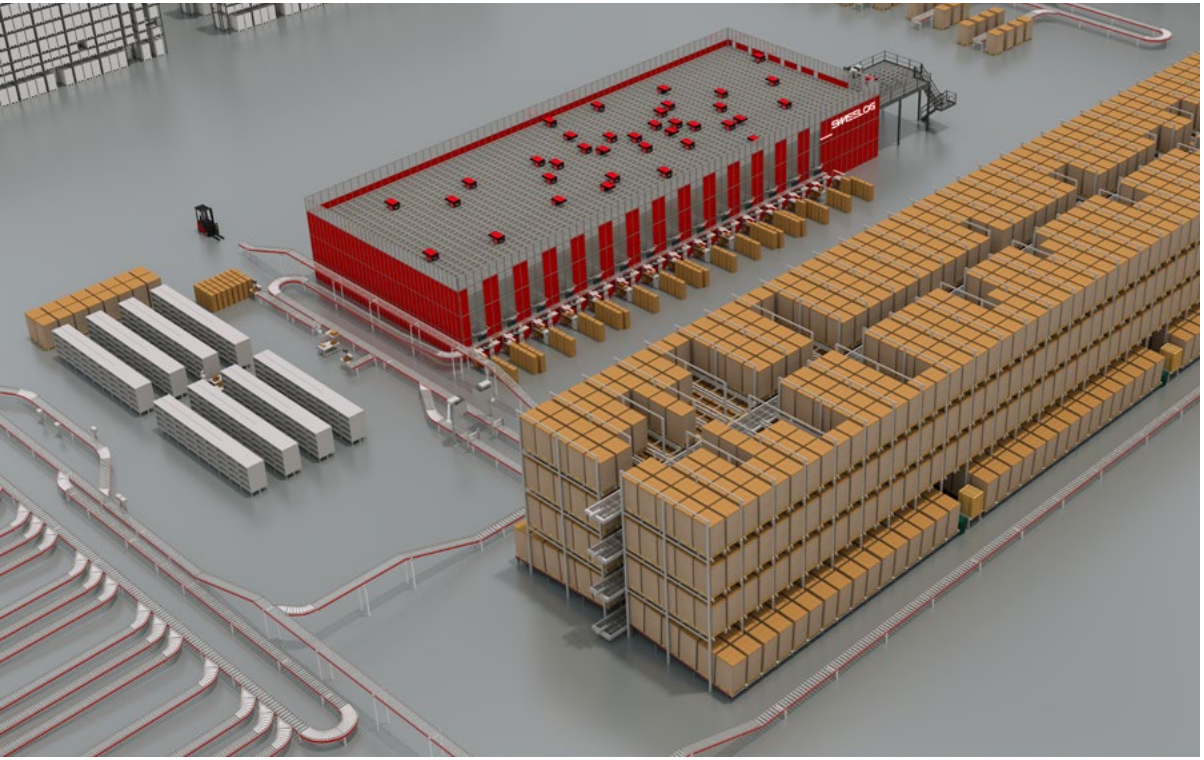
Consolidating retail distribution to leverage economies of scale

Solution Summary

A blueprint driven, modular design cut operating cost and set up controlled growth (SKU variety, faster fulfillment) under a single WES.

Requirements

Sun Taiyang Co., Ltd., a leading distributor of hair and beauty products, needed to consolidate distribution for three of its brands into a single automated fulfillment center, enabling scalable growth and improved service for both retailers and salons. This greenfield project represents Sun Taiyang's first automated warehouse, with the goals of centralizing operations, supporting future expansion, and accelerating order fulfillment with improved efficiency.



Key Design Considerations

- Consolidate distribution for three brands into one facility for operational efficiency
- Enable active, high-density storage and fulfillment for each picking and case picking
- Support direct-to-consumer e-commerce as SKU counts and order profiles expand
- Integrate advanced conveyance and automated outbound processing for speed and accuracy
- Improve worker satisfaction and retention
- Achieve cost reduction, agility, and centralized management through full-site automation

Swisslog Solution

Swisslog delivered an integrated solution featuring an AutoStore system for active storage and picking, PowerStore pallet shuttle for high-velocity pallet storage and picking, and a full suite of light-goods and pallet conveyor systems. Automated print-and-apply labeling, carton sortation, and outbound validation streamline order processing, while SynQ WES coordinates all material flows within a single platform. The centralization of three former DCs into this automated site is projected to cut annual operating expenses by 33%, boost employee engagement, and provide a same-day shipping option for orders placed before 2 PM. The modular design and SynQ-enabled orchestration ensure Sun Taiyang is well-positioned for future growth, supporting higher SKU variety, faster fulfillment, and continued growth.

NEXT STEPS

Selecting the right automation partner is critical to ensuring retail warehouse solutions remain flexible and ready for future demands. The partner's expertise, support, and technology portfolio provide the foundation for scalable systems that evolve with shifting business needs.

Swisslog offers proven expertise in engineering, implementing, and supporting modular and future-ready automation solutions tailored for retail and omnichannel distribution.

Drawing on decades of retail automation experience, our technology portfolio extends from pallet handling through item picking, with multiple technologies for each process, allowing automation technology to be matched to throughput, density, and productivity goals. Our modular SynQ software platform can manage automation and processes across the warehouse with the capability to operate as a WMS, WES or WCS, depending on application requirements. And our design and implementation processes consistently deliver flexible retail automation solutions, on time and on budget.

If you are ready to make the move to warehouse automation or have outgrown your legacy automation solution, contact us to learn more about how we can help.

To connect with one of our specialists, contact Swisslog.