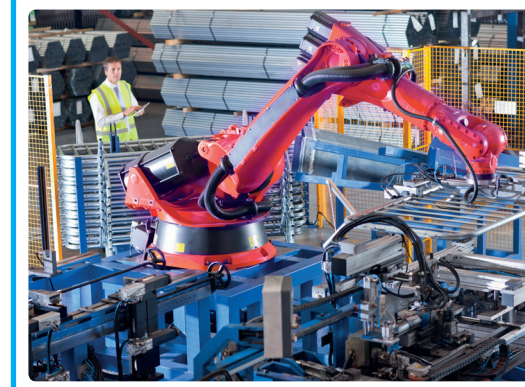


FUNDAMENTALS

Inside the walls of smart logistics

The logistics industry is seeing increased investment, driven by technology trends including automation and smart manufacturing. We analyse how the growth in e-commerce has led providers to embrace technology to drive efficiencies and contain costs.



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Much has changed in recent years. Newspapers are full of stories about vast underground and submerged warehouse plans, not to mention the prospect of airships being used as fulfilment centres. Retailers and distributors are under increasing pressure to deliver consumer products within narrower time frames. The introduction of weekend and 'next-day' deliveries has caused the industry to shift its thinking, and particularly to embrace new technologies in order to offset the incremental costs incurred in meeting these increased expectations for speed, accuracy and precision. From automotive through to food and health science, each sector has its own challenges, but at the centre of it all is the humble warehouse. Warehouse space is increasingly a key differentiator, with fundamental

changes to its size (bigger), its location (closer), and its contents (smarter).

MY SHED IS BIGGER THAN YOURS

The retail sector is at the vanguard of these changes as it grapples with the fulfilment challenges of e-commerce. Most warehouses were built before e-commerce took off, and with online sales approaching 20% of all retail sales, companies are trying to get closer to their consumers by delivering quickly and efficiently. Simplistically, the big change is more inventory being held centrally (and less in stores), with each online retail sale typically requiring up to three times more space than traditional offline sales. For example, Legal & General recently partnered with Amazon to fund the construction of their largest purpose-built multi-

level warehouse outside of the US. At 2.1m sq ft, the facility in Tilbury is also one of the largest logistics buildings in Europe.

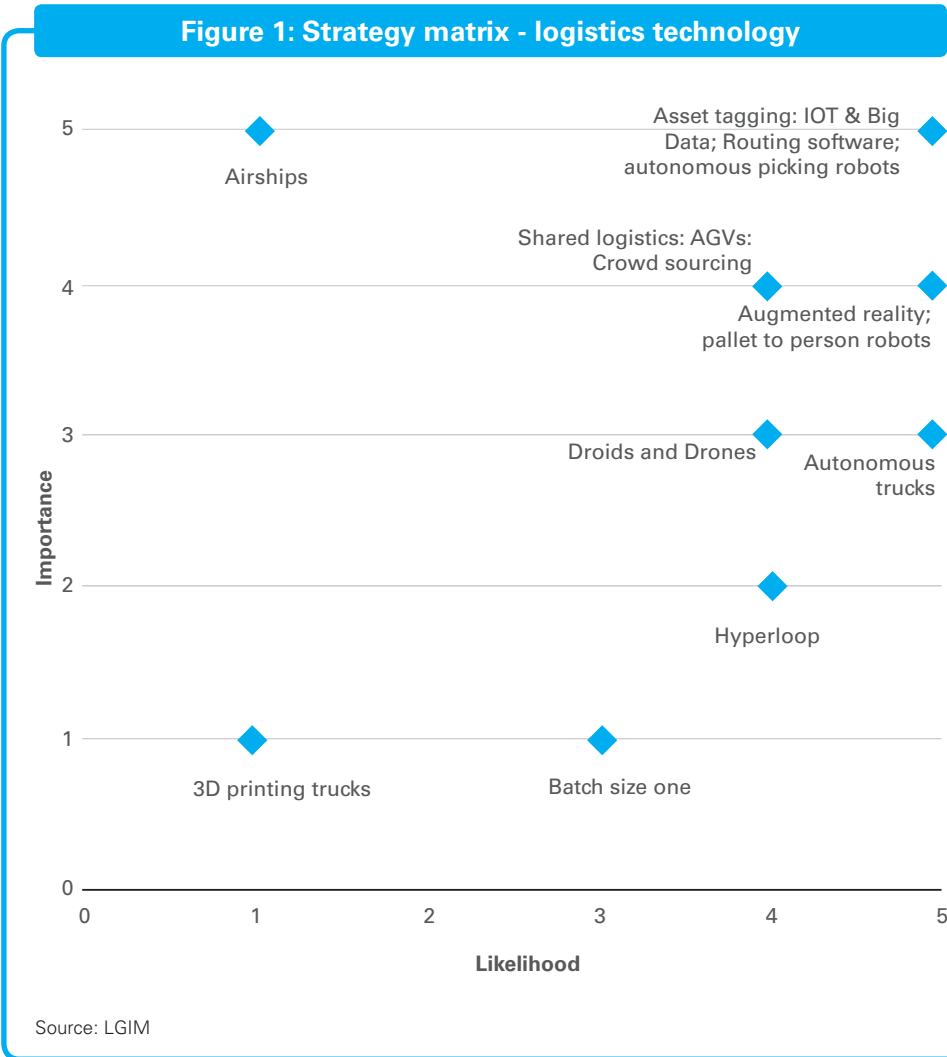
Location is equally critical, Tilbury being within delivery distance of the largest conurbation in Europe. As of 2017, 44% of Americans live within 20 miles of an Amazon warehouse, versus only 5% in 2015 - a dramatic change in just two years. It's not just Amazon either: take-up space by retail operators has increased significantly over the past few years

and they accounted for almost 60% of all warehouse take-up in in the UK in 2016. As logistics buildings get sited closer to consumers, the buildings themselves need to expand vertically to be viable in more densely occupied regions and cities. Sheds are getting bigger, coming closer, and even growing taller, with significant implications from a real estate perspective, affecting optimal location, asset specification, lease length, obsolescence risk and the amount of space required.

SIZE ISN'T EVERYTHING

Size and location aren't the only things changing rapidly. What goes inside the warehouse is also evolving fast, primarily to counter the cost conundrum of personalised picking and packing. A recent DHL survey shows that 85% of warehouses are still manually operated with 10% semi-automated and just 5% highly automated. This is starting to change, however, with analysis from CB Insights indicating technology funding into global supply chains and logistics has increased more than four-fold in the last few years, rising from \$921m in 2014 to \$4.2bn in 2016.

Not all innovations will transition from headline-grabbing to picking and packing. We sifted through a variety of innovations, from the futuristic – like drones or autonomous trucks – to the less exciting but still important – such as data management systems, to rank the technologies by potential impact and likelihood of widespread adoption in the next 5 to 10 years, as shown in figure 1.



In the top right are some of the most important components required to solve the cost conundrum of logistics: automation, robotics and software. Goldman Sachs estimates the total addressable market for these three warehouse technologies to be close to \$30bn, which partly explains the high number of acquisitions in these spaces in recent years.

ACQUIRING THE NEW TOOLS OF THE TRADE

The acquisition of Kiva by (you guessed it) Amazon in 2012 kick-started a run of consolidation. Kiva Systems, developed out of the

ashes of a 1990s online grocery failure, was an early pioneer of the robotic ‘goods to man’ warehouse process, using ultrasonic sensors to navigate around the warehouse. Five years on, Amazon can count on an army of over 45,000 robots at work in its fulfilment centres, equating to a 20% cut in its warehouse operating costs in the US. Their primary function is to bring the products to the pickers, in order to prevent the pickers walking to the products. This is a simple and fairly capital-light solution to a problem that is particularly acute for Amazon and its myriad collection of different products.

ROBOTS GET PICKY

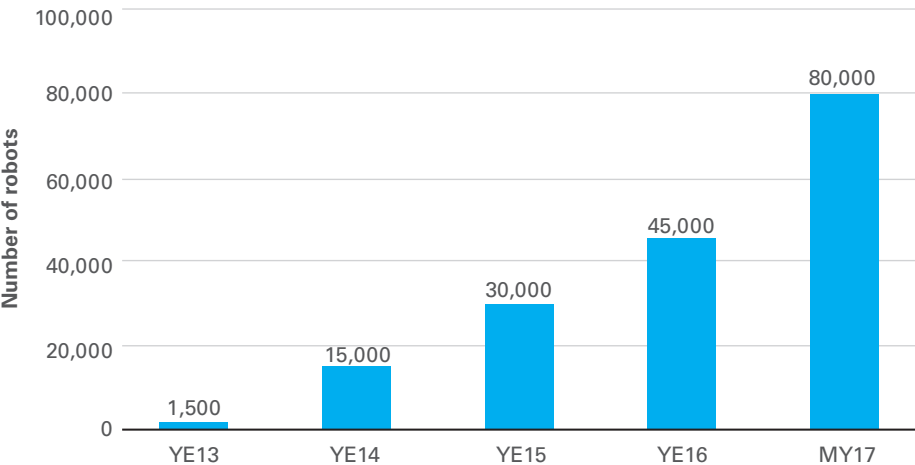
Amazon isn't the only one investing in robotics. Ocado, the online grocer, developed an automated warehouse in Andover where robots move at four metres per second, five millimetres from each other above a grid, storing and retrieving crates stacked within the grid, all connected via 4G telecoms technology. In addition, they have also prototyped this year a fruit-and-vegetable robot picker, which combines computer vision with control. In the future it will be able to distinguish fruit ripeness through machine learning!

Another fascinating technology comes from the US-based IAM Robotics, which developed a robot with a suction arm, able to autonomously move to a stack and pick items weighing up to 7 kilograms. Autonomous packaging solutions are also being tested. Amazon has recently been granted a patent for a system in which items are loaded onto trays, which robotic arms then move to the appropriate box for shipment, thus reducing packaging waste and customer frustration. The investments are happening, but it isn't entirely resulting in labour substitution just yet: Amazon still plans to hire 50,000 new workers as part of its fulfilment expansion before the holiday shopping season, with many of them set to be permanent roles.

MATERIAL HANDLING MOVES FROM MAN TO MACHINE

Established logistics players have also evolved rapidly to capture the growing trend, with forklift manufacturers Kion, Jungheinrich and Toyota all making

Figure 2: Growth in Kiva robots in operation at Amazon has accelerated in recent months



Source: Citi research, Amazon company report

acquisitions. Kion have combined innovating their warehouse-handling product offering (electric and automated trucks) with the acquisition of Dematic, the 3rd largest manufacturer of warehouse handling equipment, as they strive towards offering a '360° intra-logistics model': essentially a one-stop-shop for everything you might need to fit out and operate a warehouse. Technology and supply chain solutions now represent 25% of total Kion group sales, and the Dematic deal opens them up to a market that could be larger than industrial forklift trucks within the next five years. For example, their semi-automated picking system is five times faster than manual picking, according to senior management, providing

a solution that is front and centre of addressing the key challenge in warehouse operations.

HARDWARE AND SOFTWARE COMBINE

As Kion evolves, they aren't just investing in new hardware. The software component is critical too, and provides a higher barrier to entry when combined with the equipment itself. In Germany, the moniker "Industry 4.0" has been used to define a more synchronised move to a smarter global logistics network, where we can identify huge potential to significantly improve fulfilment, productivity and inventory management, alongside more traditional transportation logistics. It's estimated that on average a new warehouse, equipped with automated capabilities, will typically require investment of €50m.

SAP has developed EWM (Extended Warehouse Management) software for use in warehouse logistics, forming part of the group's supply chain management suite. Capable of delivering fast data throughput,

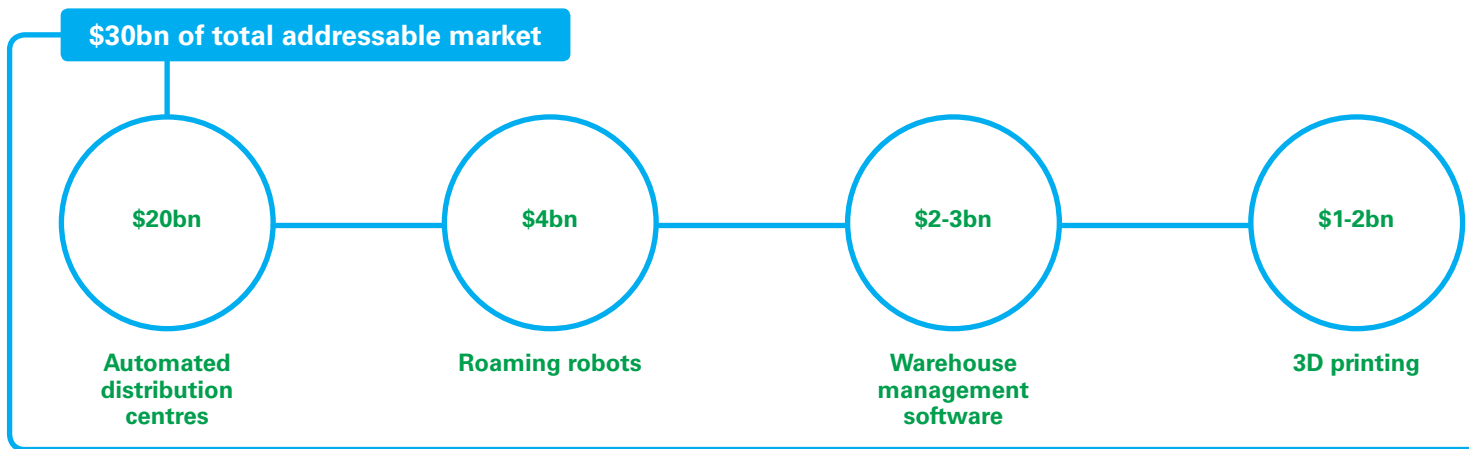
Acquiring growth
 Honeywell > Intelligrated
 Kion Group > Dematic
 Amazon > Kiva
 Midea > Kuka
 Jungheinrich > MIAS
 Toyota > Vanderlande

the technology is ideal for high levels of automation, which focuses on productivity. Importantly, the software can also be incorporated onto SAP HANA, the company's flagship cloud platform for real-time data analysis and better inventory optimisation.

Across the Atlantic, Honeywell announced last summer it had acquired Intelligrated, a leading automated warehouse solutions provider. Much of the focus of the

group in recent times has been a push towards becoming a software-industrial company, where they have looked to bulk out connected enterprises credentials. The deal is complementary to its existing expertise in barcode scanning units and extends its portfolio of strong brands. The group have a long history in manufacturing automation, data capture and sensing devices, so the transition into an automated materials handling system represents a logical step.

While it is evident that wider adoption of some technologies is still in its infancy, it is becoming increasingly apparent that innovation is cranking up the disruption, moving from theory to applied research. Companies are building partnerships and joint ventures to work on cutting edge manufacturing and software solutions, such as 3D printing and 'digital twins'.



Source: Goldman Sachs research

OUT FOR DELIVERY

The final component to 'bending the cost curve' of logistics and distribution is delivery. Aided by the falling cost of sensors and improved communication systems, delivery networks are also leveraging technology to drive efficiencies to an area that can account for up to 28% of the total cost of transportation.

A great example of utilisation comes from courier provider UPS. Earlier this year they launched a new Preload Smart Scan system, designed to error-proof processing operations. With approximately 20 million packages and documents delivered per day, UPS has begun installing Bluetooth-enabled beacons

in its package cars that communicate with scanning devices worn by employees. The beacons send signals to the scanner if an item is misplaced, which the worker will need to rectify before being able to load other packages. This technology is expected to reduce package mis-loads by 70%. It is expected to install the beacons in circa 50% of US package cars by the end of this year. Another UPS initiative, the ORION (On-Road Integrated Optimization and Navigation) system, is a predictive model that aims to optimise delivery routes in regard to fuel and time, based on historical and real-time information. UPS estimates the system helped to save \$100 million in 2016, part of which came via a

reduction of 10 million gallons of fuel consumed, improving the company's environmental performance too.

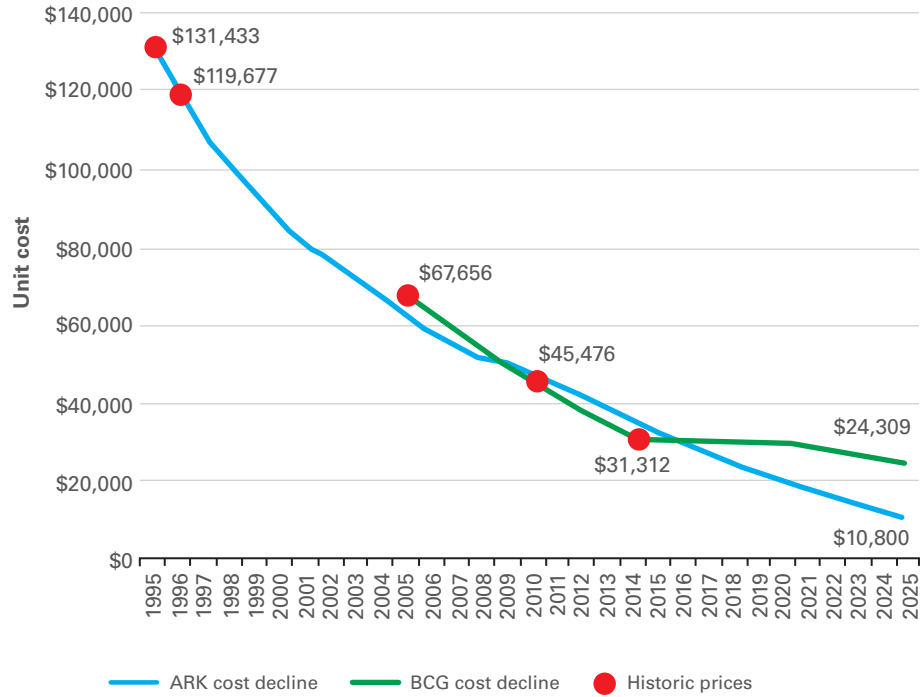
Despite the frequent media headlines, we aren't expecting drones and droids to pick up the slack just yet; there are a number of hurdles to overcome before we expect to see these implemented in their droves. Regulation, designation points and public safety are just some of the restrictions preventing roll-out, but despite the concerns, this is a theme well-backed by exploratory capex spend. Starship Technologies, for example, is partnering with companies such as Just Eat, Domino's and Hermes, and running pilot-testing for delivery droids in Hamburg and London.

LOGISTICS AND THE ATTRACTION OF WAREHOUSE AUTOMATION

As an industry, logistics property is one of the fastest growing areas in the market and we expect demand for space to increase further. After decades of over-supply, industrial vacancy rates are now approaching all-time lows due to increasing demand from retailers and logistics companies. The logistics sector recorded a 5% total return for the first half of 2017, according to figures released by CBRE, which reflects the growing appetite of domestic and international investors.

While it is difficult to fully quantify the impact of technology on the industry, it's more a matter of 'when', not 'if', robots and automation will become the backbone of the logistics supply chain. Supported by government initiatives, funding is flowing into research as companies try to contain the cost implications of changing consumer and corporate expectations. Robotics are a logical extension of the development of automation within logistics, and, combined with

Figure 3: Industrial robot cost decline (2015 dollars)



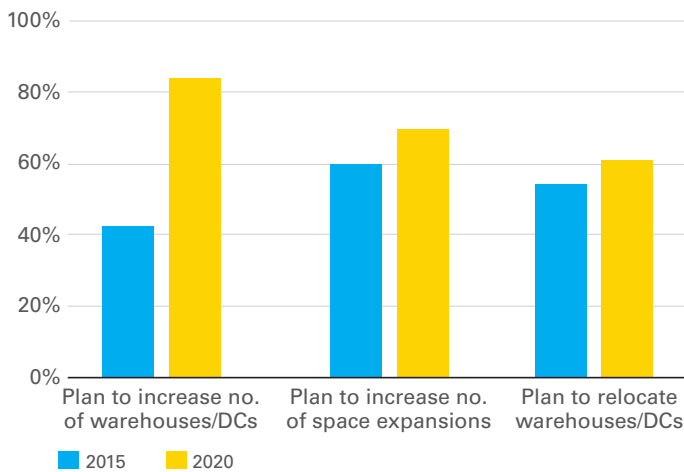
Source: ARK Investment Management LLC

software, will provide solutions to increase accuracy and efficiency. As industrial robotics cost decline, we expect these to be increasingly integrated into logistics.

Secular growth in demand for warehouse automation should mean further upside in orders for

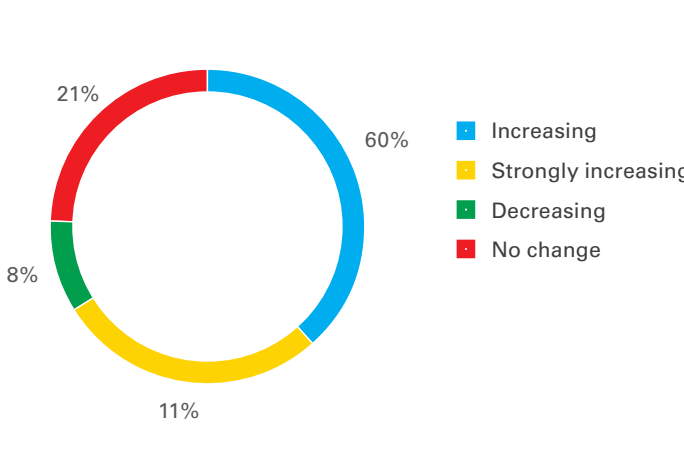
manufacturing companies, given the advancements in robotic-based automation. This presents opportunities for investors as companies become more aligned in the utilisation of technology and look to develop the next generation of smart logistics.

Figure 4: Customers want to invest more



Source: UBS research. DC refers to distribution centres

Figure 5: Direction of future automation capex



Source: UBS research

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