Ocado: disrupting itself with technology

When is a retailer not a retailer? When it's a technology company. Amazon is well known for telling interview candidates that it is a technology company and UK grocer Ocado sees itself in the same light – as a business which is as much a technology firm as it is a retailer. *Emma Herrod* and *Ian Jindal* spoke to Ocado Technology General Managers *Matt Soane* and *James Donkin* about how this arm of the business has evolved.

IN ITS past financial year, Ocado spent £26.8m on internal development costs on its proprietary software and a further £7.5m specifically on computer hardware and software. A further, £19.7m went on developing its next generation fulfilment solution, which will be used in new Customer Fulfilment Centres (CFCs) and for Ocado Smart Platform customers. A new, automated warehouse went live in Andover with robots picking products for customer orders in parallel, speeding up order pick times from a couple of hours to between 5 and 10 minutes.

In a corner of the warehouse in Hatfield, close to the company's headquarters and the offices of its technology operation, a range of robotic hands are now being tested that can pick up different items, from products in cardboard boxes and plastic bottles through to individual apples.

Ocado is known as a grocery retailer which started out delivering Waitrose goods as an online-only supermarket in 2002 and now fulfils 230,000 orders to an active customer base which last year rose almost 14%. Retail revenue in the year to 27 November 2016 reached £1,171.6m, an increase of 13.3% on the previous year.

The company also operates its own non-food businesses: in pet food site Fetch and kitchen goods firm Sizzle, as well as

multichannel, luxury health and beauty company Fabled, which it launched as a joint venture with Marie Claire in 2016.

Last year, it also implemented an in-store order picking system for Morrison's, the UK's fourth largest supermarket, which uses Ocado's Smart Platform ecommerce and order fulfilment solution.

And therein lies the concentric workings of a retailer which is also a technology company: the Ocado Smart Platform, which is effectively a white label version of Ocado with some physical store applications added such as grocery pick-from-store and click and collect functionality.

OCADO SMART PLATFORM

While the business is growing its grocery business and expanding into new areas of general merchandise, it is also seeking customers for its technology platform; all of this along with a drive to continually innovate, to optimise "to the nth degree", increasing operational efficiencies, improving the customer experience and automating repetitive, manual processes to make the roles of the people working at the company more interesting. (Its use of machine learning to prioritise in-bound customer emails is written about elsewhere in this issue of InternetRetailing and the Ocado Technology team is continually looking at areas of the business which can be improved and optimised today as well as in the future.)

Almost 1,000 people are employed by Ocado Technology. Half are based in the UK with the remainder in Poland, Bulgaria and Spain. Technologists range from software and product owners to JavaScript and UX designers for ecommerce, cloud specialists, Unix and Wi-Fi experts through to specialisms such as data scientists and robotics researchers.

The company has a willingness to disrupt itself and this becomes obvious looking around the Customer Fulfilment Centre in Hatfield, which the company claims is the most efficient grocery fulfilment centre of its kind. What has been key to this is the ability to upload code to warehouse management systems on a daily basis so the team can quickly test and further optimise operations, explains Matt Soane, General Manager, Ocado Technology.

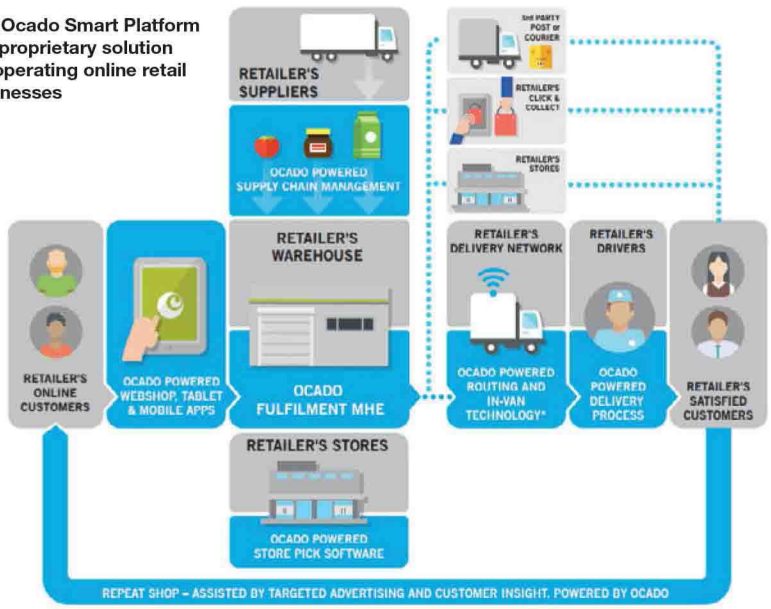
While Ocado does work with external partners, a lot of development is carried out in-house on things "where they will make a difference". Soane explains that all of the software in the warehouse has been developed by the firm with the hardware specified by it, too.

The company realises that there's no need to re-invent systems which work perfectly for its requirements. Commodity elements, such as databases, are bought in, but it will write control systems, data science algorithms, websites and supply chain systems which are unique to the Ocado offering. "Vendors are used to supplying the things we don't want to do ourselves. That's their USP," says James Donkin, General Manager, Ocado Technology. Systems need to be scalable, work in a warehouse and be grocery specific.

EFFICIENCY IN A CFC

Everything is optimised with algorithms running the warehouse to ensure the speed, accuracy and quality of each pick. Orders are picked into totes which hold open 3 carrier bags so the order in which items are picked and placed has to be optimised to ensure that a watermelon, for example, isn't placed on top of a box of eggs. There are exclusions, too, ruling which items can't be bagged together as well as possible damage scenarios.

With a typical customer order requiring between 5 and 8 totes, the system has to manage factors including which items will be placed in which bag and in which tote; journey times so that all of the totes for a customer's order arrive at the exit of the ▶



The Ocado Smart Platform is a proprietary solution for operating online retail businesses

building together; whether they contain items from the ambient part of the warehouse or the chilled area; and the location and flow of the rest of the traffic on the 20-mile network in the warehouse so everything continues to flow without delays or blockages. This 'cubing' also optimises the number of totes used, with a balance between the quantity used to pick the order in the warehouse – which is best with as many as possible – to the delivery van which requires as few totes as possible.

The warehouse system talks in real-time with the van routing system so routes can be optimised, very much like the classic travelling salesman problem, making all visits in the shortest possible route. This also allocates the right number of vans to the right time slot. This then has a knock-on effect with the website and controls the time slots offered to the end customer. An element of forecasting comes into play here, too, since when a customer chooses a time slot it's not known until the checkout whether they are shopping for a week or a major occasion or just ordering a pizza.

As Donkin explains, a number of standard algorithmic techniques were investigated when the system for scheduling van drops was developed. Dijkstra's algorithm is used to work out the shortest routes from a depot to the different delivery addresses with a simulation run to optimise the journeys.

Ocado Technology is not tied to specific techniques, languages, technologies or systems, so the teams are free to be computer or data scientists first rather than being controls engineers. Someone working with the conveyors in the warehouse, for example, will be a software developer but may have a degree in mechanical engineering and an understanding of flow, explains Soane. "We're not a shop such as a Java shop or Microsoft shop," he adds.

Its teams can use a range of approaches in both long-term R&D and in projects to solve specific, current issues or optimise areas of the business. Donkin explains that standard algorithmic techniques are used to write Ocado's own algorithms and apply machine learning. "It's a case of taking approaches that exist and then looking at them in an appropriate way for what the problems are we want to solve," he explains.

MACHINE LEARNING

The company realises that machine learning is very good at solving certain problems such as the email issue and in the warehouse. While data scientists specialising in machine learning techniques are employed, the main requirement of a project is to solve a specific problem. The solution "could be a relatively simple algorithm, it could be a statistical technique or it could be we want to use a neural net on it or so on," says Soane. "We don't approach it with an ideology that we want to use machine learning, it's just that we've discovered that machine learning happens to be very good at solving some of these problems."

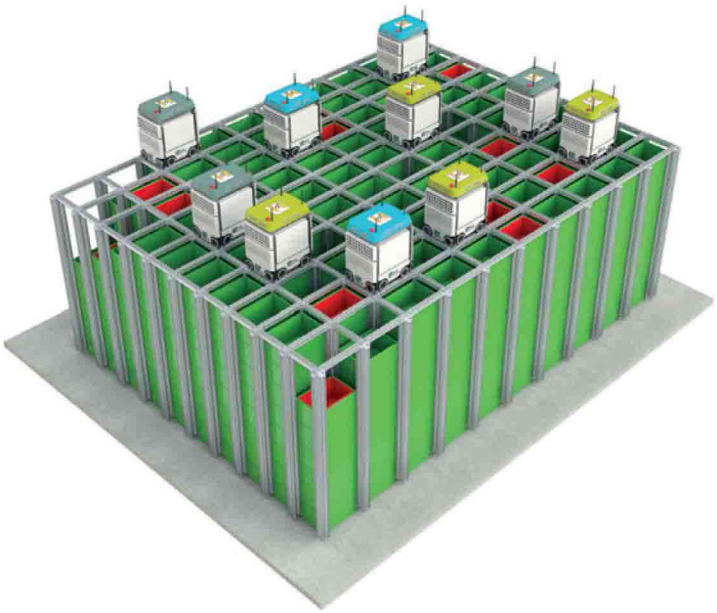
In the warehouse, for example, machine learning has been applied to the layout of products in the zone pick area. A number of items are located within easy reach of each pick station and the customer tote visits the relevant pick station on its route around the warehouse. A picker is shown an image of the item to pick on a screen and the number of which of the three bags they need to place the item. Once picked, the tote moves elsewhere in the network.

The location of products, and the stations at which pickers work, is controlled entirely by a neural network

The location of products, and the stations at which pickers work, is controlled entirely by the system. At first, a simple algorithm was tested with the fastest moving goods located close to the pickers, but it became apparent that other factors needed to be brought in too.

Rather than working out the best parameters, the engineers trained neural networks to calculate the critical factors for where products are placed. Some are obvious, such as not putting heavy products high up, and whether items can be picked up with one hand or require both.

The decision on locations and which ▶



Robots at the Andover CFC reduce order pick times from a couple of hours to under 10 minutes

INTELLECTUAL PROPERTY

Ocado Technology is not all algorithms, machine learning and robotics. The warehouse control system is written in OpenGL, a language commonly used in gaming, and uses an Xbox controller so an engineer can zoom into a 3D real-time representation of any part of the warehouse, conveyor network, totes etc, to see exactly what's happening.

Meanwhile, a machine containing three similar parts, cuts plastic bags from a large roll, inflates them and then hooks them individually into either the left, middle or right-hand side of a tote. This has eliminated the need for people to do a very monotonous job and has led to patents for Ocado.

Ocado is continually improving its business, operations and experience for the customer. And not just for its own retail customers but for the current and future customers for the Ocado Smart Platform, the retail solution which is at the heart of its multichannel technology offering.

Retail is moving into a future when it will need to offer more convenience and greater choice with a better understanding of the individual customer, believes Donkin. This requires a continuation of the data trend of the past few years with the cloud enabling retailers to process an almost infinite amount of data. "You can do things with data that you couldn't afford to do a few years ago and then apply machine learning if you want to," Soane says. "If a kid in their room can play with it, so can we."

Consumers' want for convenience and faster delivery will also require Ocado, and the wider retail industry, to automate further – using drones and driverless cars, for example. If a customer is ordering a pizza for delivery at 3am, it is better for it to be picked automatically and delivered by drone rather than running a warehouse full of people.

Ocado is working towards fully automated picking, pointing out that this will open up roles for people which are less repetitive. It is not looking to reduce the number of employees but to make what they do more interesting.

The drive for efficiency and optimisation of its own business and the need to offer best-in-class for its Smart Platform customers has led Ocado to being more than a technology-enabled retailer. It uses technology as a differentiator, continually breaking things and making them better. It is truly a company of two halves – a retailer and a technology company combined. As the Smart Platform is used by other retailers, so the Ocado Technology customer base expands. For now, Ocado Technology effectively works for Ocado and Morrison's, but the future is still under negotiation with the cloud-based SaaS Ocado Smart Platform being discussed with grocers in other countries, all of whom will be paying for guaranteed results.