

4 FUTURE VISION

Throughout this report, we have seen many important improvements in robotics technology, along with clear evidence that robots are now starting to enter the world of logistics. In the preceding chapter, we explored the innovative new technologies that, with further development, could soon be ready for full-scale testing. So looking ahead, in this chapter we consider what will happen when these latest technologies mature and become widely available. The following is one possible snapshot of our future.

4.1 Distribution Centers

Compared with the distribution centers of today, the robotic warehouses of our future are likely to improve in almost every metric. These highly scalable facilities will be more flexible and faster to relocate; they will achieve higher productivity with increased quality.

New operations will incorporate different types of robot each with a specific job to perform such as unloading trucks, co-packing, picking orders, checking inventory, or shipping goods. Most of these robots will be mobile and self-contained but they will be coordinated through advanced warehouse management systems and equipped with planning software to track inventory movements and progress orders with a high degree of accuracy.

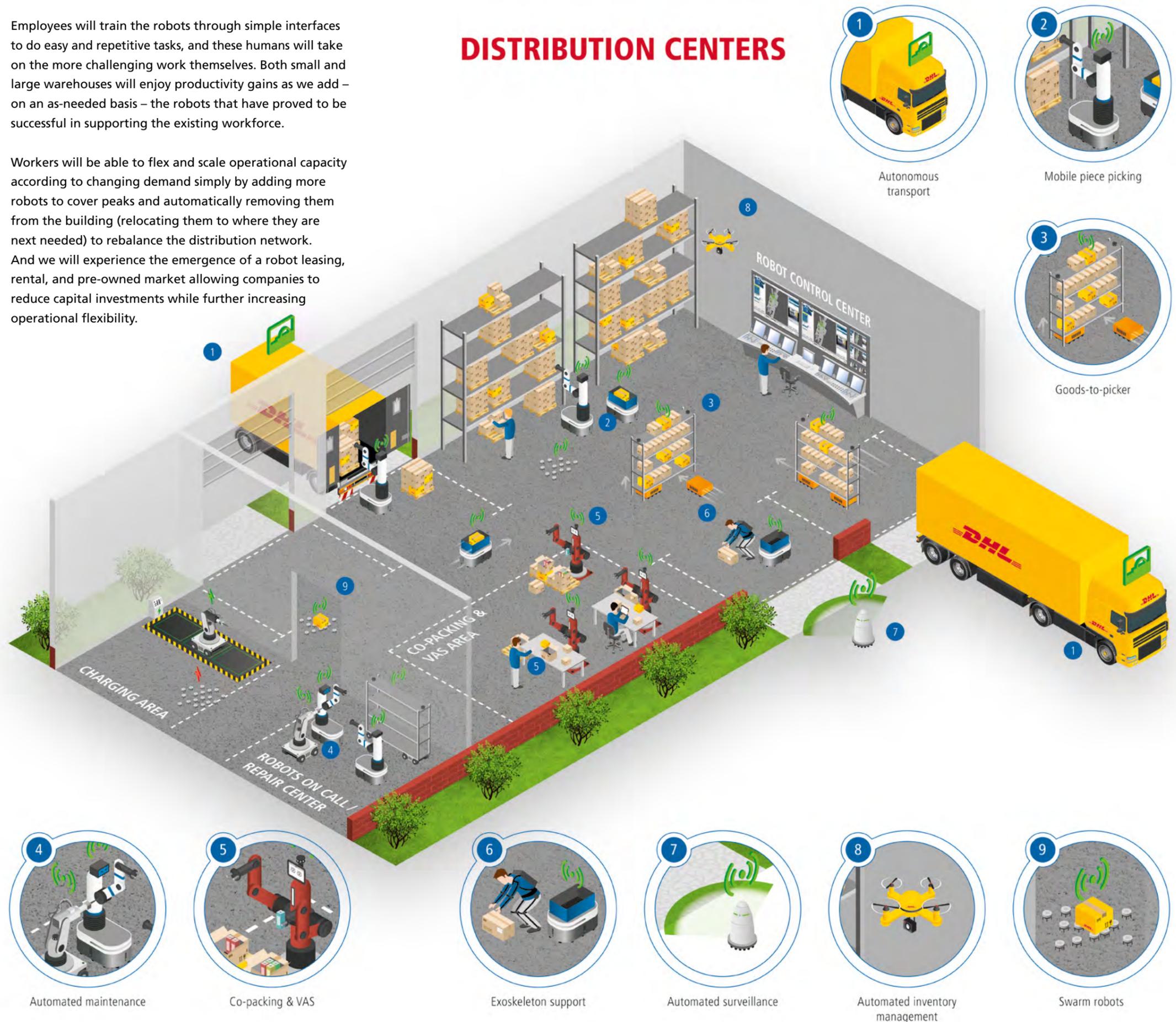
Overall reliability will increase because there will be fewer 'single points of failure' in each distribution center. As each robot acts as an individual unit, we will be able to quickly push it to the side if it breaks down and replace it with another unit from the robot fleet. Depending on the problem, we will be able to fix the broken robot on site or send it to a central repair facility. The new robot will be connected to the cloud so it will automatically download the knowledge needed to take over from its decommissioned counterpart.

Warehouse workers will be given more responsibility and higher-level tasks such as managing operations, coordinating flows, fixing robots, and handling exceptions or difficult orders. They will wear exoskeletons to help them lift heavy goods with less strain, fatigue, and chance of injury. When necessary, we will bring goods into a co-packing area where collaborative robots will work safely alongside highly skilled warehouse employees to transform basic products into new items customized for individual orders.

Employees will train the robots through simple interfaces to do easy and repetitive tasks, and these humans will take on the more challenging work themselves. Both small and large warehouses will enjoy productivity gains as we add – on an as-needed basis – the robots that have proved to be successful in supporting the existing workforce.

Workers will be able to flex and scale operational capacity according to changing demand simply by adding more robots to cover peaks and automatically removing them from the building (relocating them to where they are next needed) to rebalance the distribution network. And we will experience the emergence of a robot leasing, rental, and pre-owned market allowing companies to reduce capital investments while further increasing operational flexibility.

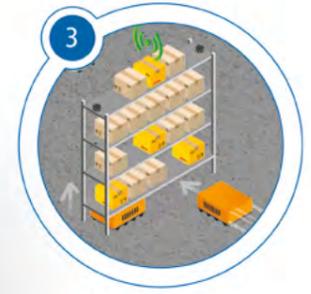
DISTRIBUTION CENTERS



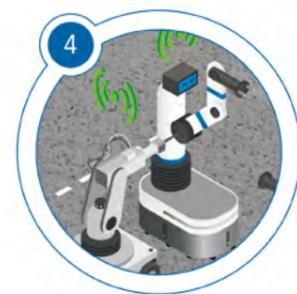
Autonomous transport



Mobile piece picking



Goods-to-picker



Automated maintenance



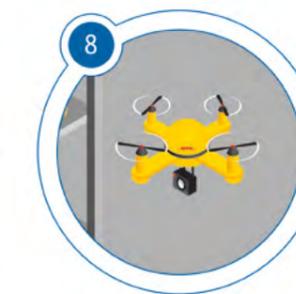
Co-packing & VAS



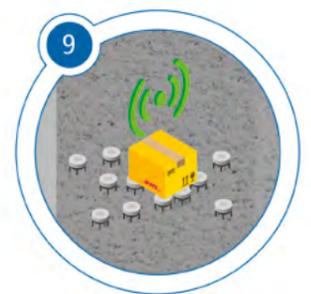
Exoskeleton support



Automated surveillance



Automated inventory management



Swarm robots

4.2 Sorting Centers

Unlike today, the sorting centers of the future will run continuously, 24 hours per day, to better align with the distribution centers that will also operate around the clock. Robotic warehouses and sorting centers will be just as effective on the last shift as they are on the first shift. Working in waves, the new supply chain will facilitate multiple shipments to end customers each day. By fully utilizing equipment across shifts, we will be able to lower logistics costs and, by processing multiple daily delivery waves, we will achieve faster service to end customers. Goods will be brought to the sorting center by self-driving trucks. These will arrive according to specific scheduled timeslots, and we will be able to efficiently control truck movements onto and around the yard using GPS and a yard management system.

When a truck arrives at the dock door, robots will unload it and sort the parcels according to final destinations. There are several possible approaches to accomplish this. For example, we could think of using a large number of mobile robots to transport the parcels from inbound dock doors to the appropriate loading areas. Each mobile robot would be loaded with parcels by a robotic arm; it would then group and sequence itself with other mobile robots to efficiently transport loads throughout the sorting center. When a truck arrives with dangerous goods, these will be automatically sorted, handled, and transported separately and securely. All of these tasks will be supervised by employees working in a robot-control center; these humans will address any issues, manage workflows, and make key operational decisions. Employees will also handle any exception parcels such as items that require repacking, relabeling, or a customs check.

When leaving the sorting center, most parcels will be loaded by robotic arms into line haul trucks which take them to the next sorting center in the network. Some items will be loaded into drones for airborne delivery to hard-to-reach addresses. Local delivery items will be loaded into mobile parcel robots which take them to individual homes in the surrounding area. And if the recipient is a high-priority customer, they will be able to send their personal self-driving vehicle to the sorting center; they can continue with their busy day elsewhere while their parcel is placed automatically into the trunk. It's clear to see that the advantages of these futuristic sorting centers – speed, flexibility, higher productivity, and more – will translate into better service for end customers, achieving faster delivery at a lower cost.

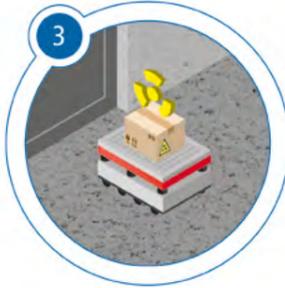
SORTING CENTERS



Automated maintenance



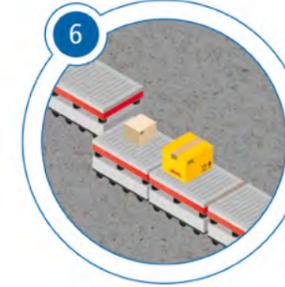
Autonomous maneuvering



Dangerous goods handling



Container loading & unloading



Swarm conveying



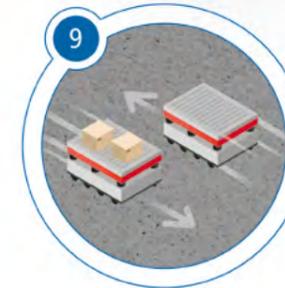
Autonomous replenishment



Autonomous delivery fleet



Autonomous trunk delivery



Swarm sorting

