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Retail in 2021 and beyond:
Trends and solutions with edge computing

March 25, 2021 | v1.0

Prepared for Lumen by GlobalData

Introduction

Retail has been reconfigured

- Even prior to the onset of the COVID-19, changing market dynamics put the retail industry under stress to wring out every efficiency possible in order to lower costs and improve agility through technology.

- Retailers were already looking to technology as a means to help further their brand, improve operational and supply chain efficacy, attract customers and encourage spend increases, engender loyalty, and drive growth and profits. COVID-19 and the fallout from the pandemic only amplified all of this.

- And the pandemic only underscored how critical retail is to the overall US economy. The lingering impacts on the domestic supply chain were felt across the country and beyond. Even online sellers suffered temporarily from the breaks as their suppliers had to pause and, in some cases, shift manufacturing and distribution challenges emerged.

- Lockdowns and restrictions that at least partially closed brick and mortar retailers had a material impact on the unemployment rate. By July 2020, 1.9 million US retail workers had filed for unemployment.

- With market pressures further compounded by the effects of the pandemic, retailers are seeking out innovative technologies to find new ways to thrive. Edge compute has emerged as a potentially integral element in supporting applications in both brick and mortar and online commerce.

- By definition, edge computing is a distributed computing model that brings processing and storage closer to the location where it is created and consumed – a capability that could be particularly essential in retail. Use cases driving development include support for immersive and latency-sensitive applications including real time navigation and analytics.
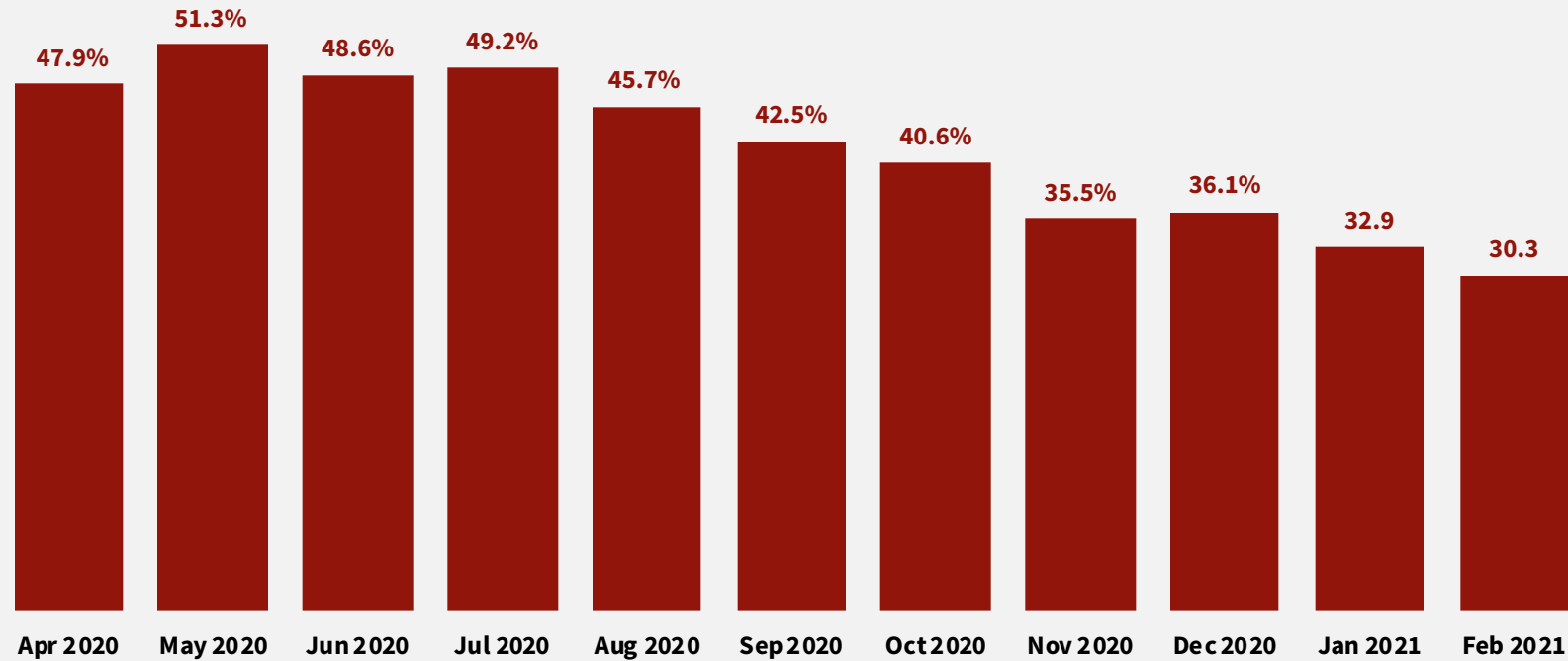
The solution of edge computing

- In a digital world, transformative change can happen at warp speed. Technology underpinned the dramatic shift to remote work and school during the pandemic. Cloud computing played a fundamental role in that change. Cloud has played a critical role in retail for years but now there is a recognition that it is time for the next chapter, one that could bring the power of cloud computing closer to retailers.

- Edge computing promises to do just that. This white paper will outline the state of retail today and in the future. The paper will lay out many of the most compelling use cases that retail edge computing could improve upon or even make possible for the first time. The white paper will put these use cases into the context of five critical themes for retail. These themes are:

  - Security
  - Enhanced customer experience
  - Safety
  - Operational effectiveness
  - Loss and fraud prevention

- The paper will also examine the solutions that exist today to help retailers make their journey to the edge. Lumen Technologies is emerging as one provider with an extensive set of services that can support this transition.

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Trends and responses

The trends that will shape retail and how retailers will respond

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Concerns with physical stores

47.9%	51.3%	48.6%	49.2%	45.7%	42.5%	40.6%	35.5%	36.1%	32.9	30.3
Apr 2020	May 2020	Jun 2020	Jul 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020	Jan 2021	Feb 2021

Greater consciousness around store safety and hygiene are now established consumer considerations

The pandemic has created a lot of concern about visiting physical shops, mostly on health grounds. In the US, 30% of shoppers currently say they are concerned about visiting stores.

While concern levels have come down since the initial phases of the pandemic, they remain heightened. And even when the pandemic fades, it is likely consumers will be more conscious of things like hygiene and social distancing. These will become longer term considerations that influence where and how people shop.

Chart shows the percentage of consumers each month who say they are concerned about visiting physical stores and retail outlets because of COVID-19; covers US
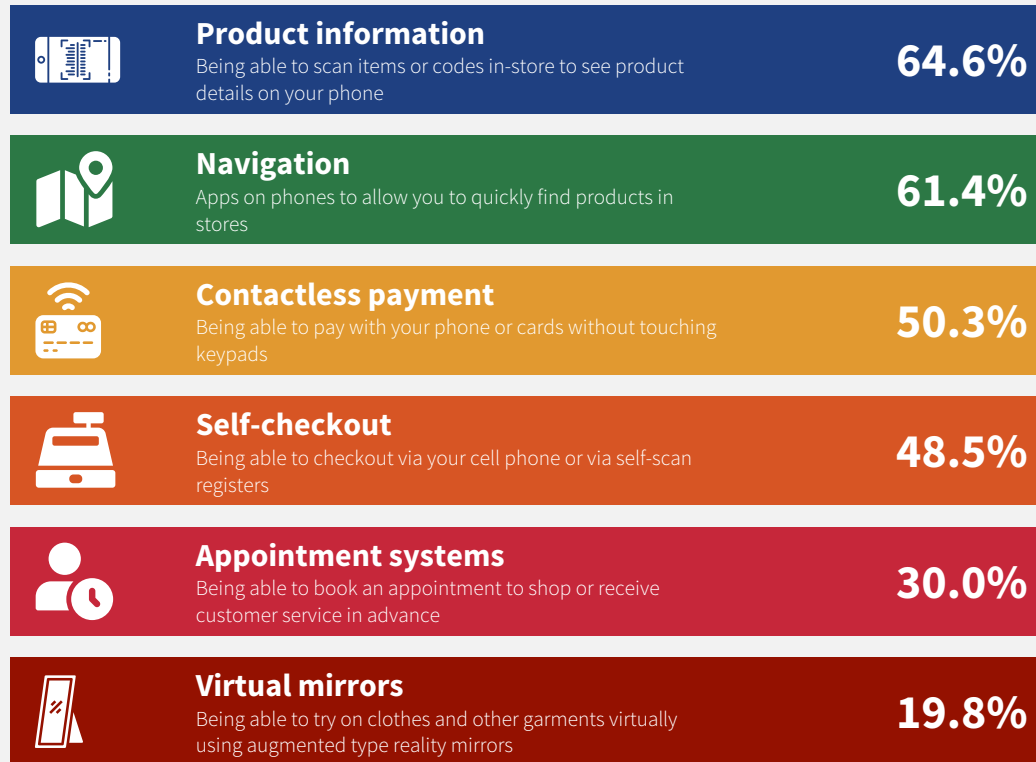
Source: GlobalData consumer research and analysis

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Requirements from physical stores

What consumers want from the retail experience

% of consumers who mention they'd like to see each solution in physical stores

Product information
Being able to scan items or codes in-store to see product details on your phone
64.6%

Navigation
Apps on phones to allow you to quickly find products in stores
61.4%

Contactless payment
Being able to pay with your phone or cards without touching keypads
50.3%

Self-checkout
Being able to checkout via your cell phone or via self-scan registers
48.5%

Appointment systems
Being able to book an appointment to shop or receive customer service in advance
30.0%

Virtual mirrors
Being able to try on clothes and other garments virtually using augmented type reality mirrors
19.8%

In a pandemic and post-pandemic world, technology can help consumers feel safer in stores

As a result of the pandemic, consumers have become a lot more conscious about their use of, and interactions in, physical stores.

One of the consequences is that high percentages of consumers want technological solutions to feel safer. Some of these solutions, such as contactless payment, self-checkouts, and virtual mirrors help minimize touch and personal interaction in stores. Others, such as product information and navigation are about making the shopping experience more efficient so that consumers can minimize their exposure to physical spaces.

While safety is foremost of consumers minds, these solutions also help enhance the general shopping experience by giving consumers more power to shop the way they want.

Graphic shows the percentage of consumers who say that they would like to see various technologies and solutions in store to help them feel safer when they go shopping; US; data from February 2021

Source: GlobalData consumer research and analysis

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Technology solutions

Consumers still like shopping in stores, but safety has become a much more important factor because of the pandemic. Retailers are also keen to emphasize a safe shopping environment for staff and customers as a way of differentiating and persuading customers to venture out to stores. Technology has a key role to play in creating safe shopping environments, especially when it comes to minimizing contact, reducing distance, and making shopping more efficient.

Safety use cases

Secure contactless payments
By connecting with an IoT security chip running on a payment kiosk, an edge computing gateway can provide financial-grade protection to facilitate payments that don't require direct physical contact with an employee and meet PCI compliance requirements.

Virtual sales staff
Edge computing supports a range of latency-sensitive applications that support retail functions including the deployment of virtual sales associates to answer customer queries and virtual check out.

Virtual safety school
As knowledge of the COVID-19 pandemic improved so did safety guidance. Edge computing can support fast roll out of new online training and/or new instructions to get new processes and procedures in place quickly.
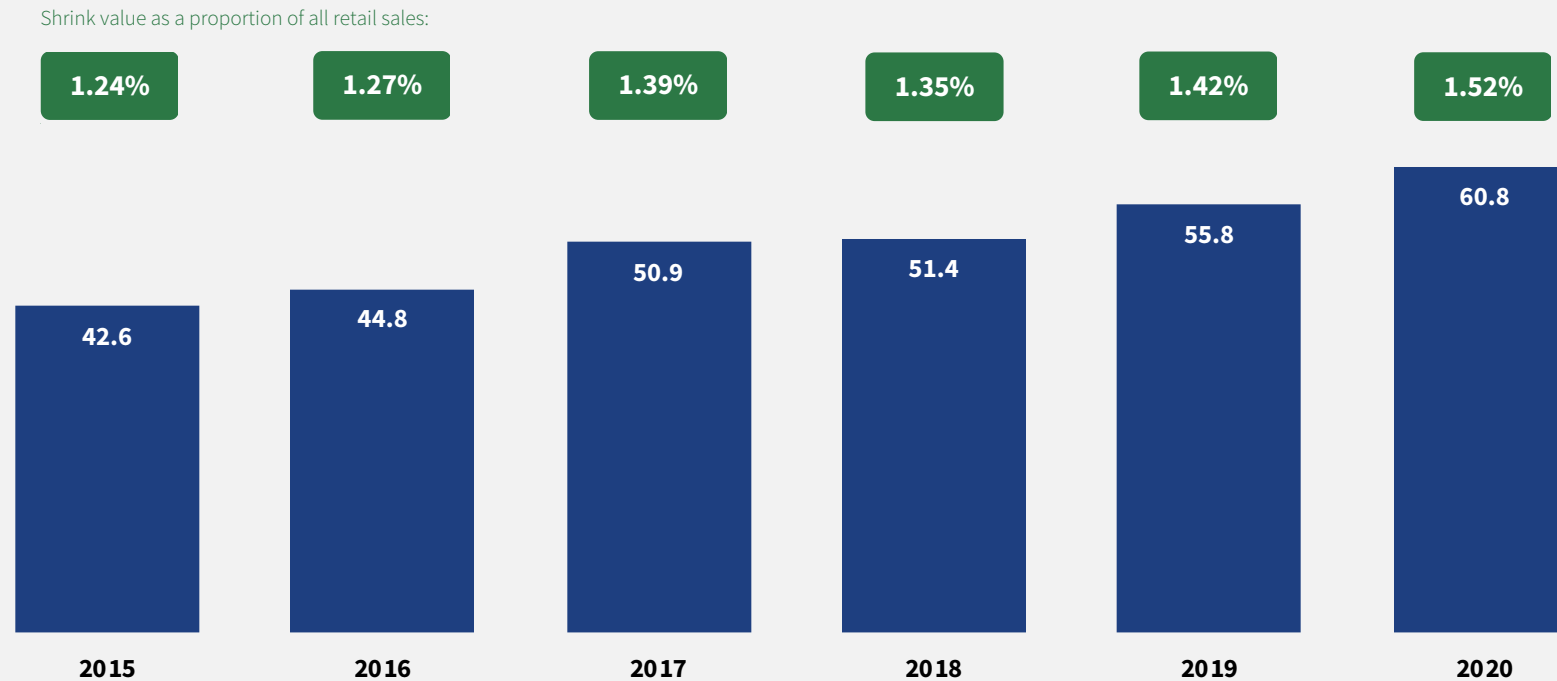
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Shrink in retail

The cost of shrink
Total value of shrink for US retailers by year ($ billions)

Shrink value as a proportion of all retail sales:

| 1.24% | 1.27% | 1.39% | 1.35% | 1.42% | 1.52% |

42.6	44.8	50.9	51.4	55.8	60.8
2015	2016	2017	2018	2019	2020

The cost of 'shrink' is rising – in absolute terms and as a proportion of retail

In US retail the cost of shrink has increased by almost 43% over the past five years. Expressed as a proportion of retail sales, the value of shrink is now 1.5%, up from 1.4% in 2019.

Last year was a particularly bad one for shrink with the cost rising by 9% over 2019, or by $5 billion in real terms. With the disruption of the pandemic this is something many retailers could ill afford.

With various other cost pressures continuing into 2021, increased shrink is an issue retailers need to tackle to support their bottom lines.
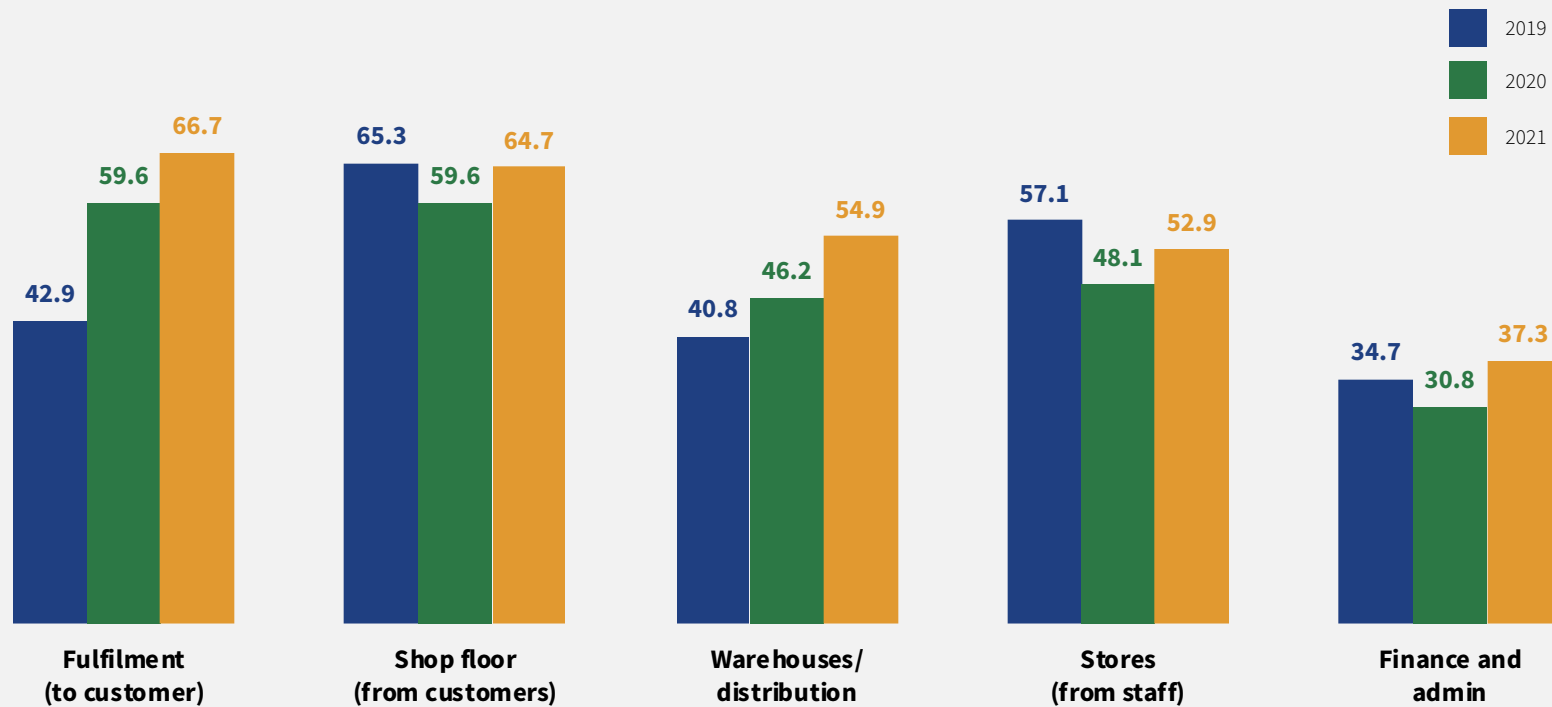
Chart shows the total estimated value of retail shrink for US retailers in each year. Shrink includes all sources from shoplifting to staff theft.
2020 is a full year estimate; US
Source: GlobalData analysis and market data

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Areas of shrink concern

Areas where retailers are concerned about shrink happening

% of retailers mentioning each area as being of concern

Legend: 2019 · 2020 · 2021

Fulfilment (to customer): 42.9, 59.6, 66.7
Shop floor (from customers): 65.3, 59.6, 64.7
Warehouses/distribution: 40.8, 46.2, 54.9
Stores (from staff): 57.1, 48.1, 52.9
Finance and admin: 34.7, 30.8, 37.3

Ecommerce is creating new risks for shrink

Overall, retailers are more concerned about shrink now than they were a few years ago. There have also been some shifts in terms of what retailers are concerned about.

As ecommerce has grown so too has the concern around shrink from fulfillment operations. Indeed, this is the highest area of concern in 2021.

As operations in warehouses become more frenetic due to the rise of online retail the opportunity for shrink here has also increased. There is an opportunity for retailers to step up monitoring to mitigate this risk.

Chart shows the percentage of retailers mentioning each area as being a concern for them in terms of shrink; US
Source: GlobalData retailer survey and analysis

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Technology solutions

With supply and fulfilment chains becoming more complex the opportunities for all types of fraud and loss are increasing. This has serious cost implications for retailers which need to deploy technology to mitigate losses.

Safety use cases

Robotics on guard
Retailers are exploring the use of data collection robots to assess inventory and identify shrink patterns. Edge computing infrastructure offers the security and lower latency to support the analytics required to run the robotics effectively.

Surveillance
Video surveillance is not new in retail but what has changed is how much more effective analytics makes the data captured. Edge computing provides the infrastructure necessary to track customer and staff behavior, flagging issues in real-time.
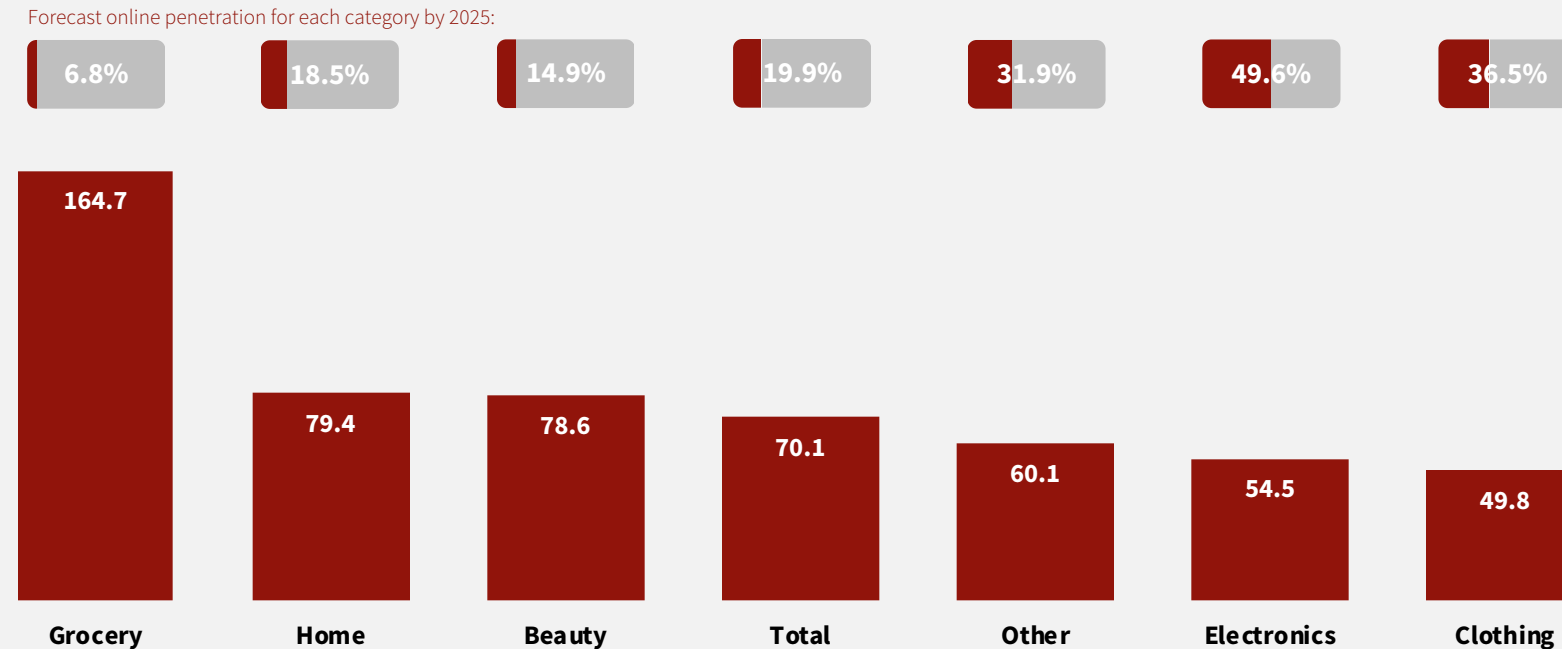

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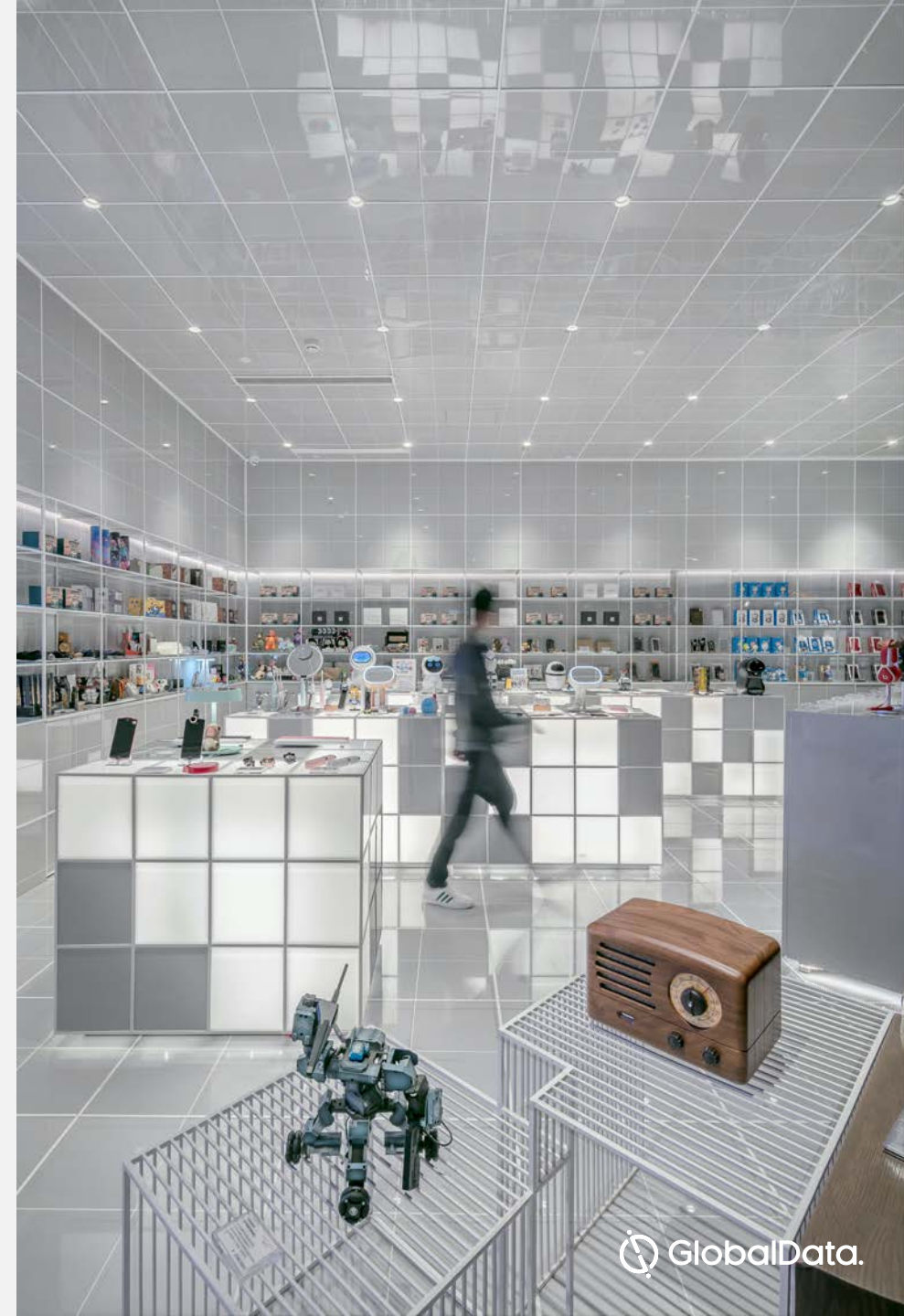
The rise of digital

Online sales growth and penetration by category
Online sales growth by category for 2019-2025 (US, %)

Forecast online penetration for each category by 2025:

Category	Penetration	Growth
Grocery	6.8%	164.7
Home	18.5%	79.4
Beauty	14.9%	78.6
Total	19.9%	70.1
Other	31.9%	60.1
Electronics	49.6%	54.5
Clothing	36.5%	49.8

Penetration is the percentage of total sales in a category which are made online. An online sale is one where the transaction or payment is made online. All data are for US.

Source: GlobalData analysis and market data

Online retail is growing rapidly and adding complexity to retailer business models

Over the next five years, online retail in the US is forecast to grow by just over 70%. By 2025, we forecast that online will account for almost a fifth of total retail sales. Growth has, in part, been fueled by the pandemic which has pushed more shoppers online.

Growth is most pronounced in grocery, where online sales will more than double. However, even digitally mature categories such as electronics and apparel will see growth of around 50%.

Although growth rates will moderate after 2025, there is still plenty of headroom for further digital growth in most categories as penetration will remain below 50%.

The growth of online will present logistical challenges for retailers. Most have already struggled to manage capacity during the surges created by the pandemic – but elevated digital demand will become a new normal that has to be handled on an everyday basis.

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Multichannel shift

Multichannel percentage
Proportion of online orders that are fulfilled by multichannel methods (US)
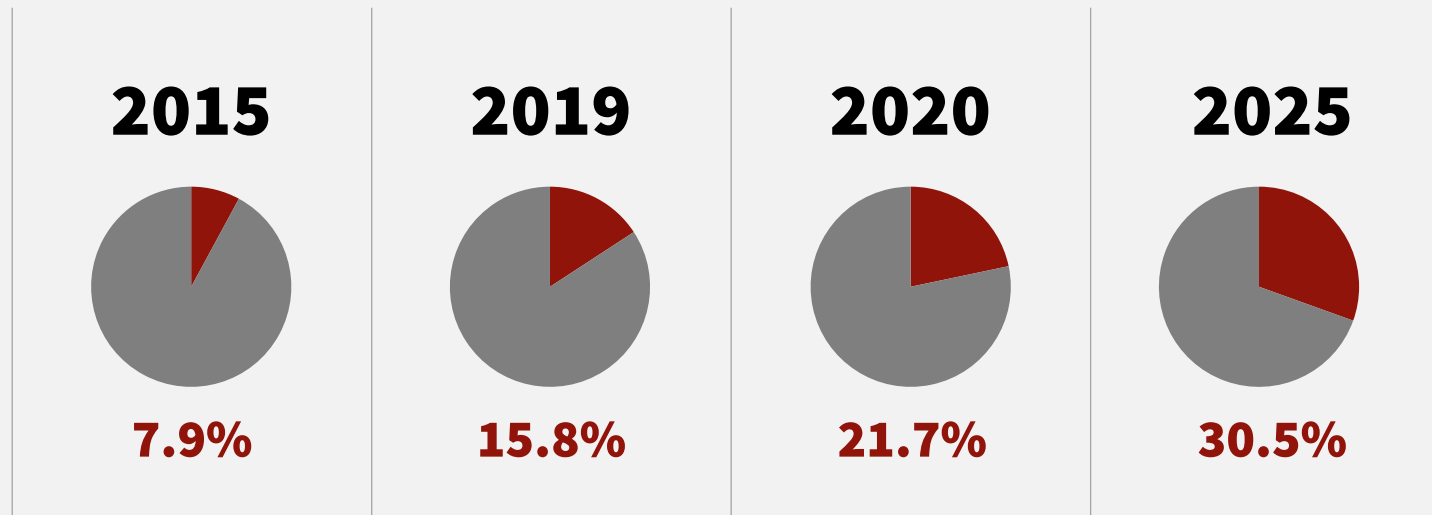
Stores are playing an increasing role in the fulfilment of online orders, which means formats need to adapt

Thanks to the range of distribution options retailers added during the pandemic, many more online orders have become connected to stores. By 2025, we estimate that just under a third of all digital transactions will be fulfilled by a store – this could be via traditional services such as curbside or in-store collection, or via products being shipped directly from a store to consumers' homes.

Linking stores to the fulfilment operation is a sensible way of increasing capacity and ensuring physical shops remain a relevant part of the retailer ecosystem.

With high volumes of orders being fulfilled from stores, retailers will need to adapt their store operations. All aspects need to be reviewed, including having dedicated space for packaging and shipping, having enough staff to process and handle orders, ensuring there is sufficient inventory, and creating processes for collection and returns.

2015	2019	2020	2025
7.9%	**15.8%**	**21.7%**	**30.5%**

Multichannel fulfillment is where an online sale is fulfilled from a physical store. This can be via a customer picking up the order from a store or via shipping from store. Please note, other multichannel connections such as researching or browsing in-store before buying online and returning to store are not included in the percentages.

Source: GlobalData analysis and market data

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Retailer responses

Retailer plans for physical stores over the next few years
% of retailers who say they're going to look at different things

Capacity reduction
Closing and shrinking existing stores
48.1%

Format flex
Opening new store formats / configurations:
67.1%

Omnichannel
Making stores part of the omnichannel ecosystem:
78.5%

Automation
Automating tasks in stores:
39.2%

Efficiencies
Optimizing inventory and product choice in store:
46.8%

Reset economics
Reducing store operating costs:
50.6%

All retailers are evolving in response to both COVID and wider industry trends

All retailers plan to evolve or invest in their stores in some way over the next three years.

Over three-quarters will look to make stores an integral part of the omnichannel ecosystem by adding or extending services such as online collection and ship-from store.

Over two-thirds say they will look to open or test new store configurations or formats to address changing consumer habits. This could, for example, involve smaller suburban off-mall formats such as the Market by Macy's concept.

Just under half of retailers plan to shut or shrink some stores.

Percentage of retailers who are planning to do certain things with their physical stores over the next three years; US; data from general retailer panel in February 2021
Source: GlobalData analysis and market data

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Technology solutions

Digital has become more important and is accelerated because of COVID. This is impacting retailers in terms of: margins, store location, fulfillment, and customer interaction – the whole operation is impacted by these shifts. A solution is to move to an omnichannel model that uses all assets (stores, data centers, etc.). To do this technology is needed to join up the whole operation. At the same time, there are increased costs of doing business because of the pandemic and other economic factors. This means retailers need to find ways of being more effective to cut costs without damaging customer service.

Operational effectiveness use cases:

Automation
More stores are employing retail robotics which effectively allows shops to act as automated mini-fulfilment centers for online orders. Edge computing supports the deployment of robotics technology by providing both the secure and high-speed processing necessary to make it work.

Logistics
Edge computing supports improved logistics efficiency through all points in the supply chain, from the point an order is received through the shipping and delivery processes.

Integration:
Edge computing works in conjunction with connected devices for systems monitoring, analysis, and predictive maintenance.

Trends Analysis
Ongoing analytics looks to identify customer buying trends to ensure products and ranges are optimized, minimizing waste and markdowns that lead to lost margins.

Lower Latency
Leveraging edge computing, retailers can expedite data processing to support real time stock positions.

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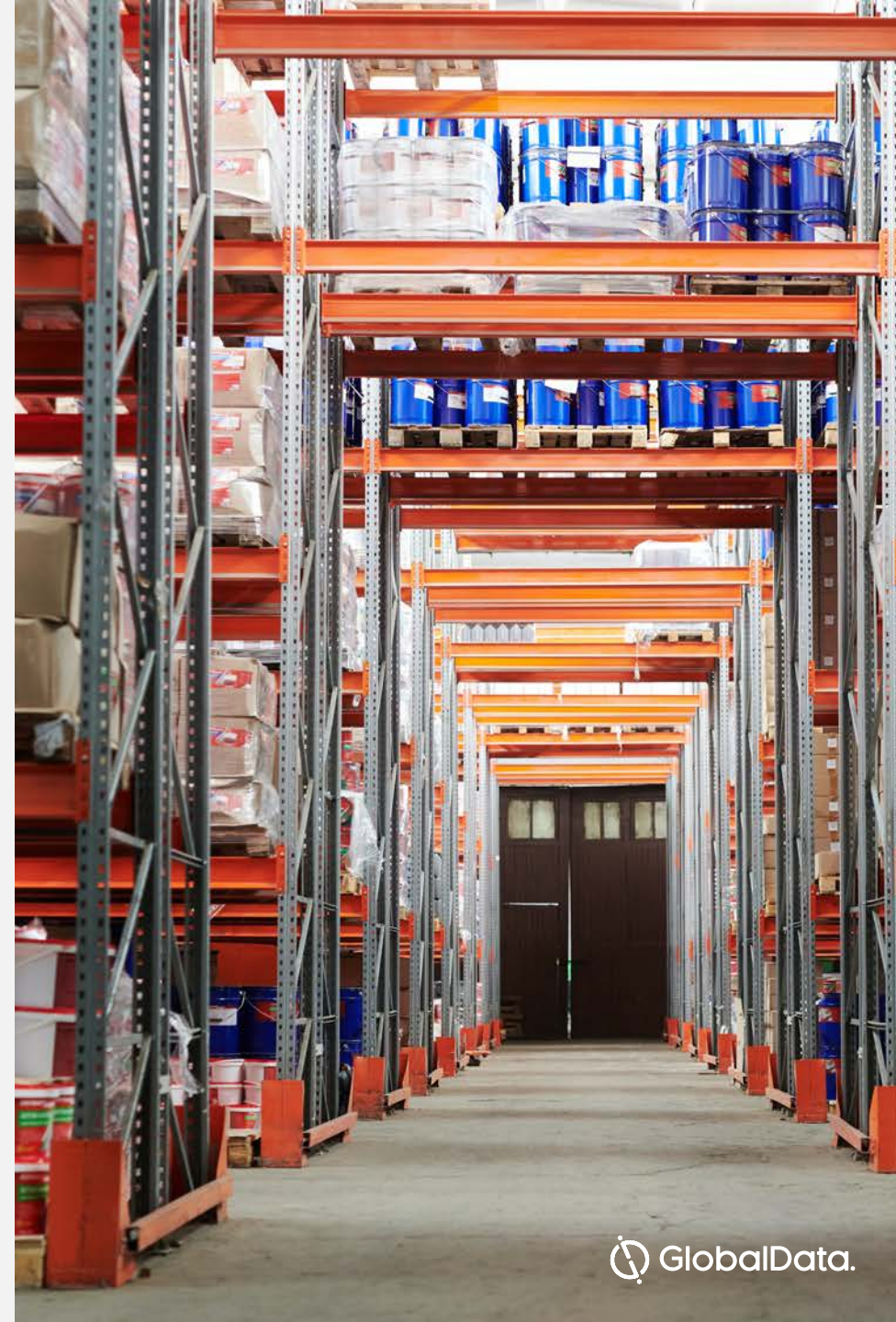
The role of stores

Main reasons why consumers visit physical stores
Percentage point change in people mentioning from 2015-2020

	Replenishment / basic purchases	To get ideas and inspiration	To seek advice or get service
United States	**-6.4**	**+7.2**	**+4.9**
United Kingdom	**-7.1**	**+8.3**	**+6.5**
Germany	**-3.5**	**+3.4**	**+4.1**
Australia	**-4.7**	**+5.3**	**+4.5**

Changes in percentage of consumers who say they visited physical stores mainly for certain reasons within a year. Table shows percentage point change in people mentioning each factor. Covers all retail store types and categories.

Source: GlobalData consumer research and analysis

The reason consumers visit stores is shifting and stores need to adapt to offer enhanced experiences

Stores used to be the only place consumers could go to buy products, so they served a variety of needs. The rise of digital has created shifts in the reasons why people are using physical shops.

Over the past five years there has been a clear move away from consumers using stores for basic purchases and replenishment trips. A lot of this more functional shopping activity has shifted online.

What consumers increasingly want from physical stores are things that online struggles to deliver such as inspiration and ideas, or the ability to speak to staff to ask advice.

Retailers need to adapt stores to be more experiential and more service oriented to cater for the needs of modern shoppers. This will often involve changing layouts and configuration, adapting staffing levels, and creating a more immersive experience.

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How stores are shopped

Spending in the 'center' of the grocery store
How consumer say their spending in the center of the store has changed to five years ago
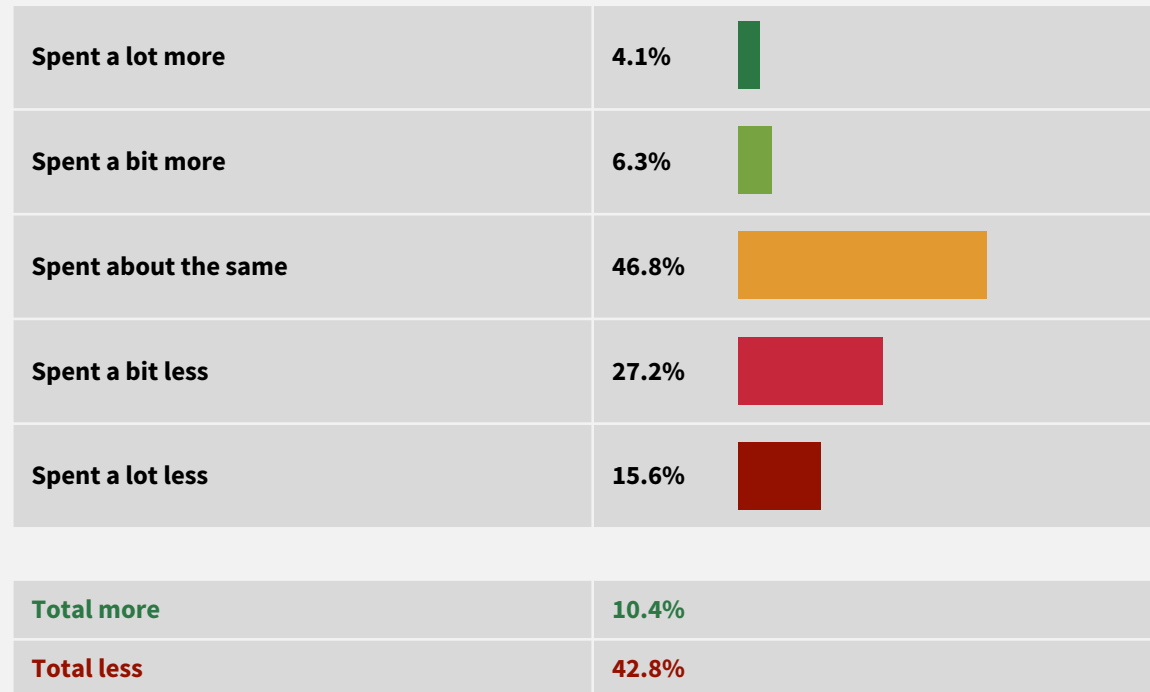
Spent a lot more	**4.1%**	
Spent a bit more	**6.3%**	
Spent about the same	**46.8%**	
Spent a bit less	**27.2%**	
Spent a lot less	**15.6%**	

Total more	**10.4%**	
Total less	**42.8%**	

Diagram shows the percentage of people whose spending has changed in various ways in the center of grocery stores / supermarkets; note that center store means the center aisles where commodities and other items tend to be sold.

Source: GlobalData consumer panel

Online and other factors are changing how shoppers use stores, and retailers need to work harder to encourage people to shop

The rise of online shopping, and of other shifting habits, is changing how consumers use traditional stores. The example opposite shows how spending in the center aisles of grocery stores has changed compared to five years ago.

Generally, people are spending less money in the center aisles of supermarkets. There are a variety of reasons for this, including increased buying of essentials online – including via subscription services such for some regularly purchased products.

Migration to other formats for essentials has also affected center store spending at grocers; this format migration includes more shopping at dollar stores or mass merchants.

Retailers now need to work much harder to drive traffic into different parts of their stores.

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Personalized offers

Percentage of consumers who say they'd be receptive to receiving personalized offers and recommendations to their cell while in store:

44.8%
(up from 29.3% six years ago)

% of receptive consumers who say that on receiving a personalized offer to their cell while shopping they would be likely to…

Visit an area of the store they had not planned to	56.6%
Look at an item they had not planned to	47.8%
Visit a store they had not planned to	44.7%
Buy something they had not planned to	33.5%

Table and data show the percentage of consumers who would be receptive to receiving personalized offers while out shopping and their reaction to it – percentages in table are of those who'd be receptive; data from February 2021

Source: GlobalData consumer research and analysis

Personalized offers can drive traffic in general and to specific parts of stores

Almost 45% of consumers say that they would be receptive to receiving personalized offers to their cellphones while in store. This number has steadily risen over the past 10 years as people have become more used to receiving marketing on their phones.

Personalized offers are a good way of shifting customer behaviors and shopping patterns in physical spaces. A majority of those receiving a personalized offer say that they would visit an area of the store they had not planned to, and almost half say they'd look at items they had not planned to.

Conversion to buying is lower, but even a fractional conversion can have a very big impact on sales.

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Technology solutions

Consumers have more power and choice in terms of what and where to buy. This makes personalizing experiences and stimulating loyalty vital. Personalization is often ineffective as it is done crudely and on partial data. To improve this, retailers need to get better at gathering data across channels and better at using AI to make sense of it and fashion it into attractive offers for shoppers. Retailers also need to improve service levels across all parts of the business to enhance loyalty.

Enhanced customer experience use cases:

Real-time analytics
Edge computing can help facilitate analytics processing of in-store video to better direct traffic to particular areas within the brick-and-mortar outlet. Data can be processed on edge devices which can then deliver offers or other incentives through an app to the consumer.

Virtual dressing rooms
Retailers are getting creative with ways to expedite and improve customer experience through features like virtual dressing rooms which let the consumer visualize how different apparel will fit without having to try on the items. Edge computing accelerates the processing of this data to make virtual fitting rooms feasible.

Augmented reality
Edge computing removes latency, making it practical to offer immersive applications like the virtual training courses Walmart made available to more than 1 million of its employees.
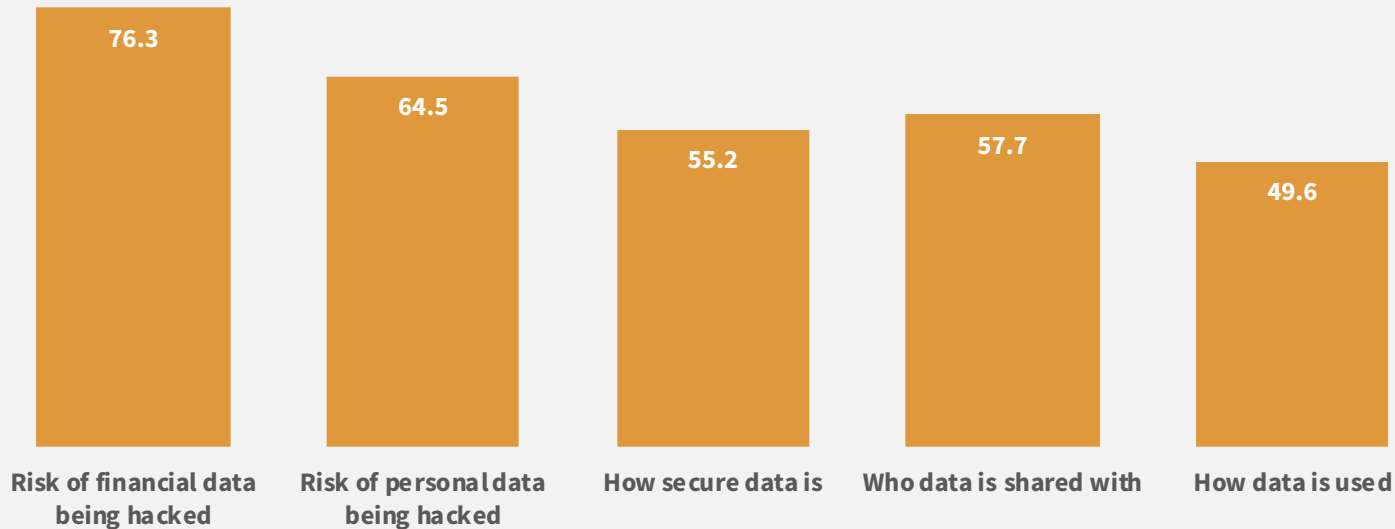
Data capture
By facilitating faster processing, edge computing makes it possible to tap into customer data either in store or online to help personalize and elevate the shopping experience.

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Data security concerns

Consumer security concerns

Percentage of retail consumers who are concerned about…

76.3	**64.5**	**55.2**	**57.7**	**49.6**
Risk of financial data being hacked	Risk of personal data being hacked	How secure data is	Who data is shared with	How data is used

Graph shows the percentage of consumers who say they have concerns about each aspect of data security. Refers only to retail; consumers could mention more than one factor; US; data from February 2021

Source: GlobalData consumer research and analysis

Consumers share information with retailers, but the vast majority have concerns about that data

88% of consumers have at least one concern about data sharing with retailers. The most common worry is the risk of financial data being hacked, followed by the risk of other personal data being hacked.

There are also concerns over who data is shared with and, generally, consumers want more control over how their data is used, and future legislation may demand this. Retailers need to have systems in place that put consumers in control of how their data is shared and used.

Data policies need to be clear and concise so that consumers are aware of what data is being gathered and how it is being used.

With more technologies able to monitor customers, retailers need to take great care not to infringe on consumer rights by gathering information without consent or informing.

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Data breach responses

Consumer responses to data breaches

How would you react to a major data breach at a retailer you normally shop at?

Action	%	
Think badly of the retailer/brand	85.8	👤👤👤👤👤👤👤👤👤👤👤👤👤👤👤👤👤👤
Contact the retailer for more information	77.3	👤👤👤👤👤👤👤👤👤👤👤👤👤👤👤👤
Stop sharing data/information in the future	72.8	👤👤👤👤👤👤👤👤👤👤👤👤👤👤👤
Stop shopping at the retailer for 3 months	39.9	👤👤👤👤👤👤👤👤
Seek some form of compensation	27.6	👤👤👤👤👤👤
Stop shopping at the retailer for 6 months	25.4	👤👤👤👤
Take legal action or seek legal advice	10.1	👤👤
Stop shopping at the retailer for good	9.9	👤👤

Data breaches can have a very negative impact on brands and retailers

A data security breach has serious implications for a retailer's brand and, potentially, the bottom line. Over 85% of consumers say that they'd think badly of a retailer where a data breach occurred, and three-quarters say they'd stop sharing data in the future.

Almost 40% say they would stop shopping at the retailer for 3 months. While not everyone would likely follow through on this, even if a fraction of customers deserted, it would have a tangible impact on sales and profitability.

The cost of a data breach is so high that retailers need to put in place protections to prevent them happening in the first place. However, in the case that a breach does occur, retailers need to have very clear policies and processes for informing customers and for reassuring them. When there is an issue, customers quickly want to know about what data has been breached and what it means for them.

Percentage of consumers who say that they would undertake certain actions if a retailer they regularly shopper at had a major data breach which potentially exposed their personal details; US; data from February 2021

Source: GlobalData consumer research and analysis

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Technology solutions

In the digital age, data, and how effectively retailers mine and use it, is critical to retailers' success. But consumers are wary with so many high-profile retail breaches in the headlines. With more data being shared between the consumer and retailers including personally identifiable information (PII) electronically, customers need reassurances, or they are likely to take their business elsewhere. Security is an essential as retailers look to leverage data for better customer experiences both in-store and online. Retailers can also use real-time information to ensure they have the right items in stock and support greater supply chain efficiencies. Edge computing can play an important role in shoring up security in both brick and mortar and ecommerce environments, providing a mechanism that resolves both security and compliance concerns.

Security use cases

Security and compliance
Edge computing provides the means to process and store information closer to the source. This in turn supports efforts to maintain compliance with geographic governance requirements by keeping data in-region and PCI compliance.

Private connection
Retailers are leveraging IoT to improve both the customer shopping experience and operational efficiency.   But each device connected to the network is a potential point of exposure. Edge computing, when effectively deployed with multiple layers of security to protect consumer and retail data, minimizes the need to transmit data over the public Internet lowering risk.

Authentication
Innovation of applications supporting both online and in-store retail is focused on meeting and exceeding customers' increasingly high expectations for a more efficient and personalized shopping experience. Edge computing infrastructure can support authentication and other security services that are essential to deliver that whether it be through facial recognition in an in-store payment kiosk or expedited payment processing.

Advancing to the Edge

Retail is looking to edge computing to help drive the next-generation of applications. The industry is also looking for a partner to help set that advance in motion. To be effective, this partner needs to bring the right mix of edge technologies, network reach, and industry expertise to the table.

Retailers are turning to Lumen to support their edge engagements. Lumen comes to these engagements delivering flexible edge computing solutions over a global fiber network designed to support digital business interactions within 5 milliseconds of latency. These speeds facilitate the delivery of the analytics and other applications that require low-latency retailers need to become dynamic data-driven businesses essential to thrive in the market today.

The Lumen edge computing solutions provide a foundational element to help retailers drive more revenue and enhance customer satisfaction by accelerating the speed of their digital business. Lumen does this by bringing applications and workloads closer to the source where data is captured, analyzed, and consumed.

Lumen rises to the challenges of edge computing with streamlined, integrated solutions that cover all the necessary elements. These include storage, security, application delivery, and intelligent solutions.

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Advancing to the Edge

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Storage

- Data is precious asset, one that should be used in real-time but also stored for longer term analysis. To most effectively leverage this data, retailers need a solution to store data created from remote digital interactions in order to capture opportunities to enhance products and services.

- Storage-as-a-Service can ingest and reduce data, as well as make intelligent decisions on how and where to move the data automatically. And because it is cloud-based, Storage-as-a-Service can send copies to multiple locations at the same time.

- The Lumen™ Storage Solution brings enterprise-grade storage for any retail IoT use case through Network Storage and Layer-2 Ethernet connectivity, complemented by Data Access Accelerator. Later this year, Lumen plans to add a Layer 3 IP VPN option to the mix.

- The solution is designed to be particularly useful in supporting cases where data is being inconsistently acquired such as in video capture and large data sets. To support consistently stable performance within an economical cost structure, Lumen gives retailers the ability to leverage stored data to create further value. Essentially, the Lumen infrastructure becomes an extension of the retailer's premise.

Security

- Modern retail applications are more dynamic and distributed than ever before. These digital applications are also absolutely essential to support the level of personalization and automation necessary to succeed in retail now and in the future.

- The nature of these applications dictates they need to run closer to where they are consumed, paving the way for more edge computing deployments. Securing the edge and the workloads being processed there needs to be a top priority.

- More and more security is delivered as a virtualized and dynamically scaled set of services rather than hardware appliance running in a data center. Security needs to be orchestrated, automated, and embedded into retail applications and the infrastructure on which they run.

- Lumen comes to the edge with a strong security portfolio bringing with it its Web Application Firewall (WAF), Bot Management, and API Protection service. These solutions, along with one of the largest DDoS deployments in the world, provide the controls retail needs to maintain a stable and high-performing application environment at the edge. Lumen™ Security is integrated, automated, and guided by high fidelity threat intelligence to help secure and improve the retail experience for customers.

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Edge computing
Advancing to the Edge

LUMEN®

Application delivery

- Increasingly, retail applications are bandwidth intensive and latency-sensitive. Edge computing infrastructure plays a key role in supporting optimal application delivery, particularly in highly distributed environments like retail by providing processing and storage close to where digital interactions are happening.

- The Lumen™ Application Delivery Solution combines CDN, CDN Edge Compute, Edge Hosting Environment, Private Cloud, and Dynamic Connections coupled with a robust set of managed services. Retailers can tap into this to achieve the level of application performance they need for a range of functions including video streaming and analytics, immersive applications, and authentication and security services.

- The Lumen Application Delivery solution elevates application performance and retail customer experiences by localizing traffic delivered at the edge. This is essential for latency-sensitive applications and workloads that demand immediate recognition between control and feedback. Retailers can condense their IT footprint and minimize energy costs by tapping Lumen secure private cloud edge as Lumen Edge Compute.

Intelligent solutions

- Processing data efficiently for retail is vital for both the customer experience and overall operational effectiveness. Lumen™ Intelligent Solutions give retailers the foundation this through edge computing locations where digital interactions occur.

- Lumen Intelligent Solutions address all the challenges retailers confront from an application perspective: latency, economics, regulatory, and autonomy for use cases such as inventory management, robotics, and supply chain optimization. The Lumen Intelligence Solutions include the Edge Hosting Environment and a global network backed by a strong skill set in managed services delivery.

- Lumen Intelligent Solutions portfolio helps retailers tap an intelligent data engine to acquire data from more sources, analyze patterns in real-time, and act on business logic close to interactions among consumers and devices.

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Details

Definitions, explanations, methodology

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Methodology and inputs

To calculate the numbers the following inputs were used:

- Consumer metrics come from GlobalData's ongoing consumer survey work and our consumer panel. This includes a survey carried out in February 2021 among a nationally representative sample of consumers in the US. In total, 2,007 people were interviewed.

- GlobalData's consumer panel, which has tracked detailed weekly shopping behaviors and buying habits of a representative sample of over 82,500 consumers since the pandemic started in March 2020 was also used for some of the trend and historic data around pandemic related shopping habits.

- Results from a survey of a representative sample of multichannel retailers operating in the US in February 2021. In total, 51 retailers were surveyed.

- Spending and retail sales data come from GlobalData's model of consumer spending which to calculate the various metrics on a national level. Retail analysts compile this model using a variety of inputs from individual retailers, official government data, industry data, consumer research data, store audits, and other sources.

- Where provided, forecast data is modelled using a three-step process:
  1. Cross-correlation auto regression of inputs over time
  2. Bayesian techniques refine to single-most robust forecast
  3. Cross-correlation auto regression and Bayesian refinement for the final output

- Inputs for the forecasting model include standard economic and social variables as well as specific data from consumer research, retailer predictions and retail metrics such as store numbers.

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About Lumen

Lumen is guided by our belief that humanity is at its best when technology advances the way we live and work. With approximately 450,000 route fiber miles and serving customers in more than 60 countries, we deliver the fastest, most secure platform for applications and data to help businesses, government and communities deliver amazing experiences.

Learn more about Lumen's network, edge cloud, security, communication and collaboration solutions and our purpose to further human progress through technology at…

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About GlobalData

GlobalData is a global research agency and consulting firm. Within the firm's retail division, our work focuses on all aspects of retailing and consumer behavior, which we deliver through a variety of different reports and our interactive Intelligence Centre. We also undertake bespoke research and consulting work for clients.

We are headquartered in New York and London with offices across the world. Our analysts and researchers work to understand the latest trends and developments in retailing across developed and emerging markets. We also have a global panel of consumers which we use to undertake consumer surveys and to gauge and assess sentiment and views on various retail issues.

We work with many of the world's leading retailers, FMCG groups, property firms and those in the financial sector to help them maximize success through developing a thorough understanding of the retail sector and its likely future performance.

Further information

For information on this report, and GlobalData's other products and services, please contact us:

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