



> Report | 2018



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# Into Uncharted Territory: Retail Transformation and its Impact on Digital Infrastructure

DCD in partnership with Vertiv  
2018

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# Our opinion

The broadly agreed characteristics of digital transformation are that it is change-driven and data-driven, that it involves the realignment of business and technology with an objective of improving customer attraction and retention. As such, it fundamentally alters the profile and capabilities of the transforming company. The holistic scope of these changes means that the progress through transformation and the impact on data infrastructure is individual to each retailer. There are, however, a number of principles of engagement that are evident from this research.

The first is that integration across operations is key to a successful transformation, to the deployment of technology and therefore to the infrastructure that supports it. This will usually mean the use of multiple data centers, of cloud (both private and public) and of colocation and outsourcing services, all of which need to be orchestrated towards the same end. The higher specification of the online retail facilities evident in this research may point to the profile of a generation of facilities that will support transformation. The drivers towards operational efficiency and optimal customer experience have laid the foundation for Edge computing as the architecture for IT delivery. There is little evidence of the level of distribution at the IT architectural level required for Edge computing and this represents one of the major capability issues that may be holding back the sector in terms of reaching and impacting the customer

As a consequence of the business model that relies on data and automation, the role of data centers will become more business-critical and require increasingly higher levels of security (both cyber- and physical). Security needs to be interwoven into the equipment and systems rather than added later.

The second principle is not a new one – that the infrastructure needs to be future-proofed. However, in this context the trends are less predictable as many of the technologies that are projected to be used are still a work in progress – robotics, machine learning, augmented reality are very much future projects. The role of major infrastructure options, in particular cloud in its various models, is still subject to debate.

The third principle is that the process as described will require new sets of skills, many still unformed. Data science and analytics are not new fields, but the integration requirements, the mapping of business requirements and technological options, of objectives to outputs, will require new skills as the technologies develop.

These reasons are why many companies on both the demand and the supply side approach the whole area of transformation on a partnership basis, as opposed to a vendor-buyer relationship. One of the sayings associated with digital transformation is that every company becomes an IT company. Partnership is one key way whereby companies who don't want to focus on IT, don't have to.



# Executive Summary

The global retail industry is undergoing digital transformation (DX) as new business strategies, processes and technologies are adopted to support a more consistent and rewarding customer experience across channels. Much has been written about the deployment of discrete technology applications for physical or on-site stores, online stores and distribution centers. However, little analysis has been given to the integration of technologies between these categories and the resulting impact on physical infrastructure requirements.

To investigate this subject, DatacenterDynamics, a global events and media company, partnered with Vertiv, a leader in critical infrastructure that enables vital applications. As part of the inquiry, we conducted 50 one-on-one interviews with executives representing major retailers, who were asked about their approach to digital transformation. The research focused on the impact of such initiatives on the digital infrastructure supporting retail companies across four areas of operation - corporate, physical stores, distribution/logistics and online retail.

## Key findings include:

1. Major retailers are at different stages of progression in digital transformation and can be grouped into three distinct evolutionary phases: Nascent, Emerging and Developed. Retailers in each group have similar customer strategies, operational focus and technology use.
2. Several trends are evident as retailers progress through the stages of DX:
  - Integration of siloed operations that support physical stores, distribution centers and online retail;
  - Aggregation and analysis of data found within these previously siloed operations to help drive a customer-directed transformation of the organization;
  - Holistic collection of data via IoT and subsequent analysis to help identify gaps in the customer experience and reveal opportunities for using existing and new technologies;
  - A shift from using technology primarily to cut costs, automate processes and exercise greater command over the supply chain towards enhancing a well-defined customer experience.
3. As technology integration takes place, retailers are able to find and utilize the wealth of data within their organization quicker, with the objective of continually working towards refining their customer experience.
4. As retailers evolve towards a more customer-directed business

model, the technologies they choose will become increasingly critical to business goals, and power densities across all of their IT spaces will increase.

5. The focus on customer experience requires speed and agility across the organization, especially in the application of new technologies. The new business drivers for acquiring physical infrastructure are cost, speed of deployment, and future flexibility. Retailers will turn away from infrastructure that is not easily integrated, scalable or modular.
6. Retail distribution centers are the unsung heroes of successful DX. As retailers evolve, they invest heavily in distribution - the amount of investment is expected to grow by 25% over the next two years. Just 4.2% of the 10 least advanced companies expect their distribution center numbers to increase over the next two years, compared to 52% among the 10 most advanced companies.
7. The adoption of colocation and cloud hosting will increase. Today, companies are using different digital infrastructure strategies for physical stores, distribution, and online retail. Physical retail currently favors the use of in-house facilities, supported by colocation, external hosting and private/hybrid cloud systems. In contrast, logistics operations are mostly supported by distributed data centers.
8. While the principles of using a hybrid mix of in-house, colocation and cloud (private and public) have been established in the pre-DX era, plans for the future development of infrastructure show no set patterns, as retailers are progressing to a large extent without precedent through a step-change process. In this, they are looking for assistance from technology and business partners.
9. Retailers in each stage of DX face different imperatives for progressing along the transformation curve:
  - Nascent: quickly embrace the idea of creating a customer-directed organization, integrate siloed operations across distribution centers, physical stores and online stores, and begin aggregating and analyzing the customer-related data to define a desired customer experience.
  - Emerging: apply technology for the sake of improving the customer experience, further transform distribution and logistics to better address customer demand and product acquisition, and move toward an integrated multi- or omni-channel experience.
  - Developed: move the organization and its use of technology beyond selling products and services, extend its brands through the use of experiential technologies, and deploy tools that can rapidly find and analyze data in order to support a more engaging customer experience in real-time.



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# Methodology

DatacenterDynamics and Vertiv recently interviewed 50 managers and executives from among major global and regional retailers about the confluence of strategies and business drivers to achieve desired levels of customer experience, digital transformation and operational improvement. We were seeking to better understand the business drivers behind DX and the technologies enabling it.

The study looks at data centers supporting four main areas of operation within the space: corporate operations, on-site stores, online retailing and distribution, warehousing and logistics (distribution).

Our goals included:

1. Mapping digital transformation – its processes and technologies – across this very diverse industry;
2. Understanding the movement of retailers through the different stages of digital transformation;
3. Discovering the key business drivers behind retailers’ technology, operational and delivery models;
4. Learning the impacts on data centers as retailers move through stages of DX.



## Who took part in the research?

- 50 telephone interviews conducted in April and May 2018 among major store retailers, excluding on-line only retailers such as Amazon. The sample includes 11 of the world’s 25 largest retailers by revenue (see Figure 1)
- The group has annual revenue of USD 953 billion, which represents around 4% of the global retail total in 2017. They employ over 4.1 million people and have a combined IT budget of USD 40.2 billion, or around 4.5% of total revenue.
- The majority of interviews took place in the USA and Europe.
- The sample comprises half respondents from the operational streams and half from the management, administration and leaderships roles on the IT and data center side of the company

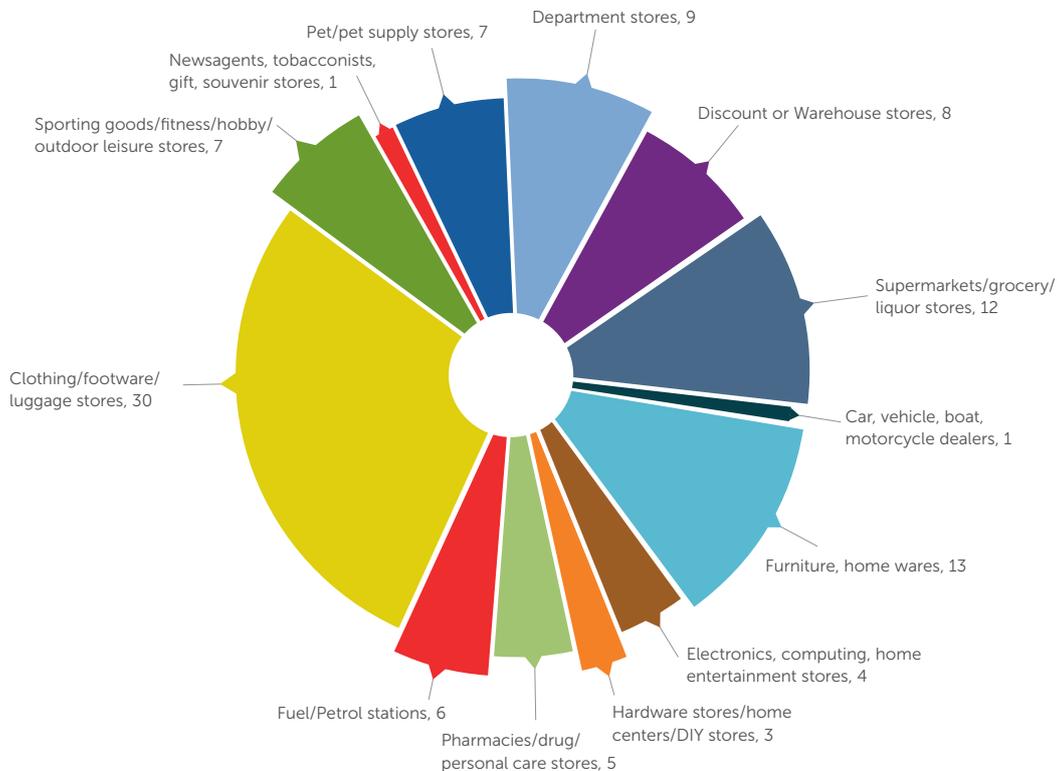


Figure 01: Retail categories in the sample

## Establishing a DX Index

The retailers in this study are at different stages of progression through digital transformation, spanning three distinct operational and technology stages:



Retailers in each of these stages share characteristics based on how they serve customers, why they use technology and how they execute their particular operational strategies. Understanding these characteristics allowed us to calculate an 'evolutionary score' – the DX Index – for each retailer and group them into the three stages.

The DX Index is based on factors such as:

- Maturity of their customer experience;
- Current and planned uptake of DX technologies;
- Level of technology and process integration across previously siloed operations;
- Investment in infrastructure to meet their requirements for transformation;
- Evidence of a well-designed forward strategy.

It should be noted that the DX Index is used as an indicator of relative evolutionary progression and has no nominal value.

The degree of DX evolution is shown below, ranked in order from the least advanced to the most advanced, with the number of retailers shown in each stage as well as the DX Index Scores that separate the stages (**Figure 02**).

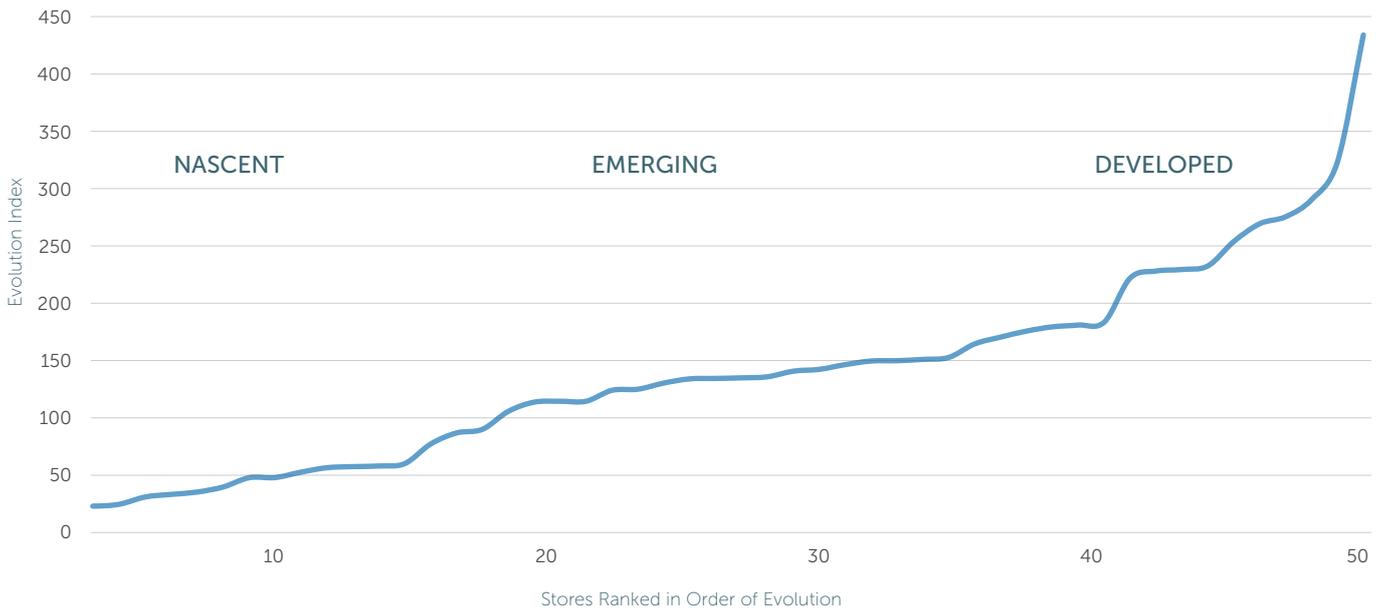


Figure 02: Mapping the DX

# Profiles by stage

## The Nascent DX Profile

Retailers in the Nascent category have DX Index scores of 26 to 60 and tend to rely exclusively on on-site store customer experiences. These companies are deploying technology to defend against online competition and to reduce waste, achieve greater control over their supply chains and reduce labor and other operational costs, as shown below.

For example, food retailers are typically in the Nascent stage of transformation, due to the challenges presented by off-premise retailing and distribution of fresh produce and the inefficiency of fulfilling grocery orders based purely on demand. Generally, there is less technological integration between corporate data centers, distribution centers and on-site stores than within the Emerging or Developed groups. The Nascent group does not rely on multiple channels which require the collection and analysis of customer and product data and the integration of supply and delivery capabilities (Figure 03).

Business continuity is about protecting the service the company delivers and this is not just an IT concern. DX requires the freedom to move the workloads between systems. Being a data-driven organization makes analytics a core aspect of ensuring service continuity and we are coordinating this across the service flow.

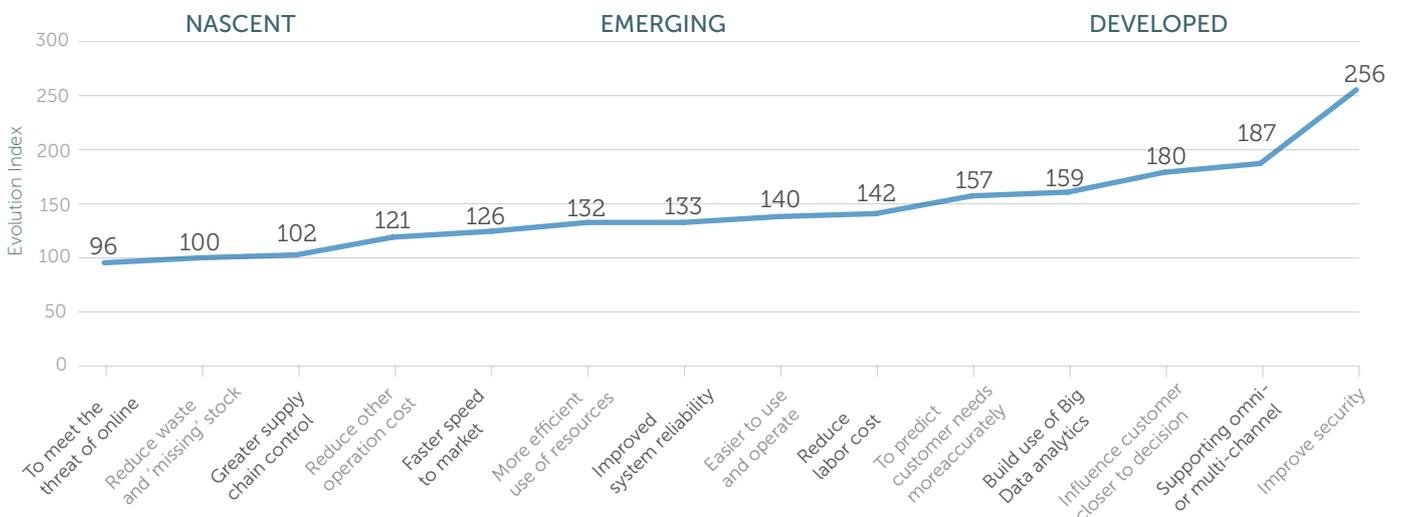
*VP, IT & Networks, Fashion & Apparel, United States*

## The Emerging DX Profile

Accounting for the largest segment – 42% – are retailers who are beginning to transform their business to accommodate a richer customer experience. They have DX Index scores of 52 to 245, so there is some cross-over between them and the Nascent group. For example, apparel retailers are generally in this group, as they are compelled to become more customer-directed by brand competition in the category, seasonal variations in fashions and tastes and vulnerability to economic downturns, when compared to necessity items with lower demand elasticity.

Emerging DX retailers are notable for adopting multi-channel customer strategies, where customers experience different capabilities online versus on-site. In this stage, distribution automation accelerates to become a linchpin of the business, where warehouse and inventory data must be collected, managed and matched against customer demand across both on-site and online stores.

Technology is deployed generally to achieve customer benefits more commonly associated with DX: influence customers closer to decisions, reduced waste and missing stock, improve speed to market to products and enhance reliability of a system that spans multiple organizational silos. Reducing labor costs – both at the distribution level and in stores - was clustered with the other "smarter" operation drivers, because to a large extent fewer staff is conditional upon them.



The numbers shown above the line on this chart are the average DX evolution scores of the companies which are driven by each factor

Figure 03: Mapping the DX



### The Developed DX Profile

In the most progressive stage are approximately 32% of retailers, with DX Index scores of 146 to 431. These are highly customer-focused and customer-directed companies, with operations and technologies aligned to provide a consistent, omni-channel customer experience for product exploration, selection, ordering delivery, returns and support. These retailers are firmly entrenched with using "big data" for improved analytics, greater customer understanding and then influencing customers, from first point of contact to purchase decision and beyond.

Improved security emerges as a key driver among this group as a result of the larger attack surface presented by IoT and fully automated systems and it is driven by the large amount of customer data required to link technologies to customers at the more advanced stages of DX. Up until that point, there may be the assumption that the security of internal operational systems will protect the transformational process.

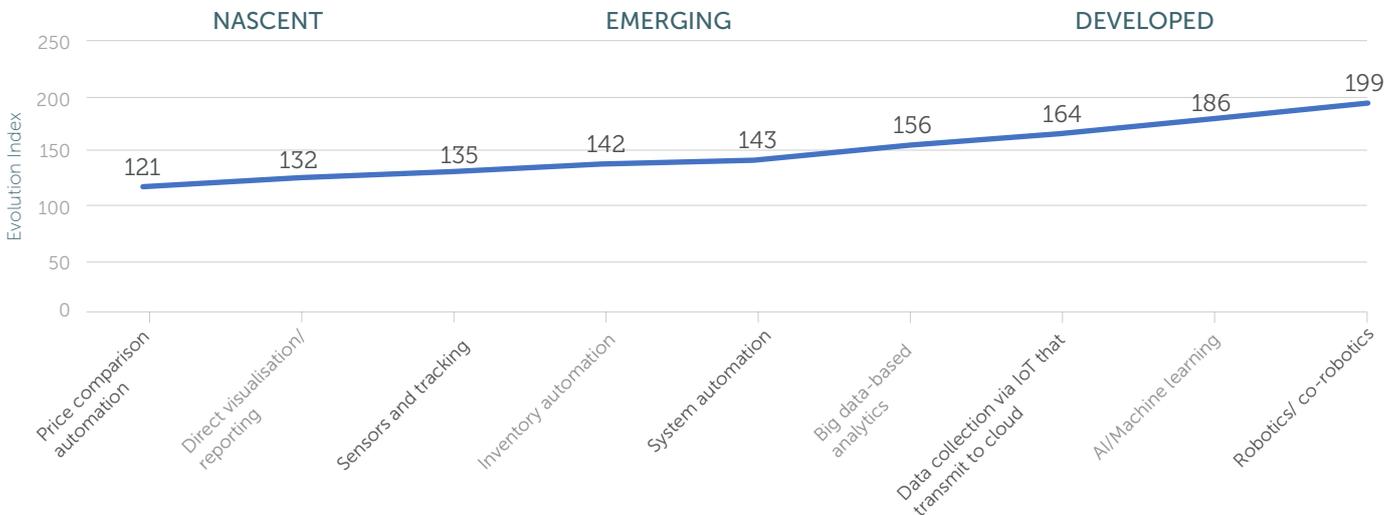
More evolved retailers tend towards fewer stores and distribution facilities, have lower revenue and staff numbers and are more dependent on online retail and logistics. While the trend is indicative only it is due largely to the greater progression among the fashion and lifestyle retail sector.

### Growing Importance of Distribution

One of the most significant factors in advancement along the digital transformation curve is role of the distribution center in serving the customer experience.

Nascent DX retailers tend to have technologies deployed in silos, with little integration between stores and distribution centers.

As they progress, deployment of inventory and system automation through the logistics chain is universally adopted, and the most highly evolved retailers have adopted even more sophisticated technologies. As retailers become more customer-focused and move into the Developed stage of transformation, they adopt distribution center technologies such as analytics, IoT to cloud, machine learning and robotics (Figure 04). ▶



The numbers shown above the line on this chart are the average DX evolution scores of the companies which have deployed each technology.

Figure 04

▶ As retailers become more customer-directed, and especially as they roll out online stores, they begin transforming their distribution centers to deliver goods wherever they are ordered. The inventory system is the key to ensuring that delivery to customers is as effective as possible and to reducing wastage of overstocking. In this most advanced stage, retailers build additional distribution centers closer to where customers are located.

In fact, while the number of on-site stores is expected to decline over the next two years, the number of distribution centers is expected to grow by 25 percent. Technology investments will remain flat for on-site stores but grow by double-digits for distribution centers.

Retailers in the Emerging DX stage are transforming their distribution centers with sensor systems to track operations, data inventory automation and real-time inventory access, and are beginning to use the cloud as the destination for data collected by IoT devices. Over the next two years, robotics, management automation, big data analytics, visualized reporting are intended deployments.

All these distribution changes are expected to make the organization more agile and customer-directed, improve time to market for new products, make use of resources more efficient and more accurately anticipate customer needs (Figure 05).

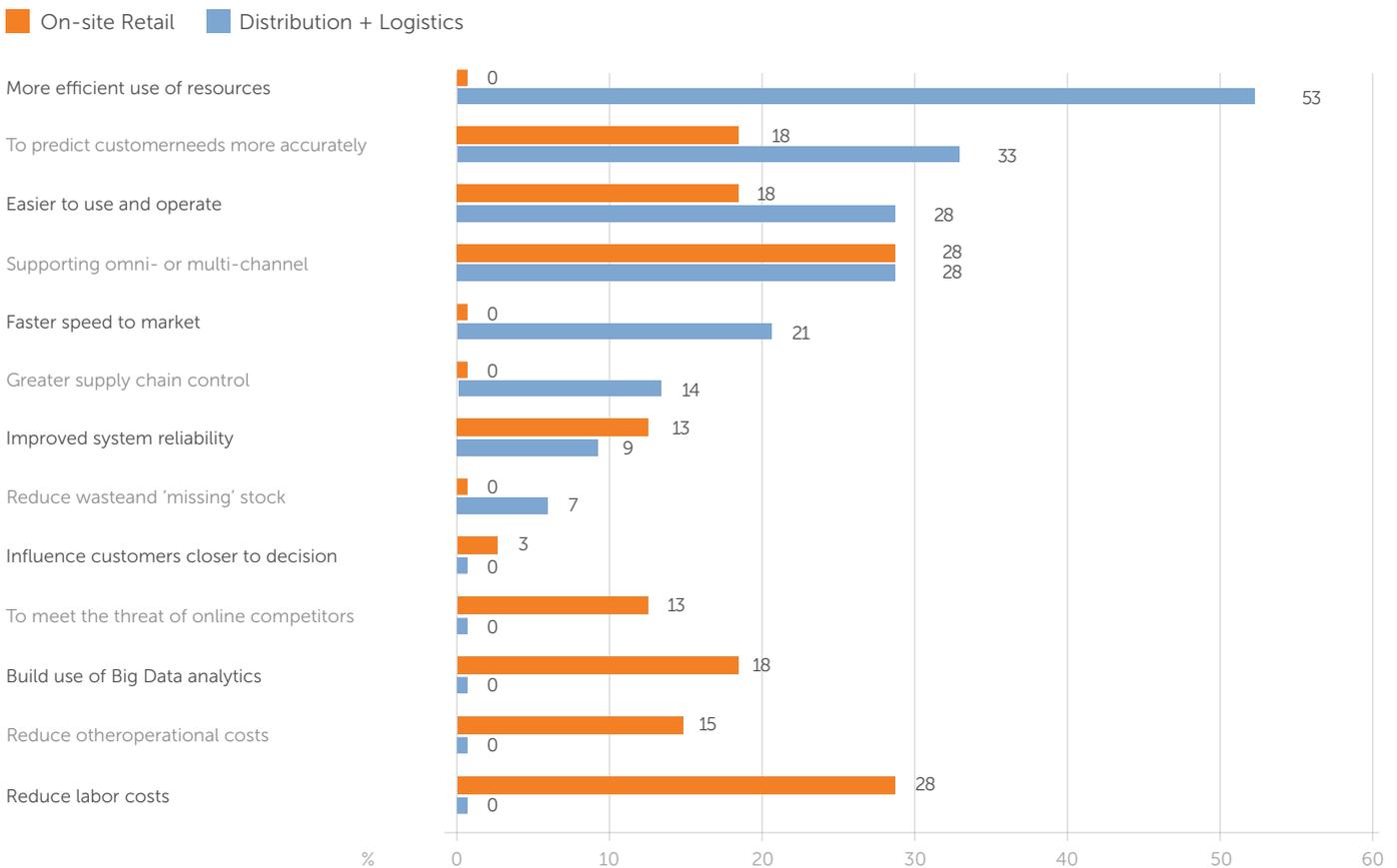


Figure 05: Drivers for Investment in DX by Area of Operations

## Technology Adoption by Data Centers Supporting On-site Stores

While distribution centers are receiving an infusion of new technologies, data centers supporting on-site stores are being upgraded with technologies for big data analytics, reporting, Wi-Fi customer tracking, real-time inventory access and automated management in general.

Over the next two years, the in-store DX will incorporate a direct customer focus through sensors and customer tracking, demand analytics, 360° customer learning and AI deployed in an interactive customer environment. These, together with augmented systems, smart shelves and IoT collection and cloud transmission systems, will form the next wave of investment and deployment within shops and stores (Figure 06 - 07).

Within these changing distribution and store spaces, it is not just the deployment of individual technology applications that is important, but the cumulative impact of these applications in making the organization more agile and responsive to customer demand. This is best illustrated by the chain of inventory analysis connecting distribution, logistics and store; or within a stage of the process, for example IoT, analytics and customer interaction technologies that are all used close to the point of sale.

These two types of data centers are close also in inventory automation since a system that gets as close to production at one end and to customers at the other needs to be consistent along the whole path, otherwise it will be limited at its weakest point.

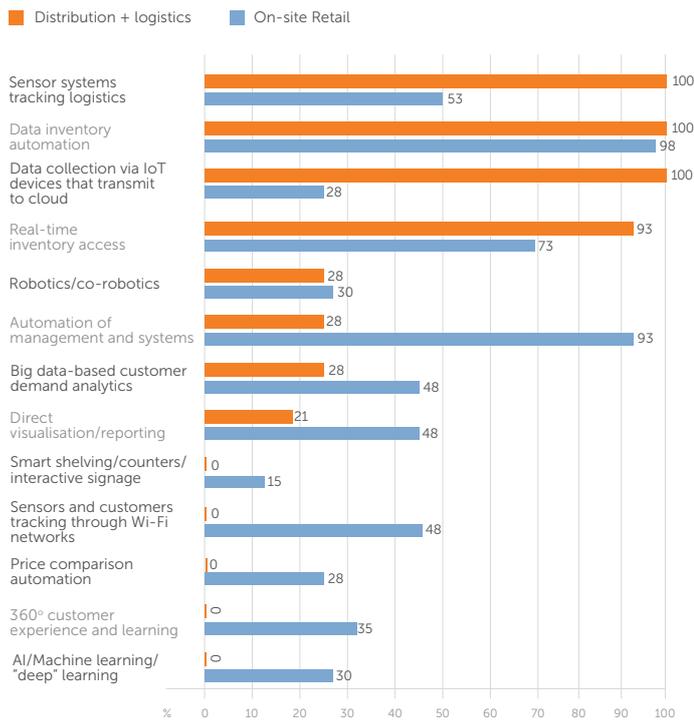


Figure 06: Current Adoption of Technologies & Processes

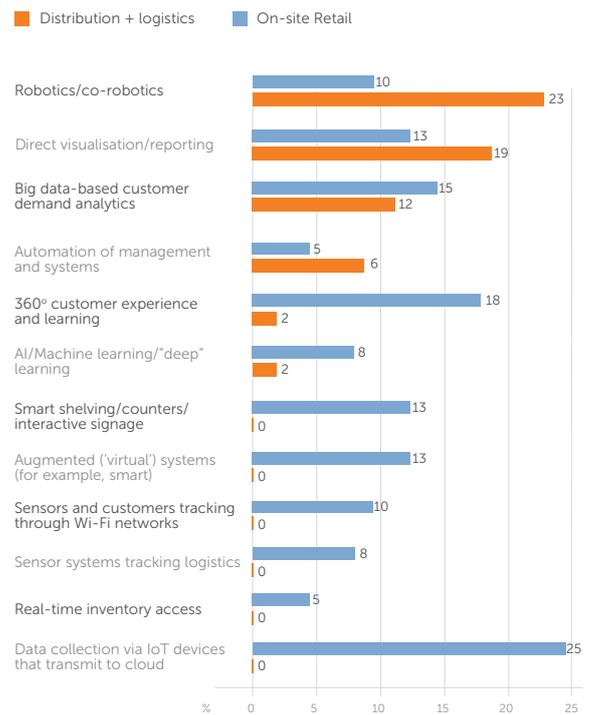


Figure 07: Adoption of Technologies & Processes Over the Next Two Years

## Current Data Center Profile and Core Operations

Survey respondents were responsible for 420 in-house data centers and 522 smaller, distributed data centers. This represents an average of 8 central and 10 localized data centers per company. These data centers account for 332,000 square meters (3.5 million square feet) of white space and a total power capacity of 473 MW, at an average of 1.42 kW per square meter (135 watts per square foot) (Figure 08).

There is a close correlation between the progression through the DX evolution and power density (Figure 09).

Supermarkets stand out as requiring larger overall quantities of power for their data centers, but at a lower than average density. Fashion, housewares and lifestyle chains tend to have smaller footprints and run at higher average densities.

In part, the need for higher densities for these chains is led by their high adoption of consumer-facing technologies to compete in the discretionary goods category. In this category they are more vulnerable to the encroachment of online retail, rapid changes in tastes and the weakness of discretionary spending during economic downturn. A high number of the major names in retail that have

	Corporate Operations	On-site Retail Operations	Distribution, Warehousing & Logistics Operations	Online Retail Operations	Total
White space (m2 x 1000) (Total)	44.9	155	62.1	69.9	331.9
Power capacity (MW) (Total)	47.2	181.4	100.7	143.5	472.8
Density (kW/m2) (Average)	1.05	1.17	1.62	2.05	1.42

Figure 08: Profile of Inhouse Data Centers by Area of Operations

gone out of business in the past 12 months demonstrates this – Toys'R'Us, Radio Shack, Payless ShoeSource, Vitamin World, and before that, Borders, Quiksilver, Blockbuster, Circuit City, BHS, Debenhams and Dick Smith. Grocery groups and supermarkets are not immune (think A&P, Palmer & Harvey, My Local) but much less commonly represented.

## Outsourcing Retail Data Center Operations

As with data center operations in general, retailers are supported by multiple forms of digital infrastructure – in-house, colocation and

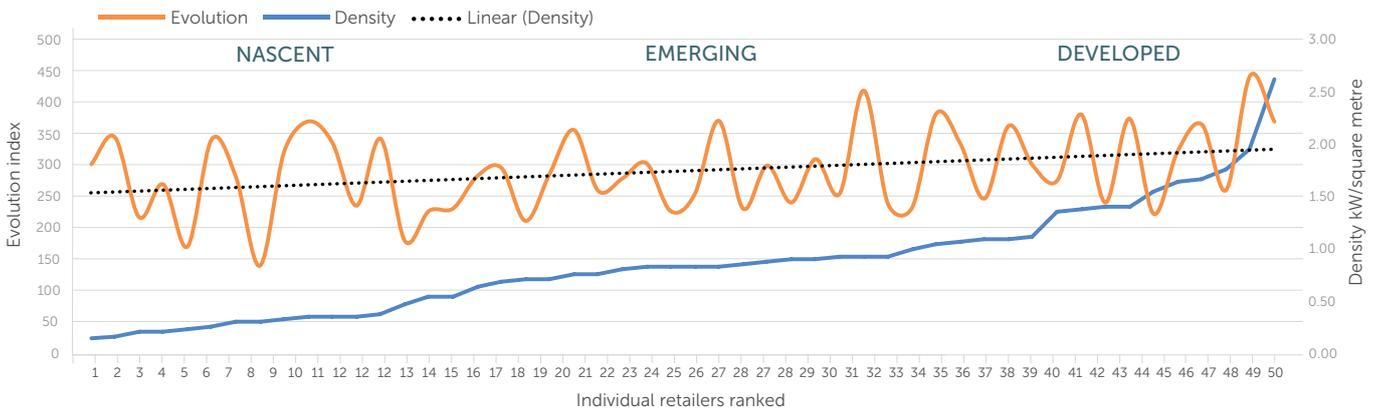


Figure 09: Average Data Center Density by Company Ranked by Evolution

Locations	On-site Retail Activities	Distribution, Warehousing & Logistics Activities
In-house central data center	95%	67%
Distributed localized data centers	38%	58%
Colocated or hosted externally	58%	33%
Private or hybrid cloud	53%	26%
Public cloud	20%	12%

Figure 10: Use of Infrastructure Options by Area of Operations

private and hybrid cloud data centers. This variation is not unusual to retailers, but represents a common series of strategies whereby options are added as the IT requirements of the company increase or change. Therefore, from an original in-house basis, colocation will be deployed to add capacity, supported by public cloud services (most usually for corporate and administrative functions) and private/hybrid cloud as a means of extending the efficiencies of cloud further into operational and customer-facing activities. The numbers of distributed, localized data centers do not seem indicate the deployment of Edge – these are smaller data centers running alongside distribution and retail arteries (Figure 10). ▶

“ We started with our own data centers distributed around our service area. The growth of online and our investment in that limited that approach. We have consolidated data centers while reaching into new areas via outsourcing. We are looking at the best model for cloud at the moment. ”

Operations Manager - Logistics, Discount Stores, United States

► These findings suggest strongly that these companies have developed different infrastructure strategies for the store retail, distribution/logistics and online retail data center operations. Store retail is based very much on in-house facilities supported by colocation, external hosting and private/hybrid cloud systems. In contrast, distribution and logistics are supported by distributed data centers, and less by any form of external infrastructure. This may be taken to indicate the centrality of distribution to the company’s operations.

### Changes in Data Center Criticality

The business criticality of data centers supporting online retail and distribution/logistics has increased over the past 2 years. In contrast, for data centers supporting onsite stores, their importance has remained the same for 77% while increasing for only 23% of respondents (Figure 11).

Retailers calculate that their cost per hour of unplanned downtime sits at just over \$1.1 million for data centers supporting both physical and online retail. The average cited for data centers supporting distribution and logistics is \$875,000 per hour.

The key costs that are factored into calculation are loss of revenue and the costs of repair and restoration. These are also the key costs for online retail. Data centers servicing distribution and logistics operations also factor in the costs of fines and penalties as unplanned downtime impacts their ability to deliver on SLAs.

### Changing Retail Delivery System

Over the next two years, retailers expect the portion of total revenue attributable to on-site stores to decline, while the portion from online retail operations will increase (Figure 12).

Decline in the contribution of physical retail will be higher among those pursuing a multi-channel strategy (-10.9%) and among the most progressive retailers, the decline is highest at 14.3%.

The number of on-site stores will increase marginally over next 2 years, by 0.4%. This contrasts with a large increase in the number of distribution centers and warehouses, by 25.8% (Figure 13). This ►

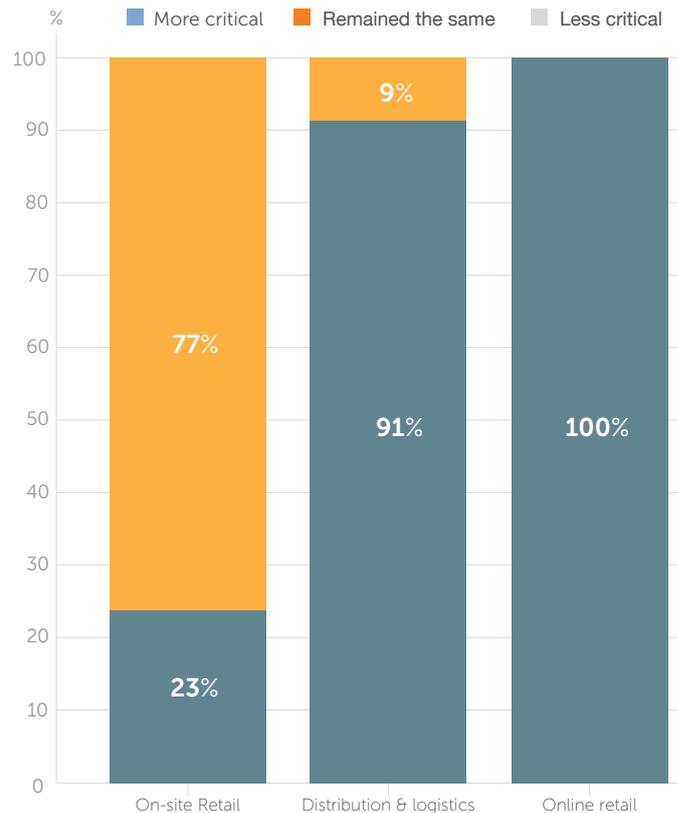


Figure 11: Changing importance of data centers by operational area

	Last Financial Year	In 2 Years' Time	% Increase
On-site Stores	63.7 %	60.6 %	- 4.9%
Online Stores	22.4 %	25.8 %	15.2%
Distribution, Warehousing, Logistics	13.9 %	13.6 %	- 2.2%

Figure 12: Estimated Change in Contribution to Revenue over next 2 Years

	Currently	In 2 Years' Time	% Increase
On-site Stores	105,223	105,653	0.4%
Distribution, Warehousing, Logistics Activities	1,215	1,215	25.8%

Figure 13: Estimated Change in Numbers of Stores & Warehouses over next 2 Years

► increase will place distribution closer to where customers are located, reduce transport costs and, as the role of the physical store is gradually eroded, will support expansion via online retail.

An increase in distribution centers correlates with progress through digital transformation. Only 4.2% of the 10 least advanced companies expect distribution center numbers to increase over the next two years, compared to 52% among the 10 most progressive companies (Figure 14).

### What's Next for Digital Infrastructure?

The next two years will see a marked decrease of 27% in the proportion of footprint across all forms of infrastructure (principally in-house, outsourced and clouds) accounted for by corporate operations and a marginal decrease in the proportion of footprint accounted for by on-site retail. There will be a strong increase in the footprint of online retail (20%) and of distribution/logistics (10%) (Figure 15 - 16).

Future increases in footprint will focus on cloud hosting and consolidation for data centers supporting on-site stores or distribution (Figure 17).

Quintile	Rate of Increase over 2 years in Distribution Centers
Most advanced (1st to 10th)	52%
Well advanced (11th to 20th)	30,3%
Moderately advanced (21st to 30th)	30,3
Not well advanced (31st to 40th)	20.2%
Least well advanced (41st to 50th)	4.2%

Figure 14

	Currently	In 2 Years' Time	% Increase/ Decrease
Corporate Activities	22.7%	16.6%	- 26.9%
Physical 'Bricks & Mortar' Operations	34.2%	33.9%	- 0.9%
Online Retail Operations	20.9%	25.1%	20.0%
Distribution, Warehousing, Logistics Operations	22.2%	24.4%	9.9%

Figure 15: Estimated Change in Proportion of Footprint over next 2 Years

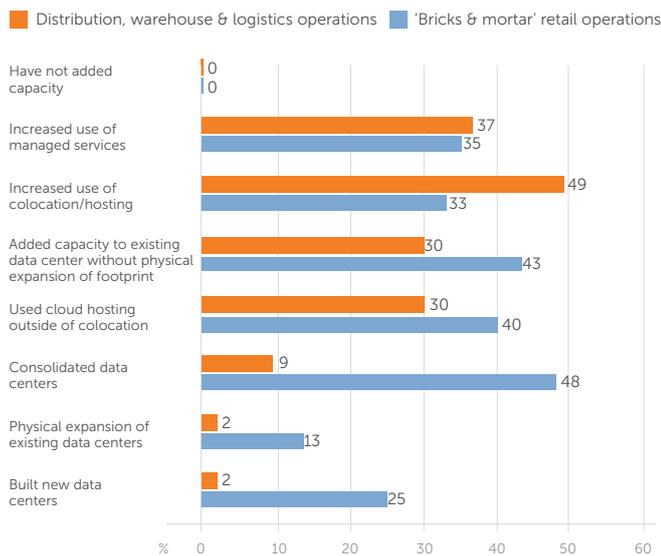


Figure 16: Means of Adding Capacity by Area of Operations

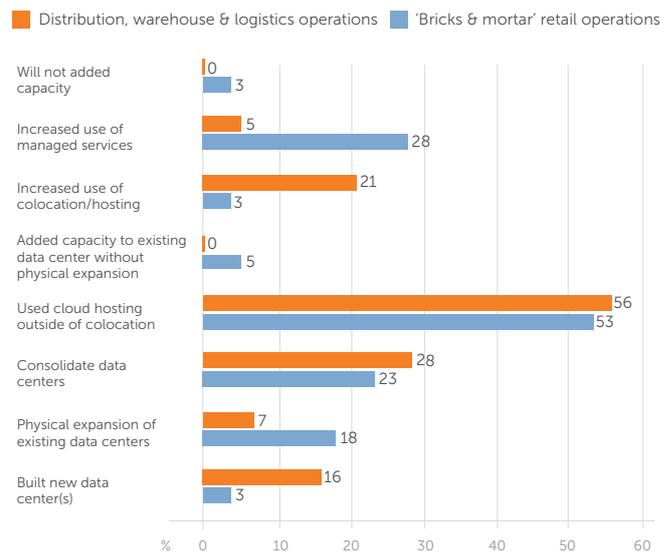


Figure 17: Future Means of Adding Capacity by Area of Operations



# Conclusion

The findings of this research indicate an industry on the cusp of transformation. All these organizations – even those defined as the most ‘Nascent’ – have deployed at least some of the technologies that will build into a DX approach, even if the drivers to do so are based on fending off threats rather than developing opportunities. And the findings indicate that there is a process based on business logic starting with the inward supply chain and then pushing the components of data collection, analytics, knowledge-based decision making and focused customer interaction closer in to the customer and the point at which purchasing decisions are made.

The involvement of marketing switches the role of the data center 180° from its original role as a support function out on the periphery of a company, bringing it fully into the core. This reflects the purpose of DX, since the objectives of effective transformation are business objectives and primary among those is the need to grow customers and loyalty.

A number of future trends can be hypothesized:

- The role of the corporate data center will continue to be diminished by the increasing importance of those data centers supporting online, distribution and on-site store operations. Already, corporate IT functions (administrative, HR, resourcing) appear to be integrated within operational data centers.
- Within individual organizations, the infrastructure supporting different operational areas are on different trajectories, indicating separate strategies. Retail operations, both in-store and online, are based almost entirely on in-house data centers supported by colocation and clouds while distribution is based more on networks with less support from colocation, outsourcing or clouds. Distribution is about to undergo a phase of build to cope with the technologies that are now being introduced, while retail is just past a strong build phase.
- The challenge will be to develop infrastructure that can unify these systems and remove the different approaches that, at the moment, characterize the different phases of operation within a single company. At the moment, public cloud is used sparingly and not evidently for DX-critical tasks (i.e. it is used for administration rather than customer-facing work). One of the key questions facing these retailers will be the deployment of cloud and the infrastructure required for immediate interaction once the range of customer-facing technologies are established – retail will then embark on its own Edge computing era.

This is new territory for these companies and the data infrastructure they are using. While the principles of using a hybrid mix of in-house, collocated facilities and clouds (private and public) has been established in the pre-DX era, the current and future development of infrastructure shows no set patterns as these retailers are progressing to a large extent without precedent through a step-change process. In this they look for assistance from technology and business partners.

The drivers towards operational efficiency and optimal customer experience have laid the foundation for Edge computing as the architecture for IT delivery. Within the distribution system there is extensive deployment of IoT data collected and transmitted to cloud but the profile of IT architecture at the store level is still based around data centers (enterprise or collocated) with some cloud support. There is little evidence of the level of distribution at the IT architectural level required for Edge computing and this represents one of the major capability issues that may be holding back the sector in terms of reaching and impacting the customer. Edge is emerging as a term for where the store’s physical presence meets the customer, it is the evolution of an interactive, immediate and impactful presence that will determine the winners in this race.