INTERNET OF THINGS IN RETAIL

How can SME vendors encourage retailers to adopt the latest technologies?
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Retailers are looking to implement Internet of Things (IoT) technologies in order to achieve a true omnichannel experience by bringing digital technologies to physical stores. Customers need to be given choice for interacting with retailers across different channels for completing their shopping journey, which may involve a range of online and offline combinations such as click and collect, and using mobile devices in stores with location-based functionality and content.

Facing a range of pressures from new eCommerce driven competitors to rising overhead costs and lower product margins, retailers aim to increase efficiency for their business processes in their stores and warehouses. IoT devices such as sensors, cameras, beacons and Wi-Fi networks can help to collect valuable data that can be analysed and used to optimise supply chains, staff deployment and store layouts.

Key IoT technologies that are used in retail include:

- **Radio-Frequency Identification (RFID)**: mainly for asset tracking in stores and warehouses
- **Sensors and Cameras**: for monitoring product status and customer traffic
- **In-store Wi-Fi**: can detect return customers and encourage digital interaction
- **Beacons**: mainly for proximity-marketing with specifically tailored content
- **Digital Signage**: various interactive functions from browsing to smart mirrors
- **Virtual and Augmented Reality**: can create a superior and game-like experience
- **Robotics and Drones**: for greater inventory and supply chain efficiency
- **Payment Systems**: mobile and NFC based payment terminals for checkout anywhere in stores
- **Smart Vending Machines**: better customer experience and predictive sales tools
- **Smart Lighting**: geo-location technology for guiding customers around stores

ICT vendors need to consider retailers’ business needs rather than focus on technical aspects and should offer a credible visionary store concept, which may require collaboration with their peers in a partnership. Retailers’ different levels of IT maturity should be considered and measurable benefits provided in order to gain retail executives’ trust. Solutions can be introduced on a small scale and then extended further by guiding retailers through their IoT adoption journey without any lock-ins.

Besides major ICT companies that dominate the market with often generic solutions, a range of smaller IoT focused vendors has emerged in the UK, serving niche technologies or specific retail segments. In addition to some hardware players, many vendors provide various software and mobile apps that are relevant for IoT and do not require the hardware to be specifically integrated but can be used for specific purposes on their own, or as part of a wider concept in partnership with other vendors.
Retailers increasingly face challenges from numerous angles such as eroding product margins, heightened competition from pure eTellers and the constant pressure to innovate. They need to offer their increasingly demanding customer base a better experience that is worth visiting a store for, instead of ordering from the convenience of one’s home. Traditional retail organisations need to embrace digital transformation by integrating and upgrading their systems, as well as by introducing a Big Data and IoT strategy that focuses on generating value and differentiation through analytics. This applies in particular to smaller retailers that need to catch up with the technologies and processes already implemented by major retail chains.

For example, supply chains and business processes require optimisation in order to achieve greater efficiency. While looking to achieve cost savings through better insight and monitoring capabilities, retailers are also under pressure to improve customer experience, launch innovative products and services, and guarantee high security levels to avoid any data breaches. Figure 1 outlines the key business challenges faced by retailers that can be addressed with IoT.

**Digital technologies can bring the omnichannel experience to physical stores**

A true omnichannel experience can be achieved by bringing digital technologies to stores and warehouses and connecting these to eCommerce platforms, mobile apps and other business operations such as marketing and product management. Data needs to be collected through various devices where relevant and linked to existing records such as customer and supply databases, and sales data from the point-of-sale (PoS). Retailers need to build out capabilities to forecast demand in real-time and change strategies immediately where needed, such as applying price reductions or showing marketing messages that are relevant to the customers currently in the store. The aim is to react better and quicker to any changing market conditions and offer customers more relevant products.
Every ‘thing’ holds a lot of valuable data that retailers can utilise for various purposes

Major retailers are looking at possibilities for collecting a wealth of data in their stores and warehouses in order to reduce operating costs by improving efficiency, and for bringing digital customer experience to their traditional bricks-and-mortar outlets. In order to achieve this, various ‘things’ are needed that capture data and communicate with each other, customers, staff members, existing IT systems and databases. These include various sensors, cameras and other location tracking technologies such as radio-frequency identification (RFID) that can collect information about their environment including traffic flows, product quality, asset whereabouts and customer behaviour. IoT devices can also enhance customers’ experience in stores through interactive terminals, virtual or augmented reality experience, smart fitting rooms and robots that can be deployed as smart sales assistants. Moreover, targeted marketing messages can be displayed on digital signage screens when sensors and cameras detect customers’ gender, approximate age, group size or facial expressions.

Figure 2 shows the key benefits that retailers expect from their IoT deployments according to the latest IoT end-user survey by market watchers GlobalData.
Just a few years ago a fully connected store was seen as a very futuristic vision of retail. However, a lot of progress is already happening in this space, albeit on a smaller but rapidly growing scale. The reasons for the increasing uptake include technological advance, which has led to the availability of smaller chips at declining price points, and the drive to integrate them into many products during the manufacturing stage, for example as RFID tags. Consumers’ increasingly connected lifestyles have also contributed to the rise of IoT in retail by demanding better interaction in stores by utilising the latest technologies, and the desire to make shopping a more personal experience based on customers’ preferences.

Various devices including sensors, cameras and beacons collect data and may also communicate with customers and staff. Therefore a reliable and integrated holistic solution needs to be set up, which includes appropriate network connections between the sites as well as locally in the form of Wi-Fi and WANs.

Collaboration between vendors is crucial for a functioning IoT ecosystem

An important aspect is the availability of a wide-ranging IoT ecosystem that features vendors from different backgrounds including smaller specialist firms such as sensor and camera makers, networking and hosting companies, as well as management software and analytics firms. Collaboration between these vendors is crucial, and as with every new technology it takes some time until industry standards are adopted and best practice cases emerge that then drive innovation efforts among other early adopters from the same industry, and steer the technology more towards mainstream adoption. IT vendors and system integrators play a key role in bringing the latest solutions to retailers and launching retail-specific offerings or reference architectures that are aimed at solving retailers’ current pain points.

Smaller retailers are starting to invest in IoT

While large retailers have already invest significantly in IoT technologies, their small and medium-sized peers tend to operate with limited budgets, and the majority currently does not have an IoT strategy in place. However, this varies greatly by retail segment since those focusing on fashion-driven branded items including apparel, sports and also some electronics retailers are usually more experimental with IoT than grocers and hardware stores. As the cost of IoT hardware such as sensors, cameras and beacons continues to come down and more standard IoT focused applications are becoming available in form of SaaS, smaller retailers are increasingly investing in IoT. They usually start small with a few devices and apps that do not need specialist IT skills for customisation, and can expand their projects gradually as they assess their uptake and success.

In view of the rising competitive pressure from innovative large high street retail chains and leading eTellers, smaller retail chains and independent specialist stores look to offer their customers a distinctive experience through the rollout of various IoT tools such as interactive kiosks with NFC terminals, in-store Wi-Fi and RFID tracking.

The following sections discuss specific IoT technologies and their capabilities in more detail.

Asset Tracking via RFID

Radio Frequency Identification (RFID) provides a unique identifier for any object that is easier and quicker to read than barcodes. RFID tags can be attached to
any object or built into products at the manufacturing stage, consisting of a chip that can carry up to 2,000 bytes of data as well as a small antenna. The tags can be identified through a reader device within a few feet (up to 20 for high-frequency) from the object, making the process of checking inventory a lot easier in stores, warehouses and during delivery. A wealth of product related data can be stored on RFID tags including product or brand names, specifications, sub-categories, use by dates, price and supplier details. This information can then be fed into supply chain management systems, which can provide the following benefits depending on usage:

- More accurate determination of assets’ and status for better managing replenishment
- Asset tracking across locations for security and managing delivery options
- Supplier evaluation and feedback

In addition to using RFID for retailers’ supply chain and store or warehouse management operations, this technology can also be applied to improve customer experience. For example, hand-held or wall-mounted reader devices could be provided in stores that allow customers to search for nearby products and check their details without having to physically search for them or move items around.

Sensors and Cameras

Sensors and cameras can collect data about existing customer and staff traffic flows around the store, as well as various criteria including temperature, waiting times, unusual activities and typical paths taken by the customer segment. This information can then be fed back to the data centre for analysis that establishes ways to optimise the flow for greater efficiency and additional sales opportunities. The findings could also lead to redesigning the store layout and product placements. The data gathered in this way can also be used to build customer profiles; however these would need to be detached from any sensitive personal data for compliance reasons, except for customers who have opted in to this type of data usage when registering for the retailer’s app or loyalty scheme.

The latest technologies also enable facial recognition through cameras and analytics software, however this is a tricky area for retailers to step into as it may not comply with data protection regulations and could lead to a backlash by customers even for scenarios where they agreed for their personal data to be used for analytics. However, generic anonymous detection of customer categories by approximate age, gender and group size can be applied in some stores, though there are also other ways to identify this, e.g. by pointing a camera at customers’ shoes which has also proved to provide reliable results and removes some of the sensitivity associated with facial images.

In-Store Wi-Fi

A reliable in-store Wi-Fi network can enable retailers to track customers by area within stores even if they do not log on to the in-store network. Accuracy ranges from around 1.5m – 15m, which means that usually aisled and key locations such as doors and checkout lanes can be segmented. As the technology evolves, tracking on a product level is becoming an opportunity that is worth exploring over the next few years. Even if only around a third of customers or less have Wi-Fi enabled on their phones, the information generated tends to be a good representative of all customers in store in terms of the shelves visited and paths taken.

The number of all customers in an area at any one time can also be estimated accurately based on the information from Wi-Fi networks and a pre-determined factor for the percentage of customers that use Wi-Fi. Therefore Wi-Fi is seen as a viable alternative to...
traditional door counters, providing greater accuracy and more detail that can also be used in combination with data from door counters. If customers sign up to a retailer’s app then they can even be tracked by their full profile since they have given consent for their data to be used for marketing and analytics purposes. According to a recent survey by GlobalData, Wi-Fi is the most common wireless technology in retail stores and warehouses, followed by Bluetooth and RFID (see Figure 3).

Beacons

Bluetooth-based Beacon technology allows personalised messages and offers to be sent to customers’ smartphones when they are near or in a store, or in close proximity to a specific product or aisle. However, it only works if they have downloaded and enabled the app, as well as their phone’s Bluetooth connection. Beacons are useful for interacting with customers in a personalised way for various purposes from marketing with special offers to asking for their opinion, providing them with information about products within their vicinity in stores and triggering interactions with sales staff through retailers’ apps.

Beacons have been successfully tested by various retailers with largely positive feedback from customers; however the technology has only been rolled out by a few major retail chains in the UK, including Tesco in partnership with Unilever for promoting Magnum ice cream. John Lewis introduced Beacons for speeding up the preparation of click and collect orders in its department stores by detecting when customers are already nearby. Some major high streets such as Regent Street in London (with the Regent Street App), and shopping centres e.g. the Swan Centre in Eastleigh have also introduced Beacons for the purpose of marketing and cross-selling to loyal shoppers.

Despite some limited usage and trials by supermarkets and department stores, the technology tends to find adoption at some specialist retailers that focus a lot on brand image and customer experience especially in the clothing sector, rather than at large supermarkets. Among the reasons why Beacons have yet to take off is their high cost, which is not justifiable for large-scale rollouts across stores without proven benefits for specific sales or operational efficiency.
and centralises data sources from all branches and the various collection points. Most value is added by combining data, e.g. from POS systems with local sensor and camera data at aisle level, as well as customer databases and social insight in order to get a full picture of customer profiles, preferences, market trends and the paths taken by people and assets. While analytics also fall into the remit of a wider Big Data strategy that can be rolled out without implementing IoT, connecting various devices and gathering data through them can take the depth of analysis and understanding to the next level.

By using IoT based data, shopper behaviour can also be mapped and compared by store, time and scenario and the best layout established for specific purposes such as determining the best approach to showcasing a product. It is advisable to start with the data and analytics needs when rolling out IoT projects rather than focusing primarily on the various hardware for data collection. The real value of IoT implementations lies in the analytics capabilities at the back-end and the ability to combine various data sources for establishing correlations and greater accuracy. This is particularly useful for understanding more complex scenarios including customer behaviour, predicting sales for fashion products and the risk relating to ordering from a certain supplier.

Virtual and Augmented Reality

Retailers are increasingly looking to offer their customers a superior and distinctive experience that is worth visiting their stores for, while most goods can also be purchased online without having to make a trip to a store. By implementing IoT based Virtual Reality (VR) and Augmented Reality (AR) the functions of digital signage and existing functions such as fitting rooms can be extended. Since customers are becoming used to the latest technologies from eCommerce and other sources such as media and gaming, they increasingly expect to see such features in physical stores as part of the overall omnichannel experience, given the notion of shopping as an experience rather than a purely transactional purchasing activity.

VR can take various forms in terms of the hardware and software deployed. For example, customers can be given wearables including smart watches, 3D experience glasses and headphones for use in stores, or fitting rooms and other experience booths can be designed specifically for VR purposes. Various sensors, cameras and microphones can detect a customer’s movement and speech so that the screen and other features can react in an interactive manner, while in some cases purely showing a short movie with special effects without any interaction can lead to higher sales.
Robotics

The advance of robotics technology has opened up opportunities for deploying robots for tasks such as picking items from shelves in warehouses but also as interactive sales assistants in stores. For example, in the US, Lowe’s in store robot is already in use at the Orchard Supply Hardware store in San Jose in California. The robot assists customers to find product and provides information about them through an interactive screen, audio and microphone. Customers can show the robot items that they are looking to buy or describe their needs as they would when interacting with a real sales assistant. The robot has machine learning capabilities so that it can answer similar queries with greater accuracy over time and create maps of product whereabouts in the store that it can refer back to later. It also allows for remote connections with an assistant who can help customers with more complex queries.

The robots feature natural language processing, collision avoidance and 3D scanning technology with the aim to create superior customer experience and identify sales opportunities. They can be programmed to interact in multiple languages, making them appealing especially to retailers that sell higher value items to international tourists. In order to gain maximum value from their deployments, vendors need offer retailers suitable analytics solutions to take advantage of the data that the robots collect. Similar to analytics on eCommerce platforms, retailers can determine which products are bought together or by people of a similar profile when gaining insight from the robot’s interactions.

IoT-based Payment Systems

IoT solutions can extend to payment functions in stores or from anywhere on customers’ mobile phones with the aim of removing any friction that traditional ways such as cash or chip and pin come with. The goal is greater convenience for the customer through purchasing with a single click in a secure environment, which can drive sales and loyalty while also reducing the number of abandoned purchases.

NFC based solutions where a phone is placed on or near a reader are becoming more popular for in-store payments, but QR codes are also commonly used, which can apply to paper based vouchers in addition to the codes being displayed on mobiles. New payment methods and terminals can be integrated with digital signage to provide customers with a better experience and give retailers further marketing opportunities that can be used in an interactive way through touch screen deployments. Security is a major aspect to consider when setting up new payment methods and linking them to various systems.

Smart Vending Machines

Similar to digital signage and customer terminals, vending machines can be equipped with various smart functions through interactive screens, sensors, cameras and Beacons. For example, the UK-based global coffee shop chain Costa has deployed an intelligent vending machine that features computing capabilities so that it can connect to social networks and via Bluetooth to customers’ devices. It also features Intel’s Audience Impression metrics suite for capturing customer demographics and impressions. This includes anonymous viewer analytics such as video recordings of customers, as well as a web-based reporting system. By deploying this, Costa can detect customer behaviour and changing trends in anonymised form and can better tailor its adverts to the target audience in real time. By providing customers with a real experience in addition to quality coffee, the retailer can charge premium prices for its solution.

Smart Lighting

Smart lighting is gaining popularity in retail for purposes beyond illumination, such as creating specific ambiances in stores, aisles or fitting rooms based on the target group and intended effect. Lighting can influence the path that shoppers take in stores, the speed of walking and the mood which needs to be right for different product areas, customer groups and needs to differ by the time of the day. It needs to be in sync with the overall ambiance including music and the store layout in order to create a positive effect rather than confusion.

Intelligent in-store LED lighting is used in stores to guide shoppers to products based on their personal preference, for example by choosing a recipe via a retailer app and then looking to purchase the ingredients and any complementary products. Smart lighting is perfectly suited for retail environments and will take off
gradually over the next five years as retailers experiment and then roll out solutions across their stores. VLC based positioning will increasingly rival Bluetooth based Beacons and could be rolled out in addition to a store’s already existing Wi-Fi network. Existing lighting can be integrated, which poses some challenges but also energy cost savings in the longer run.

**Networking for IoT**

Indoor location-based technologies play a key role in enabling retailers’ IoT strategies. These primarily include long-range and low-power Wi-Fi networks but also Bluetooth (e.g. for Beacons) and radio-frequency based communications for RFID tags. The new Wi-Fi standard 802.11ac Wave 2 allows for higher speeds and better control of network activity, which is important for efficiently managing IoT environments especially when high data volumes are handled and infrastructure needs to be scaled up and down based on demand. By applying this standard, high-density environments can be supported which are crucial for enabling Wi-Fi usage for a larger number of users in stores. When rolling out and upgrading Wi-Fi networks it is important to consider the various types of workloads involved, which usually also cover various communications including voice over IP and internet connections for some existing devices that run retail management, ERP and other software.

When adding a wider variety of hardware including sensors, cameras and beacons to the network, the traffic flow to own data centres and cloud service providers needs to be re-assessed. For example, if data is transmitted to a cloud based resource, it is often worth running some pre-analytics at edge locations that feature a few servers and also act as connection points, helping to bundle and speed up any data transfers. It is particularly important to design the network as efficiently as possible if real-time analytics with millisecond-level latency are required.

The advance of IoT in retail opens up vast opportunities for network solutions vendors including the likes of Cisco and Juniper, but also major telcos and cloud services providers. Major opportunities and challenges include:

- Upgrading and improving Wi-Fi networks by making them more robust, faster and capable of handling larger data volumes, as well as a variety of devices connected to them.
- Adding Wi-Fi access points for strengthening connections and making communications more reliable.
According to a recent study by GlobalData, the global IoT hardware market for the retail sector totaled £616 million in 2015 and is set to quadruple to £2.5 billion by 2020. On top of this, various analytics software and IT services are needed, which fall into retailers’ Big Data budgets.

Figure 4 shows the key areas that retailers are investing in as part of their IoT strategies based on a recent IoT survey by GlobalData.

Since most retailers do not have sufficient technology expertise and resources in-house for implementing and managing IoT solutions, they often use systems integrators, IT service providers and outsourcers and do not necessarily deal with hardware and software vendors directly. For example, the likes of Accenture, Deloitte, Ernst & Young, Infosys and Wipro have retail-focused practices that work alongside their IoT experts. Similarly, most telcos try to jump on the IoT bandwagon with various offerings that are applicable for retailers. Major technology partners that offer IoT solutions for retailers include Cisco, IBM, Google, Microsoft, Intel and Amazon.

**Other innovative technologies**

Telematics (e.g. for delivery truck fleet tracking) is emerging as a key investment area although its market size is still relatively small in retail. In addition, constrained application platforms based on the constrained application protocol (CoAP) are seeing a lot of interest for creating greater energy efficiency for connected IoT environments based on lower-power devices. CoAP enables, for example, low-power sensors and actuators to communicate interactively via the internet. It implements a lightweight application layer and runs on devices that support the User Datagram Protocol (UDP).

However, the largest investments are in real-time location tracking which includes most technologies discussed earlier, including beacons, in-store Wi-Fi, RFID, as well as cameras and sensors. A strong growth is expected in auto-identification and mobility technologies such as mobile check-in points for identifying customers entering stores, as well as various mobile apps and communication technologies that may include beacons and Wi-Fi if used for this purpose. NFC technology is also considered in this context, and is already in use by the majority of retailers. NFC also serves various other purposes in retail such as mobile payments through mobile PoS solutions that can be located anywhere in the store, and as checkpoint kiosks that can display information about products if their tag is placed on the NFC reader.

Smart shopping cards can be equipped with various location-based technologies such as beacons, RFID and GPS, as well as tablets that can provide guidance around a store, link to shopping lists and display targeted adverts.

Drones may also be included in IoT solutions and can be used for delivery of goods primarily in rural areas, and for flying through warehouses for taking inventory in a more efficient way, as already deployed by some large retailers.
Small and medium-sized IoT technology vendors play a crucial role in driving innovation. They usually target very specific areas such as smart mirrors, intelligent vending solutions, image and speech recognition or customer service robotics. While some SMEs provide full-product solutions including hardware, software and services, others focus exclusively on some components such as providing beacon or sensor hardware that is integrated into other vendors’ solutions. SMEs also play an active role in software and mobile apps that are linked to IoT, such as specific retail management and eCommerce solutions, inventory tracking applications and loyalty programs.

**Small and medium-sized vendors can provide more tailored solutions**

SMEs may concentrate their efforts on a specific technology that is applicable for most types or retailers, or they can choose to target specific niche segments where they see a particular gap in the market for an innovative approach. Examples are vendors that offer solutions such as stock management for DIY retailers, RFID tracking for high-end products or mobile payment solutions for outdoor hospitality retail.

A large number of smaller vendors also provide various software and mobile apps that are relevant for IoT and do not require the hardware to be specifically integrated but can be used for specific purposes or as part of a wider concept. These solutions include tools such as sensor data visualisation, video and image recording, as well as various accounting, collaboration and social interaction applications.

Examples for recent UK startups that provide IoT technologies for retailers include the following:

- **BLOCKVERIFY** - provides supply chain management, anti-counterfeit measures for high-end products
- **BLUE SENSE NETWORKS** – provides iBeacon hardware, cloud platform and developer tools
- **DIGITAL BRIDGE** – visualises products in customers’ homes through augmented reality solution
- **EVRYTHING** – ‘Web of Things’ software platform for managing IoT environments
- **HOXTON ANALYTICS** – offers customer path analysis for stores based on camera technology
- **OPENSENSORS.IO** – creates smart environments through a network of sensors
- **STARSHIP TECHNOLOGIES** – provides robots that run on pavements for takeaway food delivery

Independent shops are starting to gradually deploy IoT technologies

Smaller retailers, pop-up stores and even street market traders are adopting at least some IoT features, for which SME solutions are particularly relevant. An example is The Dandy Lab, an innovative pop up store in Shoreditch in London that used wall-mounted NFC readers and smart product tags for displaying the relevant content on digital signage based on customers’ product selections. Cameras were pointed at customers’ shoes to detect their gender and direction of walking with high accuracy, with the data then being used for analytics to optimise the store layout.

The Digital Catapult expects retailers of all sizes in the UK to expand their IoT efforts over the next few years, with technologies such as RFID, beacons and digital signage becoming commonplace in high street shops, including some smaller store chains and independent shops.
Advice for ICT Vendors

In view of retailers’ specific needs and their approach to selecting vendors and technologies, The Digital Catapult advises the following for small-medium sized ICT vendors with IoT capabilities:

**FOCUS ON ROI FOR THE RETAILER.** Around half of the IoT projects carried out by retailers have a 6-12 month ROI goal attached to them, while around a third relate to achieving an ROI target within 1-2 years. Smaller ICT vendors are well-placed to guide SME retailers through this process.

**OFFER RETAIL FOCUSED END-TO-END SOLUTIONS.** Retailers tend to value vertical and usage case specific offerings that are more relevant to them than generic offerings with reference architectures. Even if the retail differentiation is limited to branding and a few extras, this can make a real difference in terms of marketing.

**FOCUS ON BUSINESS BENEFITS rather than technical capabilities.** Many decision-makers in retail organisations are not highly tech-savvy (e.g. CEO, CFO, CMO) and need to clearly understand the advantage of investing in specific IoT technologies and solutions without getting lost in translation.

**CONSIDER THE RETAILER’S IT MATURITY.** Retailers are at different stages regarding their IT maturity level that may require different approaches to IoT and their overall infrastructure. Assess their current situation and challenges before offering some of the latest technologies that they might not yet be ready for. Smaller retailers in particular may need some handholding during IoT implementation, testing and operation.

**PARTNER WITH SYSTEMS INTEGRATORS.** Retailers often have closer relationships with local or global systems integrators who have a deeper understanding of the retail market and can assist in making generic solutions more relevant to retailers’ needs. They can also provide important inputs regarding their digital transformation and future-proof technologies for smart stores and related analytics.

**OFFER HYBRID SOLUTIONS.** Some retailers are happy with fully cloud-based analytics; however the majority are bound by regulations to keep sensitive customer data on-premise or prefer to run their own hardware infrastructure while also taking advantage of cloud-based solutions. Analytics solutions that combine both worlds and integrate well into retailers’ existing infrastructure often have the upper hand.

**DIFFERENTIATE ON FEATURES.** Your solution can stand out from the competition if you can offer very specific customer experience or analytics features for a wide range of retail use cases and retailers’ business challenges. This may include combining a wealth of data sources from different IoT-enabled hardware and offering a range of visualisation tools for role-specific purposes within retail (e.g. aimed at sales assistants or warehouse managers).

**COLLABORATE WITH TECHNOLOGY PEERS.** Small-medium sized vendors should look out for opportunities for partnerships and collaboration initiatives that enable them to share best practices, bundle resources and develop joint go-to-market initiatives. Support can be provided by government-funded initiatives such as the The Digital Catapult programme that aim to encourage technology development and can provide training especially for startups.

Advice for Retailers

The Digital Catapult advises small-medium sized retailers who are planning to implement or extend their IoT and analytics activities to consider the following:

**IOT DOES NOT NEED TO BE COMPLEX AND EXPENSIVE.** SME retailers should not be put off by the common misconception that IoT environments require large-scale investment into various components. As the cost of sensors, cameras and beacons continuous to fall and analytics software can be consumed as a fully managed service, even small independent shops can take advantage of the latest technologies.

**IMPLEMENT IOT SOLUTIONS ONE STEP AT A TIME.** It is best practice to test IoT solutions on a smaller scale by limiting rollouts to certain products, shelves or selected customers before a larger implementation. By following a step-by-step approach, technical issues can be ironed out early on in the process, and customer
perception monitored to avoid going off the rails with irrelevant or too disruptive tools.

**YOU NEED A CLEAR BUSINESS OBJECTIVE** that justifies upfront investment and operational costs. Objectives could be measured in terms of ROI and specific measurable goals that help avoid the project failing and gaining support from senior executives. Goals could include sales targets, customer loyalty and brand awareness, but also cost reductions for business processes such as warehousing and inventory checks.

**WORK CLOSELY WITH SPECIALIST VENDORS AND LOCAL PARTNERS.** Solutions providers should be chosen based on their capabilities for the specific technologies that you are looking to implement, or by their expertise in your retail segment. Local SMEs are often a good fit for smaller retailers and can offer more tailored solutions for their environments than standard solutions from larger market-leading vendors.

**CONSIDER CLOUD-BASED ANALYTICS SOLUTIONS** in the form of SaaS straight from vendors’ data centres without the need for complex hardware or software installations. SaaS is often easier and quicker to implement and scale out, especially for smaller retailers with limited budgets and IT expertise. But beware of different pricing models and potential data protection issues when dealing with sensitive data.

**GAIN A COMPETITIVE ADVANTAGE THROUGH CUSTOMER EXPERIENCE.** The latest IoT hardware can enhance customers’ experience in stores by making it easier to find products and gain information about them. Technologies such as VR/AR, interactive digital signage and communication via Beacons and mobile apps can boost brand image and lead to higher customer loyalty.

**DO NOT AUTOMATE IN ORDER TO REPLACE SALES ASSISTANTS.** The introduction of the latest robotics and automation technologies can improve efficiency in stores and warehouses, which can lead to a better customer experience. However, staff will still add crucial value and should not be replaced but become part of semi-automated processes, focusing on the more complex tasks. Many customers actually choose to shop in smaller stores because they prefer the higher level of human interaction compared to superstores.

**ANALYSE CUSTOMERS’ PERCEPTION OF IOT.** Customers may not appreciate to shop in stores that are excessively plastered with cameras and sensors if they cannot perceive any benefits and rather worry about data privacy. They should not be forced to sign in to physical stores through their phones or have to use in-store robots but should be given the option to participate if they wish. Some tools may prove to be counterproductive for the store’s target group and may require modification/removal after ambitious trials. Millennials and elderly shoppers may require different approaches that could be served through different IoT solutions in combination with sales assistants and existing business processes.