bricz PLAYBOOK

Warehouse Robotics Implementation

A Supply Chain Perspective

Executive Summary

The playbook highlights project lifecycle for warehouse robotics implementation project and provides key integration touchpoints for a successful roll-out of robots in the warehouse.

Warehouse Robotics Project Lifecycle

Warehouse robotics implementation project involves a variety of stakeholders including operations, business, robot vendors, software vendors, training, and technology teams. With such a dynamic team, it is imperative to have a structured approach to robots' deployment to ensure business continuity. The below five-phase approach helps to provide structure.

1. Project Initiation
2. Deployment Planning
3. Install and Integrate
4. Test and Train
5. Deploy

Key Integration

Robots in the warehouse are designed to do a variety of tasks, hence it is important to have a seamless flow of information between robots' systems and existing systems to execute a specific use case. This playbook describes key integration touchpoints based on the solution.

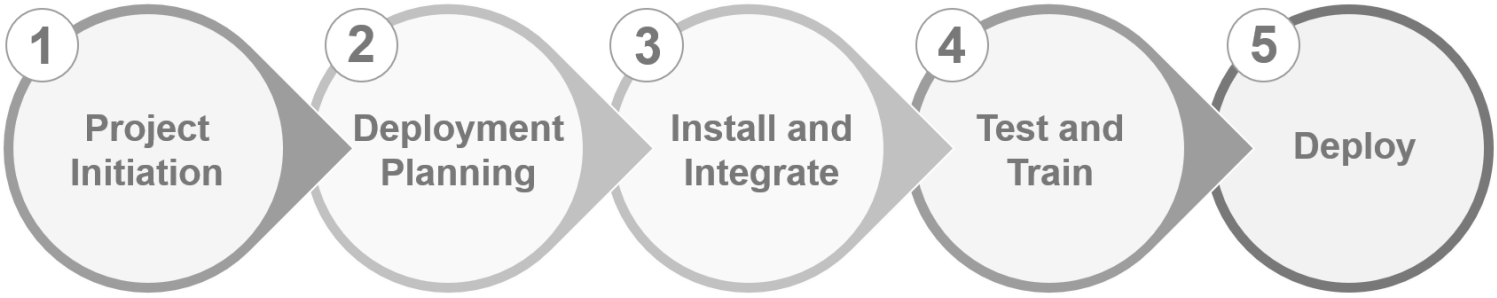
Solution: Person-to-Goods AMRs
Solution: Goods-to-Person AMRs
Solution: Robotic Arm Sortation (RAS)

In conclusion, the playbook aims to be the first guide for implementing robotics in the warehouse.

With an exponential increase in robot deployments in warehouses, Bricz has designed a playbook to help understand the warehouse robotics project lifecycle and key integration touchpoints. This playbook should be used as a guide for your warehouse robotics project. The playbook describes key phases in the warehouse robotics project lifecycle followed by key integration touchpoints based on solutions like Person-to-goods AMR solution, Goods-to-person AMR solution, and Robotic Arm Sortation.

Warehouse Robotics Project Lifecycle

Implementing robots in the warehouse usually follow below five-phase process:



1 Project Initiation Phase

Warehouse robotics project initiation is an important step in establishing and level setting the goal of the project, defining roles and responsibilities, timelines, and final deliverables. Below are three main tasks that should take place during this step, not limited to,

- *Establish the scope of the project*
- *Establish deliverables, KPIs, and timelines*
- *Establish team members, roles, and responsibilities*

2 Deployment Planning Phase

As a next step, the operations and robot deployment team need to strategize the robot deployment plan and visit each site, in case of a multi-site project. The goal of this step is to build a comprehensive list of items that need to be addressed per site and sequence of site roll-out in case of a multi-site project. The list can be categorized into areas like facility layout redesigning, physical infrastructure needs, technology needs, HR needs, health and safety standards, and similar items. Robot vendor's team can guide and help navigate many of these conversations. At a high level, this step encompasses:

- Visit deployment site
- Establish any facility re-configuration or re-designing needs including
  - *Installation of robot readable location barcodes*
  - *Opening space to install chargers, induct queue, unloading queue and similar*
  - *Review Network and Wi-fi connectivity*

3 Install and Integrate Phase

This step is resource-intensive delivering initial deliverables for the project. This step can be divided into two parallel workstream – install and integration workstream.

Install Workstream

Install workstream will prepare the site for robot installation by installing network upgrades, free-up space for robots, and peripherals followed by robots being deployed. Tasks include, not limited to,

- Install any additional network and wi-fi needs
- Setup robots and peripherals at the site
- Map creation - for AMR solutions
- Test
  - Robot navigation in case of AMR solution
  - Degrees of freedom in case of robotic arm

Integration Workstream

Robots are execution systems acting based on the information provided by WMS or WES system hence it is critical to have a seamless integration between existing systems and robotic systems. Based on industry knowledge and experience, we recommend below task as minimum tasks to ensure seamless integration.

- Establish middleware/communication method between robotic system and WMS
- Establish business workflow
- Establish integration design
- Develop integration
- Unit test integration

4 Test and Train Phase

As with any system implementation, testing the system and training workforce on the system is an essential step towards deployment. Overarching tasks include, but not limited to,

- Perform integrated end-to-end testing including robots
- Execute all use cases, edge cases and exception handling cases
- Train associates on the new system (using train-the-trainer and/or shadowing method)

5 Deploy Phase

The project proceeds to this step once testing and training have been concluded to ensure all business flows, exception handling is addressed systemically and operationally. This step comprises of two major tasks:

- Roll-out robots to production flow
- Monitor the production

Key Integration

Integrating robotic systems with existing software systems is crucial for the successful implementation of robots in the warehouse. Below are key integration touchpoints based on solutions being implemented.

Solution: Person-to-Goods (PTG) AMR

Vendors: Fetch Robotics, Locus Robotics and similar

Integration	Direction	Description
Wave and Release (picking task download)	WMS/WES to PTG system	Information flow from WMS/WES to the PTG system with data related to picking tasks. Data points can be order number, order line, LPN, item, quantity, destination location, pick location, LPN labels, and any corresponding data point needed for AMR to complete the pick task.
Induct totes/containers	PTG system to WMS/WES	When an LPNs are associated with an AMR, AMR will transmit the information to WMS/WES for each LPN.
Picking	PTG system to WMS/WES	For any inventory picked against the need, AMR will transmit the information to WMS/WES to confirm the pick.
Pick Complete	PTG system to WMS/WES	Once all the inventory need is fulfilled, AMRs will transmit picking complete message for the LPN.
Tote/container transfer	PTG system to WMS/WES	PTG system will transmit new robot id to WMS/WES in case LPN is transferred between AMR

Solution: Goods-to-Person (GTP) AMR

Vendors: GreyOrange, Geek+ and similar
Use Case: Picking and Packing

Integration	Direction	Description
Item Download	WMS/WES to GTP System	WMS/WES to send metadata related to inventory that will be handle by the system. It can include item desc, product attributes, size, uom, and similar data points.
Wave and Release (picking task download)	WMS/WES to GTP System	Information flow from WMS/WES to the GTP system with data related to picking tasks. Data points can be the order number, order line, priority, LPN, item, quantity, LPN labels, and any corresponding data point needed for the GTP system to complete the pick task.
Picking	GTP system to WMS/WES	GTP system will bring the robot to picker to pick inventory against the need. Picker will confirm the pick and GTP system will transmit the information to WMS/WES.
Packing	GTP system to WMS/WES	Once LPN is packed. GTP system will transmit packing complete message to WMS/WES.
Replenish/Put	WMS to GTP system	WMS/WES will direct items, quantity that needs to be put into the GTP system for subsequent picking. Integration is needed to ensure enough inventory is available for picking.

Use Case: Parcel Sortation

Integration	Direction	Description
Dimensional Weight Scale	GTP system to WMS/WES	Transmission of dimensional weight for an accurate parcel shipping price.
Induct	GTP system to WMS/WES	Once the package is loaded on the AMR, induct confirmation message will be transmitted to WMS/WES with robot number that is doing the induction
Sort Confirmation	GTP system to WMS/WES	Once the package is sorted to a shipping container, sort confirmation is sent to WMS/WES.

Solution: Robotic Arm Sortation (RAS)

Vendors: Kindred AI, Righthand Robotics and similar

Integration	Direction	Description
Order Add	WMS/WES to RAS	At the time an order is waved, if all items on the order are eligible, and the full order can fit inside the cubbies used by the robotics arm sortation, a message with the order number, SKUs, and quantities is sent.
Order Delete	WMS/WES to RAS	If an order that is RAS eligible bypasses the arm and is sorted and packed manually, WMS informs the RAS system that the order and its details can be removed from their database (to prevent data buildup)
Unit LPN Pick	WMS/WES to RAS	When a unit is picked and a unit LPN is applied, the picking system sends the unit LPN number, the order number, and either the SKU or the order line number. This lets the RAS system know that the unit LPN is tied to a specific order
Put/Sort Complete	RAS to WMS/WES	Once the RAS has completely sorted the order to a cubby, a message is sent with the order number and the cubby number for visibility
Cubby Cleared	RAS to WMS/WES	This message is generated when a user pulls the order from a cubby and confirms via the mechanical button on the RAS machine that the cubby is cleared. This message can contain any detail needed, but it is typically used for labor tracking only.

Conclusion:

The implementation of robots in the warehouse can be a daunting task due to accelerated timelines and multiple stakeholders. The playbook may not be exhaustive of all tasks and integrations that may take place during the implementation, but it provides a good high-level view to proceed with confidence in the warehouse robotics implementation project.