



The data-driven supply chain

Preparing Australian retail for an emergence of data-driven collaboration.

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Executive summary

Technological advances are transforming the world of supply chain management, making data easier to collect, interpret and share. As a result, we are about to see the emergence of supply chains where data from every web search, transaction and movement of stock, trucks, team members and customers will be captured and combined with other data to better predict and manage resources to satisfy customer demands. The age of the data-driven supply chain is here.

All those in the retail industry will need to adapt quickly or risk losing out to those organisations that are able to leverage data to cut supply chain costs and compete more effectively. In this report, we explore the implications of data-driven supply chains for Australian businesses. What are the benefits? How ready are supply chain actors to adopt a data-driven approach? And what are some of the barriers to adoption?

Our research, conducted in Australia with a sample of retailers, logistics companies and manufacturers, shows there is a very strong appetite for a data-driven approach to supply chain management. We discovered that their interest lies not only in the power of data to transform traditional supply chain KPIs like inventory turnover, delivery in full on time (DIFOT), defect reduction, responsiveness and network optimisation, but also to more general business benefits like sustainable competitive advantage, improved management of risk and loss, improved margins, better informed business decisions and agility.

Many are already adopting the key technologies required for the data-driven

supply chain and are enjoying generally positive relationships with their supply chain partners. So what's holding them back?

Our research identifies a number of barriers that need to be removed before data-driven supply chains reach their full potential. Our respondents reported a reluctance to share data, the need to properly secure it, skills gaps in their businesses, challenges with technology, organisational issues and issues relating to the alignment of goals and processes as major obstacles to deployment. But all these problems are solvable. In this report, we also feature case studies of businesses that are successfully embracing a data-driven approach, including German retailer, Otto, Target USA, Australia Post and Linfox.

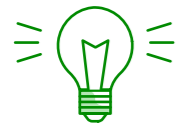
From these case studies and our research, we conclude that there are a number of key issues to be addressed before data-driven supply chains can be widely adopted in Australia. In particular, organisations need to:

- Recognise data as a resource that only has value in use and needs to be shared
- Assure the security of their data
- Align incentives between partners so there is mutual benefit from collaboration.

The retail ecosystem as a whole needs to bring in new data science skills, and smaller businesses need to develop strategies to participate in the data-driven supply chain or risk being relegated to low-value, transactional relationships.

We end with a look at what's looming on the technology horizon and how organisations can leverage these developments to realise the extraordinary benefits promised by the data-driven supply chain.





Introduction

It has been said that data is the new oil because it has the power to transform every industry. In our last report, Spacetime Marketing, we looked at the power of data to transform retail marketing. In this report, we look at the power of data to transform an equally important part of retail: the supply chain.

The supply chain is vital to the retail industry as it represents both a large cost and a source of competitive advantage. Supply chain costs are all the costs associated with warehousing, transporting and handling goods from the point of manufacture to the point of purchase. They have been calculated by the Reserve Bank¹ to represent 40% of retail selling prices. As a result, any company in the supply chain that controls these costs can potentially improve profitability. In other cases, a supply chain can also provide a competitive advantage by delivering goods to the right place more quickly than rivals, thereby serving customers better.

Organisations that are able to leverage data to cut supply chain costs and compete more effectively will gain the edge in the market. Today, it increasingly comes down to data – how it’s captured, stored and analysed – all of which has been a key factor in the success of organisations as diverse as Wal Mart, Inditex, Amazon and Alibaba.

Of course, supply chains have existed since the earliest days of the retail industry, but the concept of supply chain management (SCM) only emerged in the 1980s and has been defined as:

“The management of upstream and downstream relationships with suppliers and customers in order to deliver superior customer value at less cost to the supply chain as a whole.”²

At the core of SCM is the theory of collaborative advantage³ - the idea that more value is created by collaboration than by competition, and that when two or more organisations pool resources and skills, all will benefit.

One of the earliest examples of supply chain collaboration in action was between Walmart and Proctor & Gamble in the mid 1980s.⁴ Walmart agreed to share point of sale data with Proctor & Gamble and, in turn, Proctor & Gamble agreed to ensure optimal on-shelf inventory at Walmart. This resulted in increased sales, decreased inventory in the supply chain, lower costs for Walmart and better market intelligence for Proctor & Gamble. Since then, supply chain collaboration (SCC) has become a well-established practice in parts of the retail industry, with studies showing that it delivers benefits such as risk reduction, cost reduction, access to complementary resources, improved productivity, increased competitive advantage and increased profitability over time

Today, technological advances are about to usher us into a new era of supply chain management. The ability to capture supply chain data will rise exponentially with 5.5 billion smartphones and 20 billion IoT (Internet of Things) devices in the market by 2020.⁵ This means it will be possible to collect data not just on sales and production schedules between retailer and manufacturer (as in the Walmart and Proctor & Gamble case), but also on the location and condition of goods throughout the supply chain. These devices will also capture data on everything from consumer and team member movements (both in and outside stores), stock levels in consumers’ fridges and appliances, the availability of consumers to receive a delivery, and much more.

Data storage is already being transformed through the increasing capacity and flexibility, and decreasing cost of cloud computing. Wide adoption of cloud computing – in combination with other technologies like blockchain and data exchanges – will mean information can be shared by all parties, not just point-to-point

collaborators like retailers and manufacturers.

Data analysis will also be transformed as autonomous or semi-autonomous platforms allow businesses to discover deeper insights, make predictions, or generate recommendations in virtual real time. Most of all, high-speed data networks will enable collaboration to take place at a pace that allows timely business decisions.

Traditional retailers face competitive disruption from online, digital-native retailers like Amazon and Alibaba, who are already masters of supply chain data. Both collect every customer click and use it to predict buying patterns, optimise the placement of inventory in the network and maximise both the speed and efficiency of delivery. Scott Galloway⁶ has predicted that in the future Amazon will send consumers two boxes a week: one containing all the goods Amazon thinks you will need and the other to return what you don’t require, all based on data captured through interactions in the supply chain.

In this report, we look at how ready the Australian retail industry is to take advantage of the potential of such data-driven supply chains and how prepared they are to compete with data-driven online competitors. What do retailers see as the benefits of deploying a data-driven supply chain? And what are the challenges involved in deploying a data-driven approach (including for the human relationships that make any supply chain work)?

The 5G Journey

“5G” is actually an umbrella term for the next major wave of cellular network technology.

5G will be a combination of transformational technologies that will address specific use cases. Whilst 1G, 2G, 3G and 4G were primarily about voice and then data, 5G will be about connecting everything with minimal delay, faster speeds and at larger scale with billions of devices (via the Internet of Things).

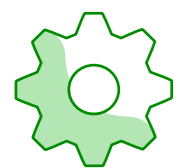
It’s important to understand that the journey from 4G to 5G will not be a step change. Rather, many features that will eventually be collectively standardised as “5G” will be incorporated into forthcoming releases of 4G LTE standards and will progressively be deployed by carriers such as Telstra alongside 5G deployments.

There will be three major benefits to 5G:

- **Ultra-low latency:** For mobile broadband services, 5G will approximately halve latency, which will greatly improve the responsiveness of internet applications. For mission-critical IoT applications, 5G will provide very low latencies at very high reliability, which will enable brand new industrial automation applications
- **Increased speeds:** 5G will provide significantly faster data speeds and greater capacity, eventually providing ten times the speeds and capacity of 4G.
- **Massive machine-to-machine communications:** 4G technologies are today facilitating IoT sensor networks at scale, but 5G will increase scale to support billions of devices without human intervention.

5G will enable the new technologies that improve efficiency, speed and reliability through a number of features:

- A Distributed Cloud Architecture means resources can be allocated from the cloud enabling a better user experience
- Massive MIMO Antennas that can focus the radio signal towards multiple users simultaneously, increasing speeds and reducing interference
- New protocols and frame structures, which will reduce latency for all services and improve reliability for mission-critical IoT services
- Network Slicing, which enables a granular way to segment the network, allowing finely grained performance and cost optimisation to be applied to individual applications, industries and customers
- Network Function Virtualisation enables the use of commodity network infrastructure, which can rapidly adapt to the changing needs of the network.



Australia Post: Data driving functional capability

Australia Post has been around for 209 years, but the last seven have seen some of the biggest changes in its history, with the number of parcels they deliver overtaking letters for the first time. There is no doubt this has been driven by Australia's growing appetite for online shopping – up a whopping 19.2% last year alone. For the company, this new e-commerce world is presenting both enormous opportunities – and challenges – as they move from their traditional business model towards an omnichannel, on-demand future.

As both a retailer through its nationwide network of Post Offices and a delivery organisation, the company is now looking very closely at its supply chain and how it can better leverage data to improve the customer experience. It's all about understanding what the customer wants and aligning their service offering to that. And the organisation understands that customers want choice, they want convenience, and they want everything now.

Like many big corporates, their legacy systems and infrastructure have required major transformation. Beyond that, however, they are now focusing on a number of key questions. What do customers want in-store? How do retail systems connect to real-time inventory? How does the customer want their parcel delivered: click and collect, online or physical? How can the customer get visibility of their order? And how can the delivery network be optimised to get a parcel to the customer as quickly and efficiently as possible?

Data is the thread that runs through all this, and the customer's mobile number is one simple data set that is proving very powerful, connecting into all the organisation's internal data sets and systems. By having access to that data and knowing where an item is in the supply chain, the company allows their customers to say, 'I want this item delivered here now, but in ten minutes time I want to change my preference,' and the supply chain has the flexibility and fluidity to keep up.

Australia Post's biggest challenge now is how best to use data to drive change and improve collaboration. The recent launch of the Shipster platform is a prime example.

With Shipster, Australia Post is essentially creating an ecosystem of merchants and retailers involved in online shopping. The aim is both to help them grow their online businesses and remove one of the biggest barriers to that goal – shipping and shipping costs – by combining data from merchants, consumers and logistics providers to get items where and when people want them. Over a hundred retailers and merchants are already onboard and another thousand are on the horizon.

So what next for Australia Post? Will drones one day be delivering our mail? Nothing is being ruled out of the mix, it seems. Whether it's an autonomous electric vehicle or a drone, the company aims to continue leveraging data, and evolving its business model to make sure they can keep giving customers what they want, when and where they want it.

Find out how another Australian company, Linfox, is taking a new approach to data on page 34.



3. Our research

3.1. Research questions and hypothesis

In our research, we sought to explore the phenomena of data-driven supply chains and investigate three key questions:

1. What are the key readiness factors for the successful execution of a data-driven retail supply chain?
2. What are the current readiness levels across retail, transport/logistics and manufacturing businesses?
3. What gaps in readiness exist between supply chain actors (retail, transport/logistics and manufacturing) and between small and large organisations in these sectors?

Data-driven supply chain framework

We hypothesised that readiness to adopt a data-driven supply chain (DDSC) approach consists of three conditions.

First, there must be a belief in the business benefits that DDSC can deliver i.e. management must believe that an investment in DDSC can deliver increased sales, margins or business efficiency

through measurable improvements in supply chain KPIs like fulfilment rates, inventory productivity, responsiveness, quality or network optimisation.

Secondly, the key technology elements of a DDSC must be adopted. These are the technologies that are facilitating large-scale data capture (IoT), automatic analysis (AA) and more effective collaboration between supply chain partners (cloud, blockchain and data exchanges). Thirdly, we hypothesised that for a DDSC approach to be implemented, there must be strong relationships between the supply chain partners. The resulting framework builds on a recent review of academic studies into supply chain collaboration by Ralston et al⁸ that found the three main initiators of SCC are internal (belief), technological and relational.



Data-driven supply chain framework

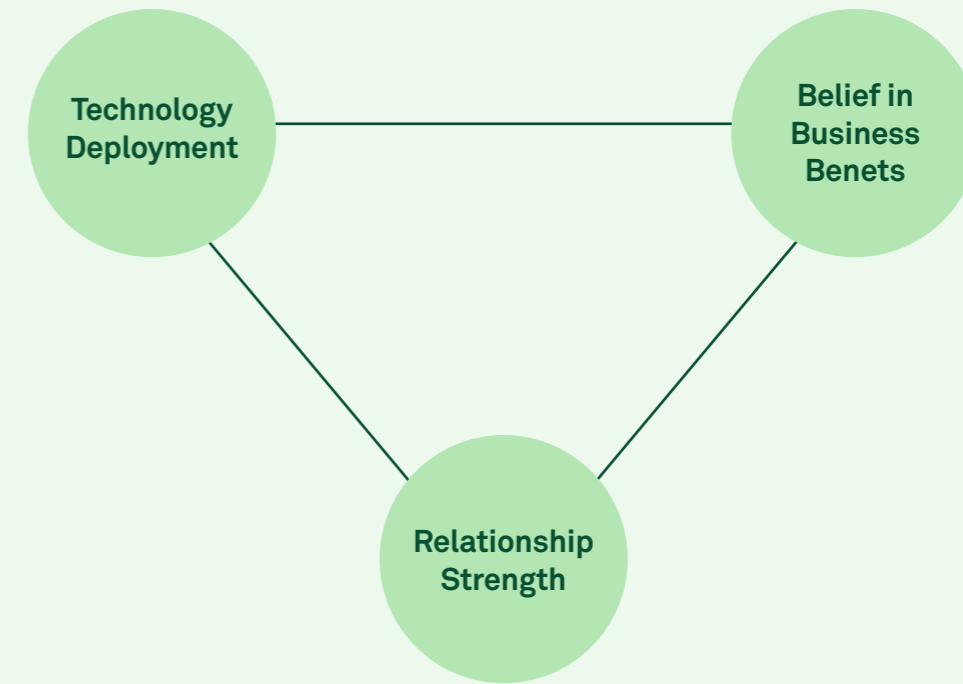
Deployment of key technology

- a. Data capture devices (IoT, video, etc.)
- b. Automated data analysis tools
- c. Platforms for collaboration (cloud, blockchain, etc.)

1. Belief that data-driven supply chains will increase sales, margin and business efficiency through improvements in:

- a. Fullfilment (delivery in full, on time [DIFOT])
- b. Inventory (turnover, days supply, carrying cost)
- c. Responsiveness (lead time, flexibility)
- d. Quality (defects)
- e. Network optimisation

2. Top management commitment



Inter and intra company

- a. Levels of trust
- b. Risk and reward sharing
- c. Common business language

Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
Source: Forrester Research conducted the fieldwork for the quantitative part of the research on behalf of Telstra.

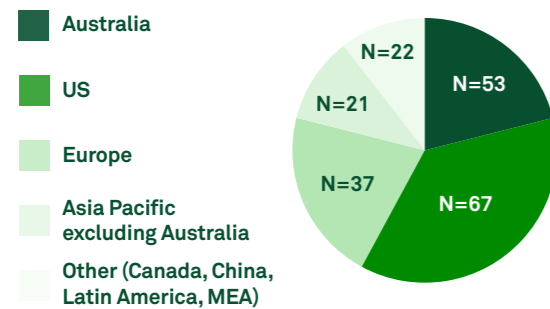
3.2. Sample and method

We conducted both quantitative and qualitative research to answer our research questions and test our hypotheses. Forrester Research conducted the quantitative part of the research on behalf of Telstra. The data was gathered via an online survey during December 2017 and January

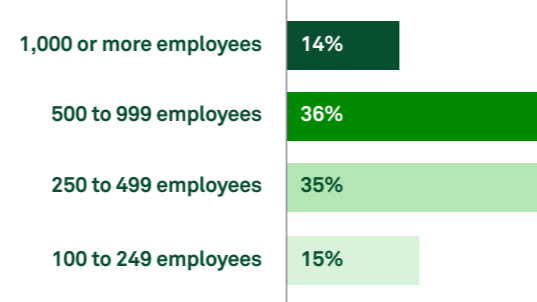
2018. 200 responses were received from supply chain professionals from around Australia. An effort was made to ensure we received responses from all parts of the supply chain (retail, transport/ logistics and manufacturing) and that both smaller businesses and larger businesses were represented.

Respondent profile

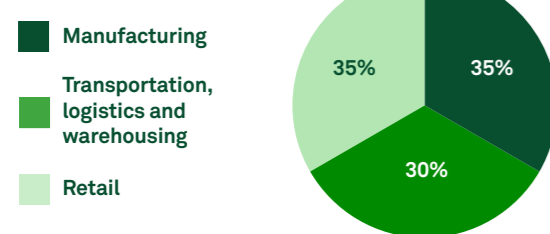
Company HQ location



Company size (in Australia)



Target industries



Level of decision-making



Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
 Source: Forrester Research conducted the fieldwork for the quantitative part of the research on behalf of Telstra.

The qualitative phase of the research consisted of a number of semistructured interviews with retail supply chain professionals from Australia. The interviews were conducted between November 2017 and February 2018.

3.3. Results and discussion

3.3.1. Belief in business benefits

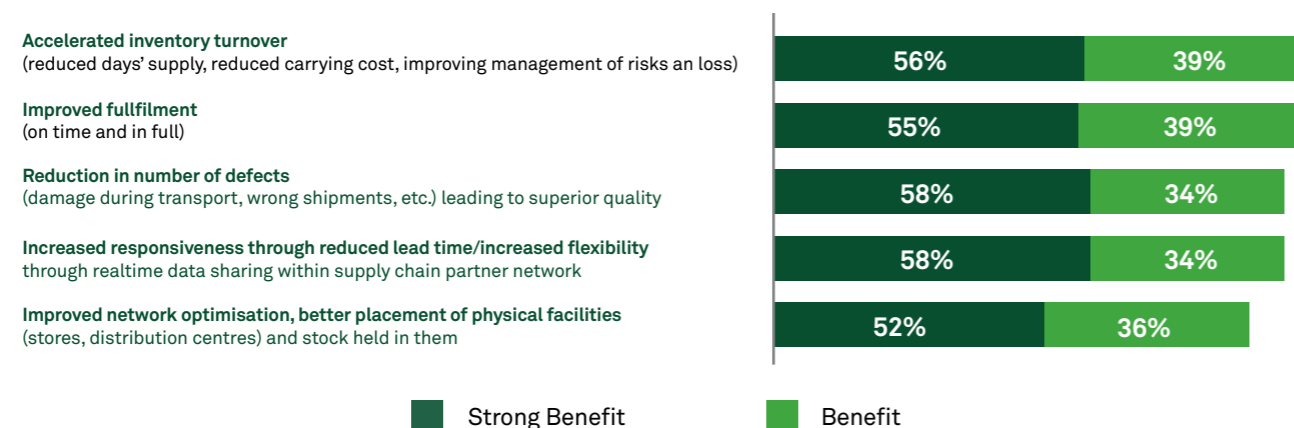
Our survey respondents showed an overwhelming belief that a data-driven

approach will deliver tangible business benefits in both traditional supply chain deliverables and general business performance.

Traditional deliverables like inventory turnover, delivery in full on time (DIFOT), defect reduction, responsiveness and network optimisation were all seen as benefits of a data-driven approach.

“To what degree do you believe the following are benefits of your organisation implementing a data-driven supply chain?”

(Showing percentage of respondents selecting “Strong benefit” or “Benefit”)



Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
 Source: Forrester Research conducted the fieldwork for the quantitative part of the research on behalf of Telstra.

When asked to rank these benefits, our respondents nominated improvements in DIFOT (70%) and better utilisation of assets (including inventory) across the network (62%) as the most important.

The interviews we conducted confirmed a belief that data-driven supply chains would create positive outcomes in terms of cost, visibility and agility, as well as improving work practices in the supply chain.

“...often when...something's gone wrong or out of service or your cost profile's not right 99% of the time, what underpins that is the right information not being in the right place.”

“Understocking and overstocking is costing us a small fortune.”

“We've got (thousands of) products that are shipped on the average of the average rather than the optimal of what we actually could ship. So we see an enormous amount of ability to strip a huge amount of cost out of our supply chain (using data).”

“Stock management should take up 10% of my time but it's taking up 95% of it. It's like playing catch-up football.”

“15-20% of complaints relate to fresh products. Anecdotally lettuce has a lifespan of 2-3 days and a lack of visibility leads to participants holding the stock at non-retail locations for over 24 hours, limiting shelf life.”

“I suppose, over time, (data has) become more important because once upon a time a logistics transport infrastructure was locked and loaded for life, so it was all about inventory. Nowadays, pretty much every part of the supply chain is flexible... In the eighties, data was more about making sure you ordered the right stock. Nowadays every part of the supply chain is driven by some data decision.”

“So the promise of data that is richer, more connected is that we potentially could respond in a more agile fit for purpose way that would scale both up and down to match demand (while) maintaining service levels.”

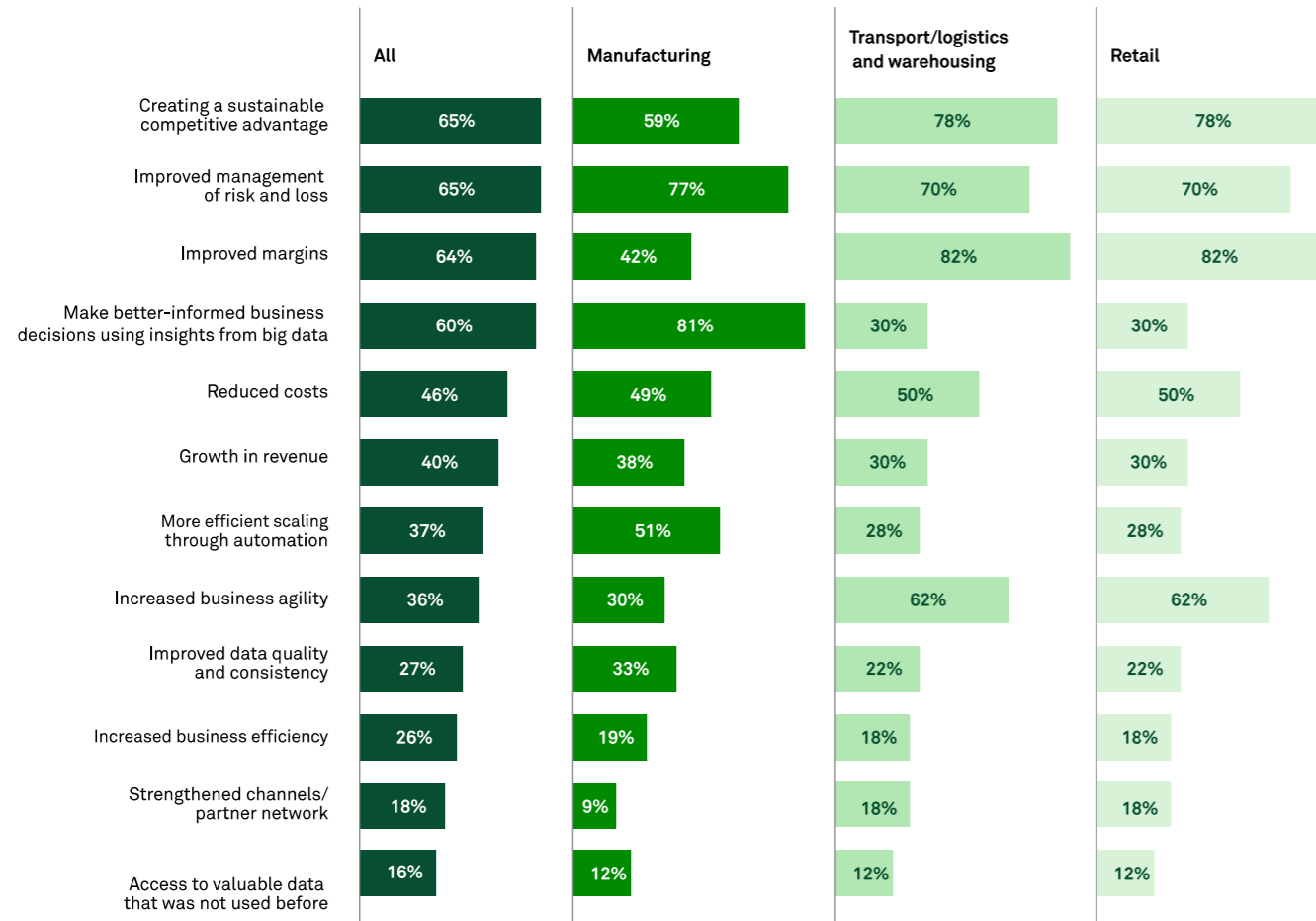
There was also recognition across the supply chain that DDSCs would improve general business performance – delivering sustainable competitive advantage, improved management of risk and loss, improved margins, better informed business decisions and agility. However, the ranking of these benefits was not consistent.

In general, retailers and transport logistics companies were in lock-step, but manufacturers ranked the benefits differently. For example, while higher margins ranked as the number one general business benefit for retailers and transport/logistics companies, it only ranked sixth with manufacturers. Likewise, while better-informed business decisions ranked number one with manufacturers, it ranked only sixth with retailers and transport/logistics companies. And while increased business agility was seen as an important benefit by 62% of retailers and transport/logistics companies, less than half of manufacturers shared this view.

This disparity in ranking of business benefits is probably a reflection of the different planning horizons of retailers, transport/logistics companies and manufacturers. Manufacturers like to plan production as far in advance as possible, to maximise efficiency, while retailers and transport/logistics companies are more concerned with maximising demand opportunities as they present themselves. The issue of alignment has always been important in supply chain collaboration, and it will be important in deploying a data-driven supply chain because both require a coalition of the willing.

“Which of the following could be/are benefits of your organisation implementing data-driven decisions?”

(Showing aggregate percentages of ranks)



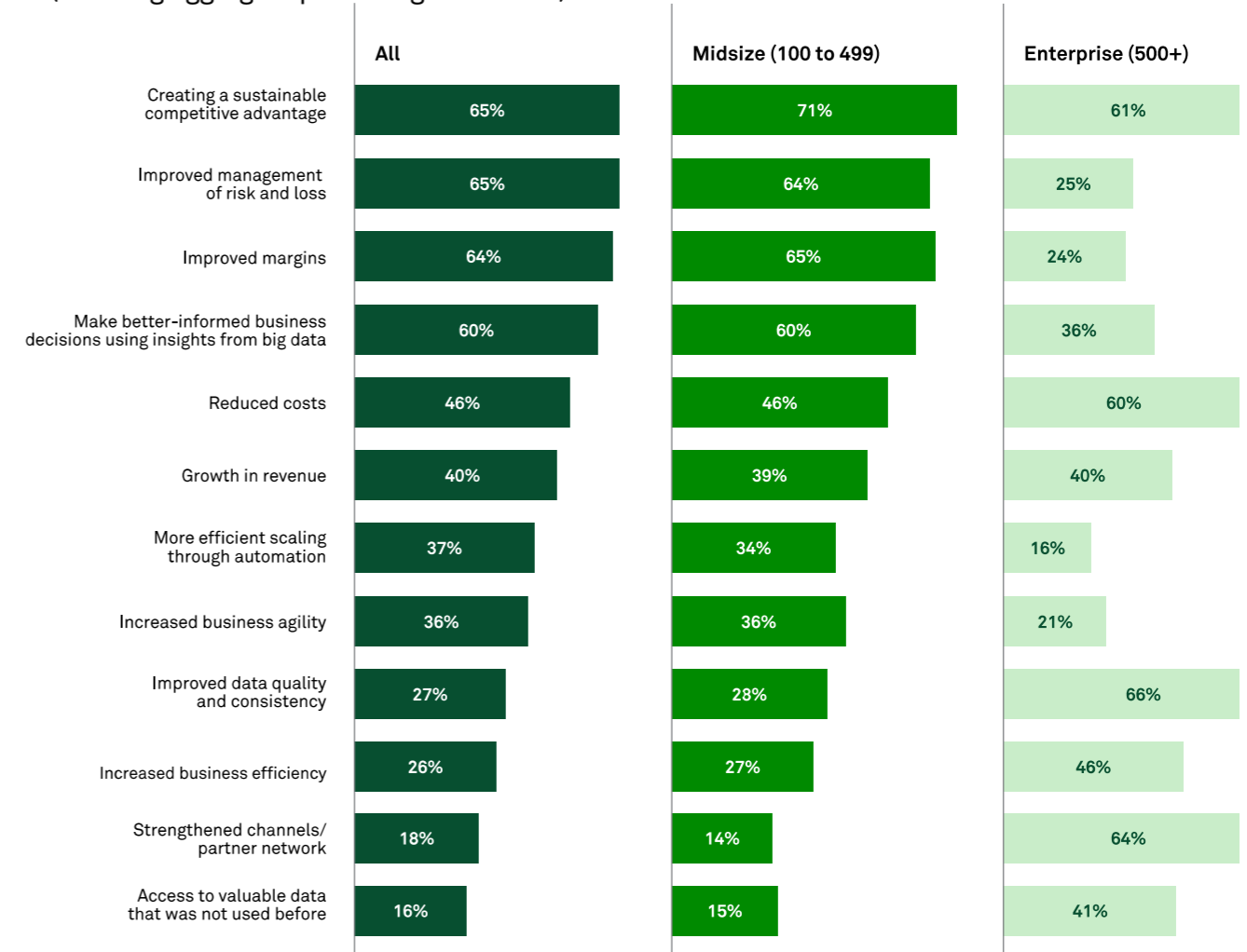
Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
Source: Forrester Research conducted the fieldwork for the quantitative part of the research on behalf of Telstra.

As well as recognition of the benefits, there is both aspiration and action among supply chain businesses to actually implement a datadriven approach in their operation. For instance, 65% of our survey respondents aspire to become more data-driven, 57% aspire to become more advanced in their analysis of data and 57% say that they already gather more data and apply the learnings more quickly than their competitors.

Retailers, transport/logistics and manufacturers are broadly aligned here. However, there is – perhaps unsurprisingly – a divergence between large and smaller businesses. Smaller businesses are generally less aspirational and have taken less action towards becoming data-driven than large businesses, even though our research shows they have a bigger belief in some of the core business benefits of becoming more data-driven.

“Which of the following could be/are benefits of your organisation implementing data-driven decisions?”

(Showing aggregate percentages of ranks)



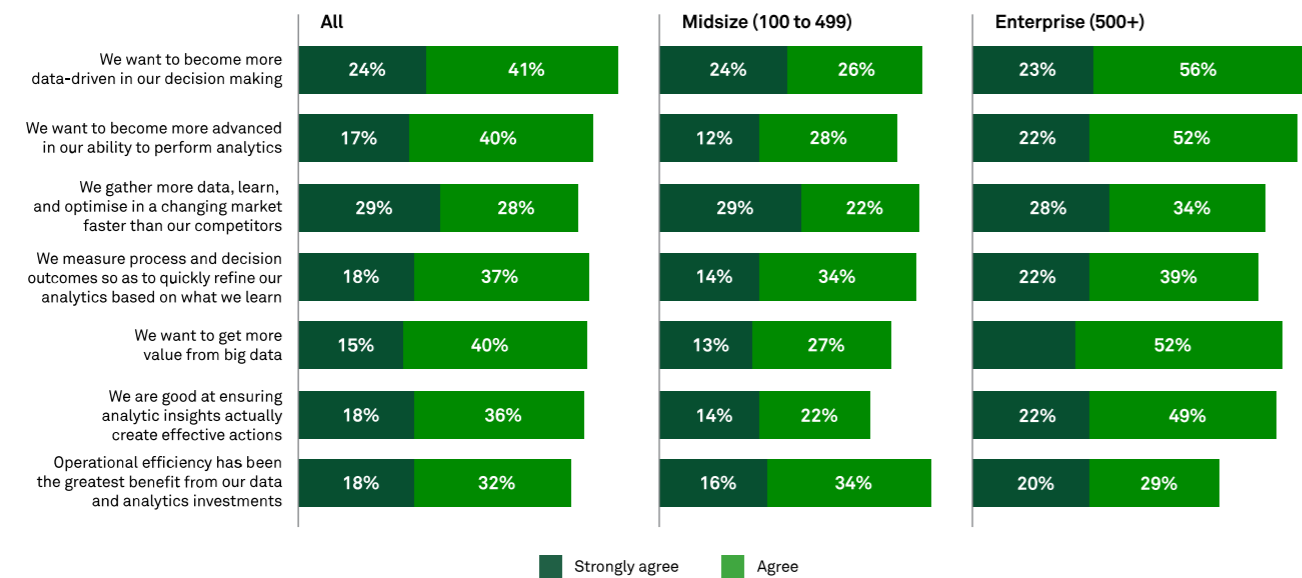
Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
Source: Forrester Research conducted the fieldwork for the quantitative part of the research on behalf of Telstra.

This could be a reflection of both the resources required to deploy a data-driven approach and the relative lack of power enjoyed by small businesses compared with large enterprises in supply chain negotiations. SMEs know that data-driven supply chains will deliver tangible

business benefits, but don't expect and are not preparing to be part of the ecosystem. If there is general agreement that data-driven supply chains will deliver substantial benefits, smaller businesses need to find the resources to compete.

“Thinking about your company’s operations, how much do you agree/disagree with the following statements?”

(Showing percentage of respondents selecting “Strongly agree” or “Agree”)



Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
Source: Forrester Research conducted the fieldwork for the quantitative part of the research on behalf of Telstra.

3.3.2. Technology deployment

The second part of our hypothesis was that some key technologies need to be deployed for an organisation to be ready for a data-driven supply chain. These technologies come in three categories:

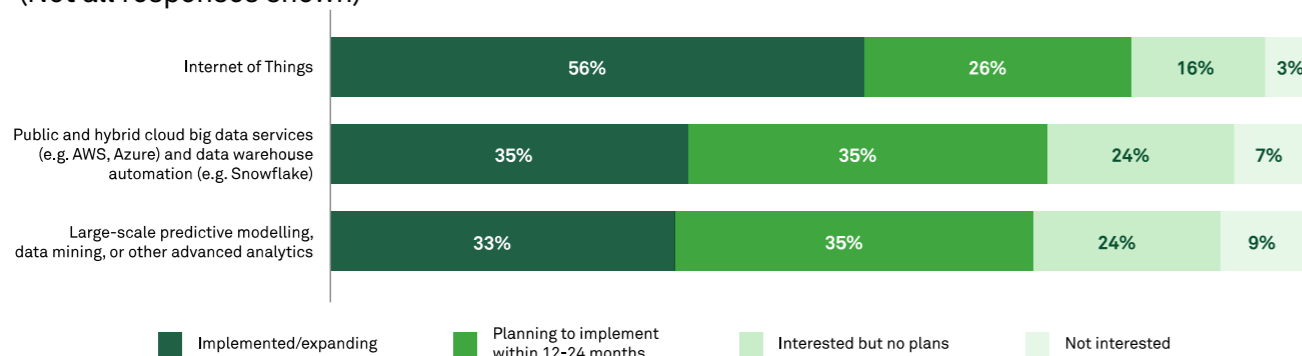
1. Technologies to collect data at scale (IoT).
2. Technologies to analyse it automatically or semi-automatically (AI).

3. Platforms on which to collaborate with the data.

The good news from our study is that these technologies are being adopted across the supply chain and there are plans to increase adoption over the next 12-24 months. Very few of our survey respondents were not interested in deploying these technologies.

“What are your firm’s plans for the following technology concepts?”

(Not all responses shown)



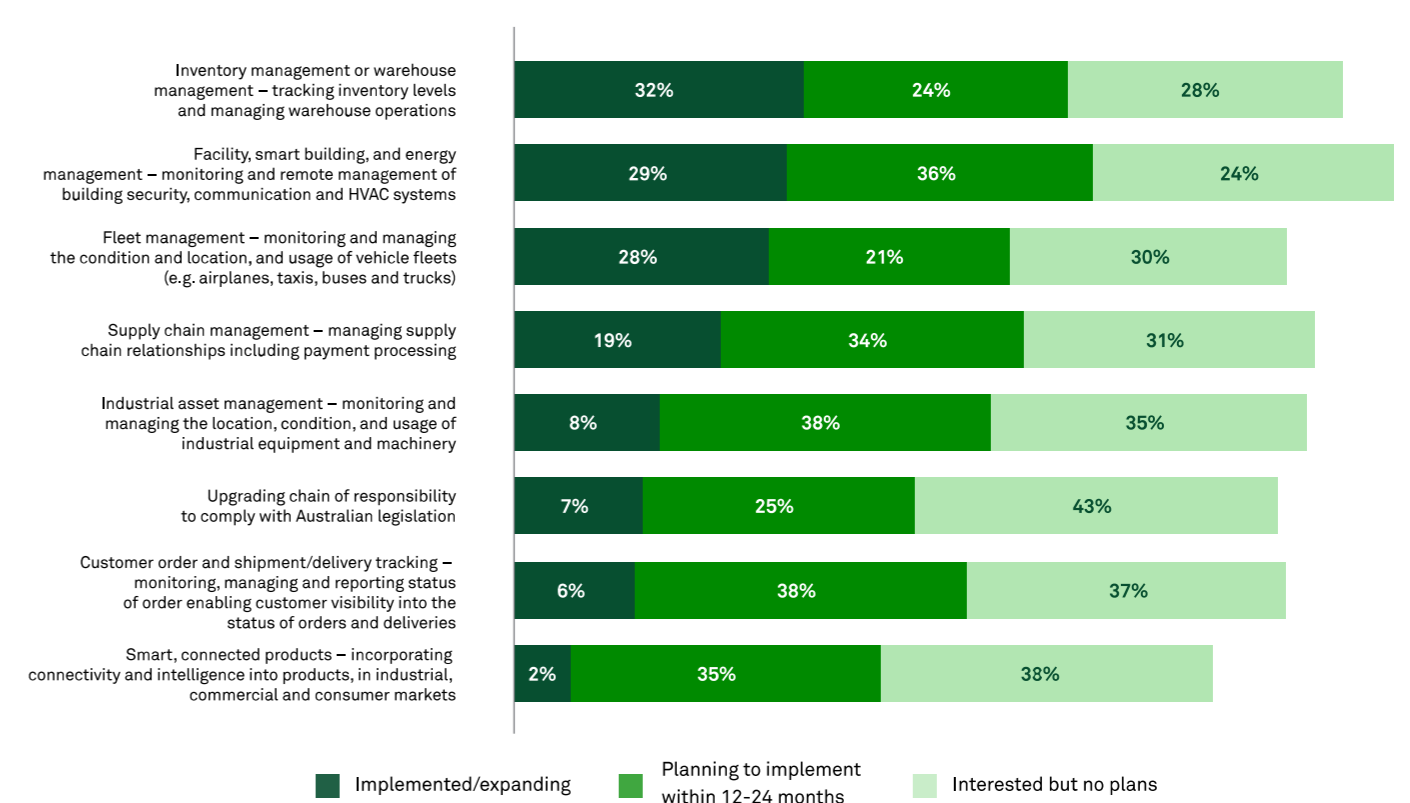
Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
Source: Forrester Research conducted the fieldwork for the quantitative part of the research on behalf of Telstra.

When we asked what type of deployments were in place or under consideration, the responses show that it is mainly IoT

technology for the collection of data for supply chain management.

“Thinking about your company’s operations, how much do you agree/disagree with the following statements?”

(Showing percentage of respondents selecting “Strongly agree” or “Agree”)



Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
Source: Forrester Research conducted the fieldwork for the quantitative part of the research on behalf of Telstra.

In our interviews, we found a number of IoT applications are being deployed in the transport/logistics sector.

“We’re doing lots of trials at the moment with vision picking, to capture a lot more information via cameras – things like serial numbers and bar codes. One of our big sectors is service logistics. So you might have the technician out fixing something and (with vision picking) be able to log in to the DC, say this is the part that I need, to be able to see what they’re looking at and confirm it before shipping it out there.” There is also enthusiasm for a test-and-learn approach to adopting technology.

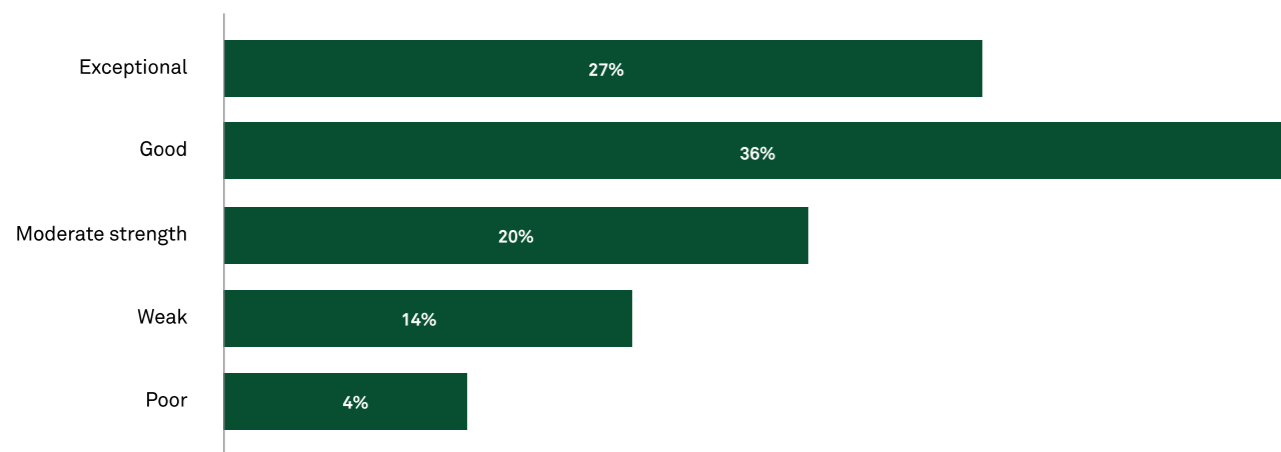
“We’ve been trialling autonomous forklifts. The business case doesn’t particularly stack up at this point, but we know it’s coming ... so we’re learning now what the implications (are) from a safety point of view, what happens if the batteries die, how do you overrule it, all those types of things – that’s the way that we sort of approach this technology.”

3.3.3. Relationship with partners

The third part of our hypothesis was that relationships need to be strong for an organisation to be ready for data-driven supply chain. In this case, 63% of our survey respondent reported having good or exceptional relationships with their suppliers and customers. This would seem to be a solid platform on which to build supply chain collaboration technology.



“How would you rate the strength of relationships between your company and your supply chain partners related to collaborative technology?”



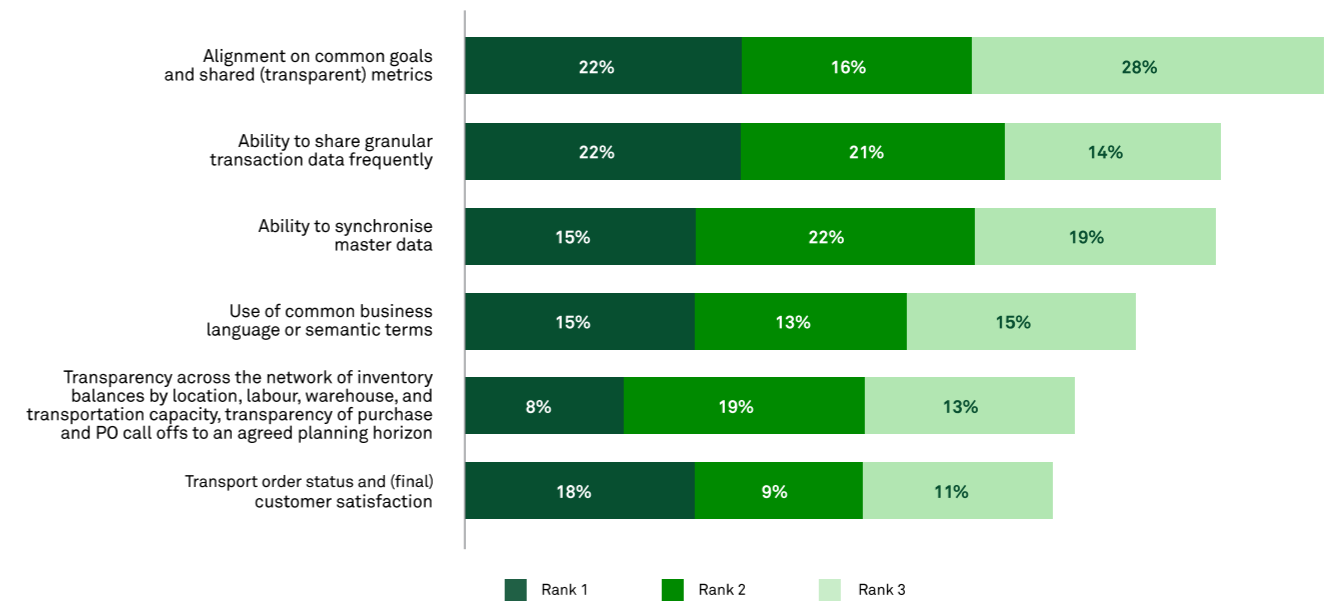
Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
Source: Forrester Research conducted the fieldwork for the quantitative part of the research on behalf of Telstra.

Where collaboration is being practised, a number of specific business benefits occur. It was interesting that our survey respondents ranked the benefits “soft”

to “hard” i.e. they see the most benefit in “aligning objectives” followed by actually “seeing the data that will help drive the supply chain more efficiently”.

“Which of the following factors do you see as key operational improvement of collaborating between your company and your supply chain partners?”

(Showing top three ranks)



Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
Source: Forrester Research conducted the fieldwork for the quantitative part of the research on behalf of Telstra.

In our interviews, collaborative relationships were consistently characterised as being founded on mutual benefit.

“When I meet with those (collaborative) suppliers, I do get a sense, it was a genuine desire, for our businesses to be successful and more successful. And what that looks like to me is they understand what our strategy is – they’re trying to present to us products that align to what that forward strategy and customer aspiration is. So that, to me, says they’re truly trying to make our business successful.”

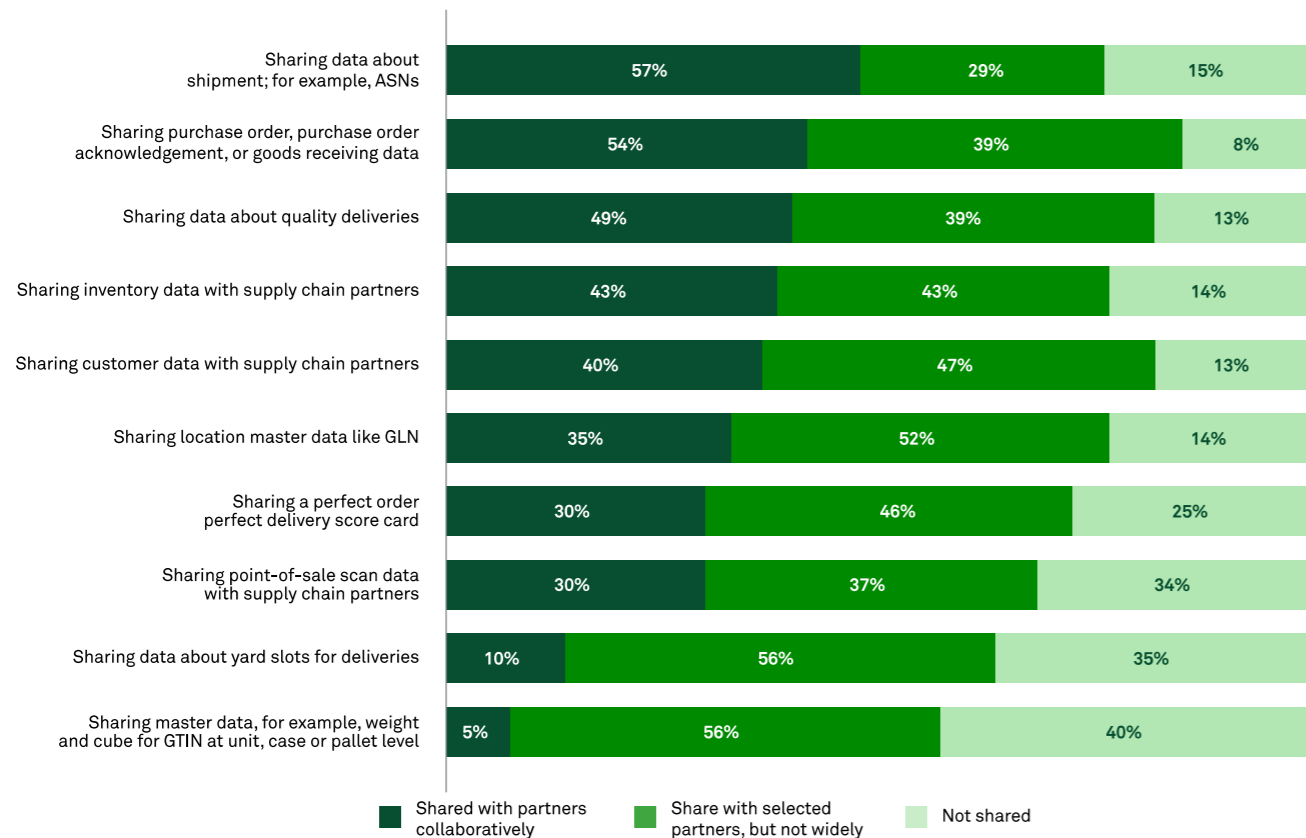
“I think (collaboration) means having a long-term goal and both being focused on what you’re trying to achieve and there being benefit in that for both of you versus each being year by year, hit a number and it’s all focused on

what we need to achieve... Just that ability to accept there’s two sides of the story and we’re both here being willing to share and learn from each other. And being open for us to try new things that might mean sometimes we actually fail even if that might mean that we don’t hit a result.”

When we asked what data was currently being shared with suppliers and customers, a different picture emerged. Data is indeed being shared, but this mainly relates to having a delivery accepted or an invoice paid. Strategically important data that could make the supply chain work more efficiently – like sales information from retail point of sale systems or item master data – are among the least likely to be shared. This implies an inherent lack of trust between supply chain partners when it comes to sharing strategically valuable information.

“To what degree do you share data with your partners across the supply chain?”

(Not all responses shown)



Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
Note: Percentage may not total 100 because of rounding
Source: Forrester Research conducted the fieldwork for the quantitative part of the research on behalf of Telstra.

The reluctance to share strategic information was a theme of our interviews. Some saw it as a deeply embedded cultural phenomenon that will be hard to break.

“Our entire commercial and legal system in Australia, New Zealand and probably other parts of the Commonwealth are adversarial. Resolving an issue, it’s not inquisitorial, it’s not data-driven ... it’s all adversarial. So the buying and selling relationship, whenever there’s two parties where one is providing a service to another, you always get to this adversarial position, which is hard to break.”

Some retailers guard information jealously and infer in it a sense of competitive advantage. “We actually had a request from a big (manufacturer) the other day where they want us to give them all our store data and store sales so they can predict (demand). We don’t actually give that information, we hold that pretty tight because, for us, it’s a competitive advantage.”

Ironically, some retailers are still prepared to blame the manufacturer or wholesaler when out of stocks occur during promotional periods.

“One of the biggest problems was we would never get a proper forecast from the (retailer) and then there’d be the age-old ‘well, you should have had the stock, we’ve had lost sales, etc.’” Some in the third party logistics (3PL) world challenged the retailer view that data has intrinsic value. They were especially opposed to the idea that supply chain partners should be charged a fee for access to it. They instead argued that, like many other resources, supply chain data really only has value in use.

“My view is that the value in the currency of data has something to answer for. I think that we’re now realising that what the data can tell you is the real value, and by sharing it you’re going to maximise the value. And I think that ownership of data is the biggest inhibitor too, not only collaboration of course, but a truly data-driven supply chain.”

Find out how Otto is using predictive customer analytics in the supply chain. See the case study on page 31

3.3.4. Barriers to adoption

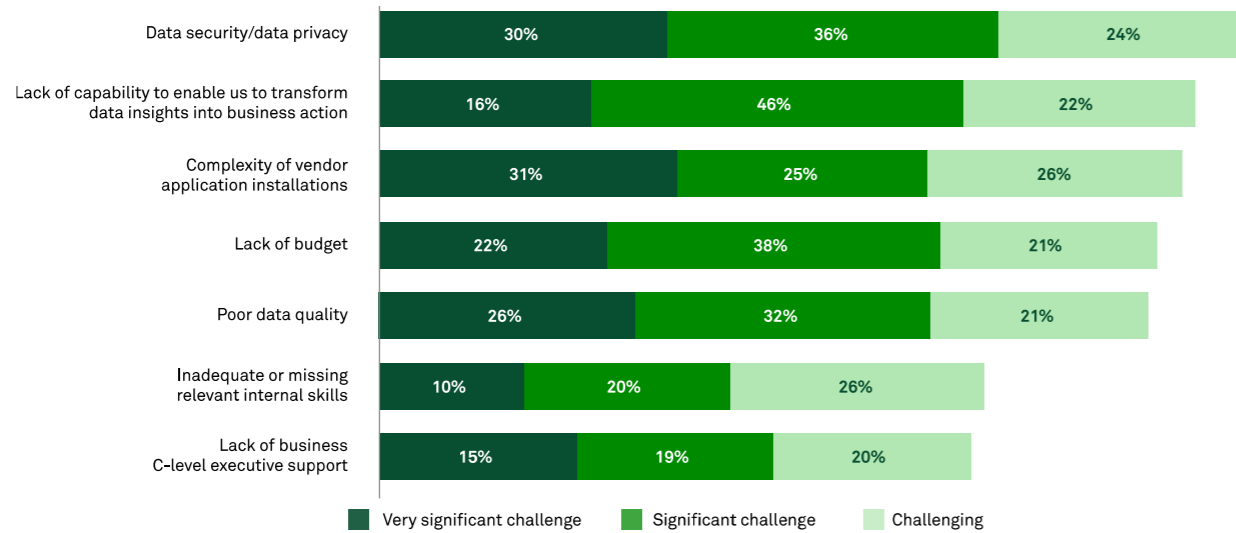
We have seen that actors in the retail supply chain understand the benefits of a data-driven approach, have begun deploying the necessary technology and claim good relationships with their supply chain partners. According to our hypothesis, this would suggest there is a degree of readiness to adopt the data-driven supply chain, so what are the barriers to deployment?

“How do we bridge that gap between us seeming so futuristic to people that they don’t even know where to start? You know, how do we bridge that gap, that practical reality of taking the next step to execution (that) seems real?”



“What are the biggest challenges your firm faces in implementing a data-driven supply chain strategy?”

(Showing percentage of respondents selecting “Very significant challenge,” “Significant challenge,” or “Challenge”)



Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
Source: Forrester Research conducted the fieldwork for the quantitative part of the research on behalf of Telstra.

Data security

The number one barrier seen by our survey respondents to adopting a DDSC approach was security of data. This is not surprising given that we have seen how importantly our respondents regarded data.

In our interviews, we also found businesses conscious of a duty of care around data on behalf of their customers.

“The technology’s moving faster than the social implications or the security implications. We’re probably one of those sorts of organisations that need to make sure everything is protected. And we’re quite conservative in our approach – if we don’t think that we can do it properly then we tend not to do it.”

There are also concerns about the size of the ecosystem that could potentially be sharing data. Many SMEs, in particular, may not have the security measures in place to ensure a retail ERP system is safe if made available for collaboration.

“We’re very protective of making sure that there’s no way they can bring our systems down or that they can create viruses within our system by giving them the access.”

Skills gaps

The next most important barrier to adoption of DDSCs is a skills gap within supply chain organisations. Supply chain organisations feel they simply do not have the skills available to execute on a data-driven approach. As we will see later in the report, this is an issue already being addressed by some overseas retailers.

Complexity of technology deployments

Our survey respondents also saw practical problems in deploying a data-driven approach that related to the complexity of the technology. When we asked specifically about deploying data capture and analysis tools, respondents cited major challenges as including the management of data capture and movement, the maturity of AI technology, integrating applications, governance of management and sharing of data, as well as the previously mentioned skills gaps.

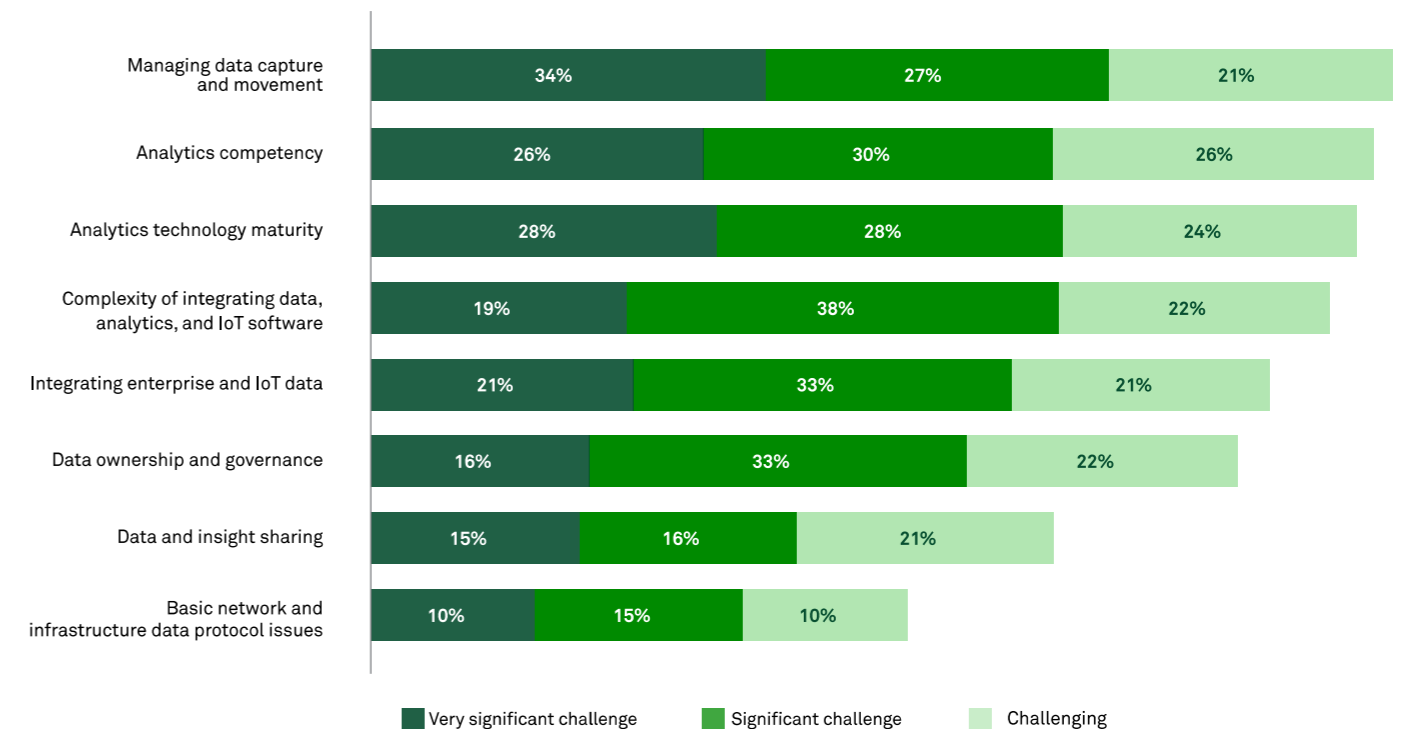
In our interviews, we heard that even when a retailer has the intention to collaborate, sometimes they simply do not have the technological tools to do so.

“I don’t think we’ve got the tools to give our suppliers the real transactional information and right forecast to collaborate properly.”



“Looking at the technical implementation of data capture and analysis tools and technology, how challenging is each element for its implementation in your organisation?”

(Showing percentage of respondents electing “Very significant challenge,” “Significant challenge,” or “Challenge”)



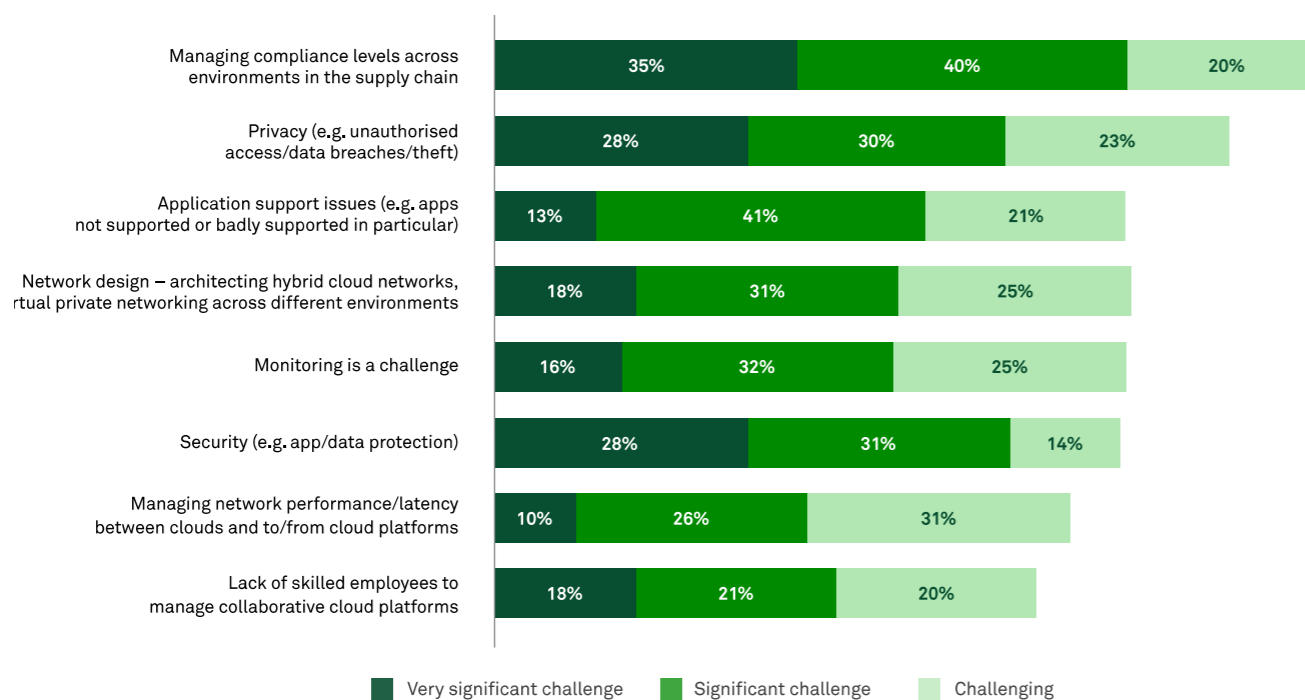
Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
Source: Forrester Research conducted the fieldwork for the quantitative part of the research on behalf of Telstra.

When we asked specifically about cloud deployment as a collaboration platform, our survey respondents cited a number of issues relating to operating across

multiple platforms, including managing compliance, security, support for apps, network design latency and the skills gap previously noted.

“Looking at the technical implementation of cloud collaboration technology, how challenging is each element for its implementation in your organisation?”

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Base: 200 decision makers/influencers responsible for supply chain operations strategies within Australia
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Some CEOs are simply philosophically opposed to holding data outside the building, which makes any kind of data-based collaboration difficult.

“I’ve heard people come into the business and say, ‘You’ve spent so much on servers and there’s other ways of doing things now,’ but (the CEO is) very protective of our infrastructure and that probably can be a bit of a barrier when you’re sharing information.”

Others are looking forward beyond pure cloud to data exchanges, which promise the ability to share harmonised data sets between partners. “If there was a technology platform that you could exchange information on, that you could collaborate on in an easy way, then that would enable you to, I think, manage a bigger pool of partners. But I don’t see that anywhere at the moment.”

Organisational barriers

Our interviews also uncovered a number of familiar organisational barriers in the way of innovation. Attracting funds for supply chain investments, especially when competing with other projects that are seen to have a direct impact on revenue, was seen to be a problem.

“I suppose a lot of our time and attention is growing our store network. So therefore, the priority is market growth.”

“It’s hard to compete (for) the CEO’s attention when you’ve got Sales and Marketing promising the world and increasing sales by 10% is going to deliver (more benefit) than a 50% improvement in the supply chain.”

In the retail world, supply chain managers are not used to building investment cases for transformative investments yet they need to assume that role in the future.

“Supply chain managers are often in an influencer role and it’s quite new for us to be seen as bringing value to the business other than the lens of lowest cost to move. The concept of data connectivity creating enterprise value coming from a supply chain professional would be foreign for most I suspect!”

There is also the problem of maintaining legacy systems and investments while simultaneously trying to transform.

“It’s a complex web of legacy stuff that you’re trying to unravel while you’re trying to bolt on the new. And, for me, I feel that’s the hardest thing to work through.”

One of things our respondents admired about Amazon was the way innovation is baked in to their organisational process.

“What they do is implement straightaway and they then assess the customer experience. And if the customer experience is of value and resonates and it is the right customer experience, then they will quickly find the efficient (way to deploy it) in the supply chain.”

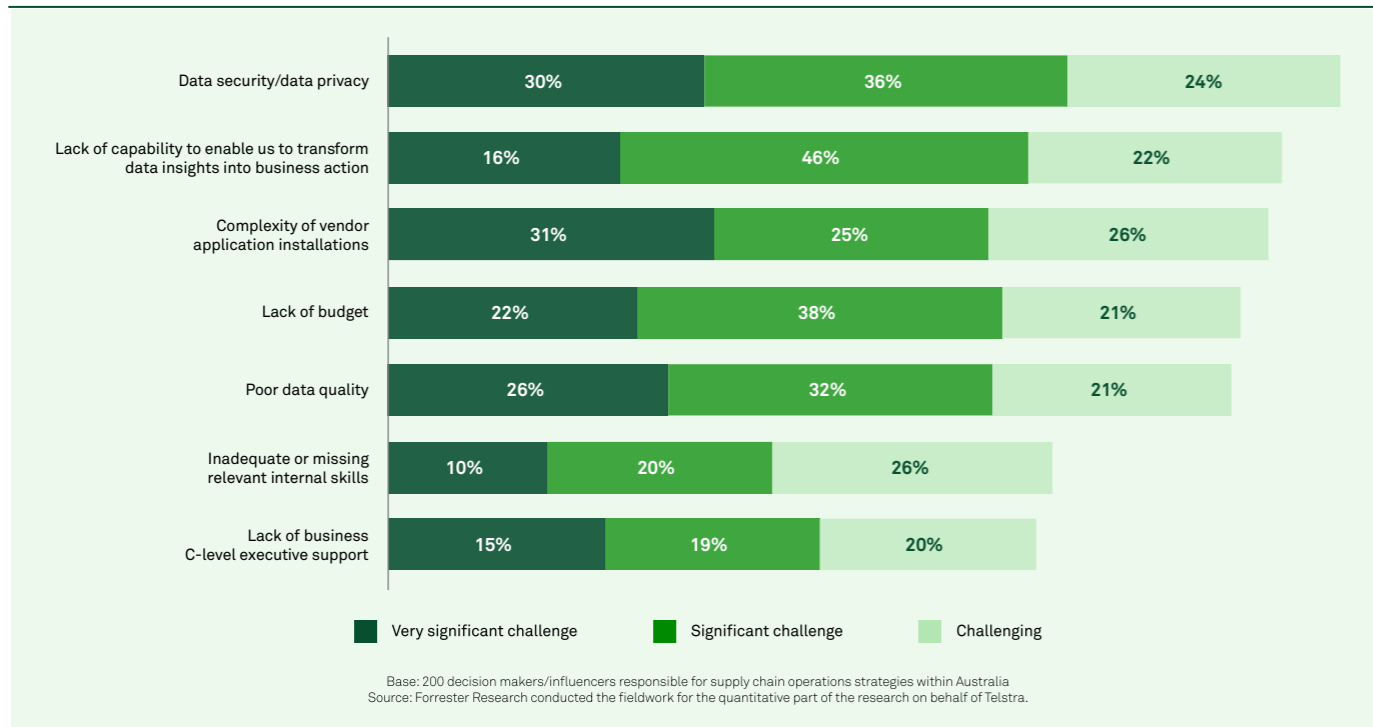
Relational barriers

To collaboration When we asked about barriers to collaborating more with partners, a non-technological factor was ranked highest i.e. alignment on common goals. This was closely followed by the lack of a common business language or data standards to facilitate data exchange.

It’s interesting that for this question, security was ranked lowest among the responses. This suggests there are major strategic alignment and data harmonisation issues to be addressed before the issue of security can even be considered.

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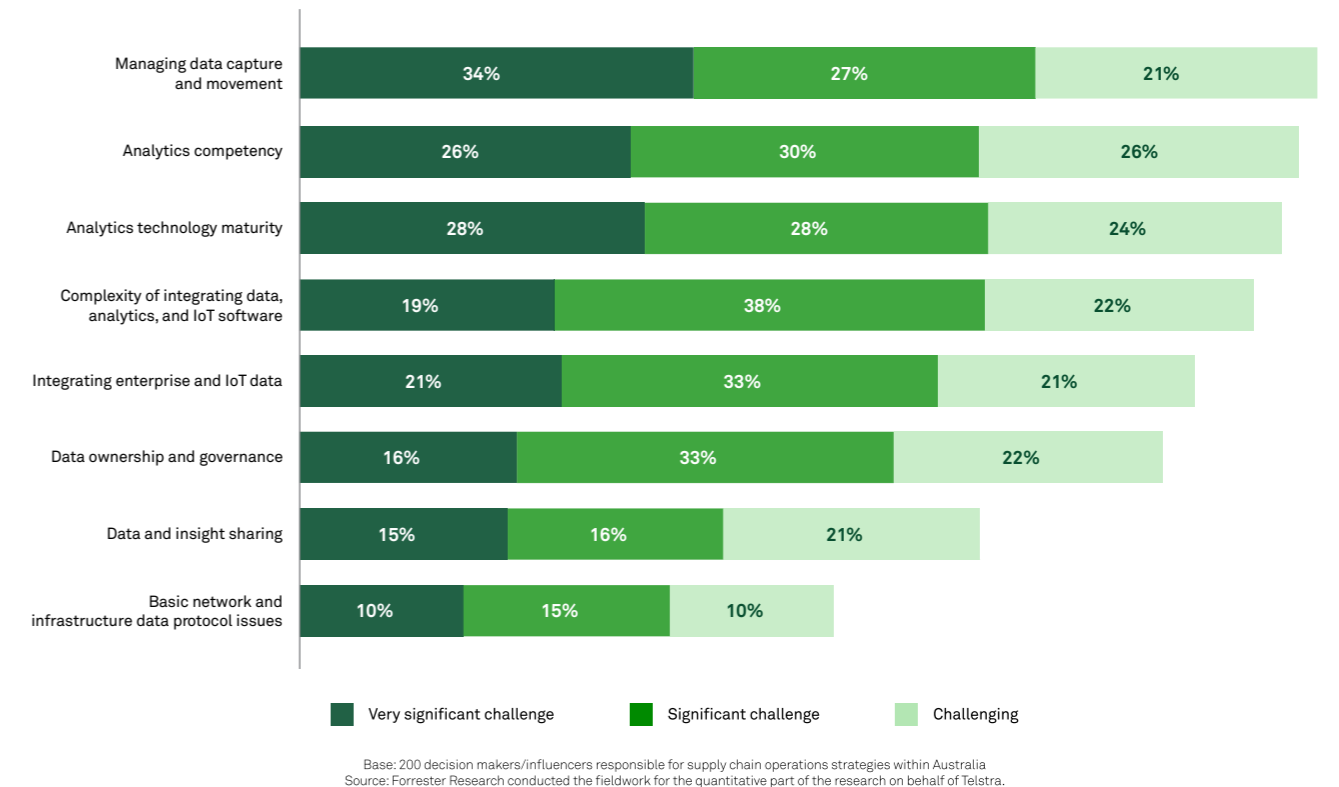
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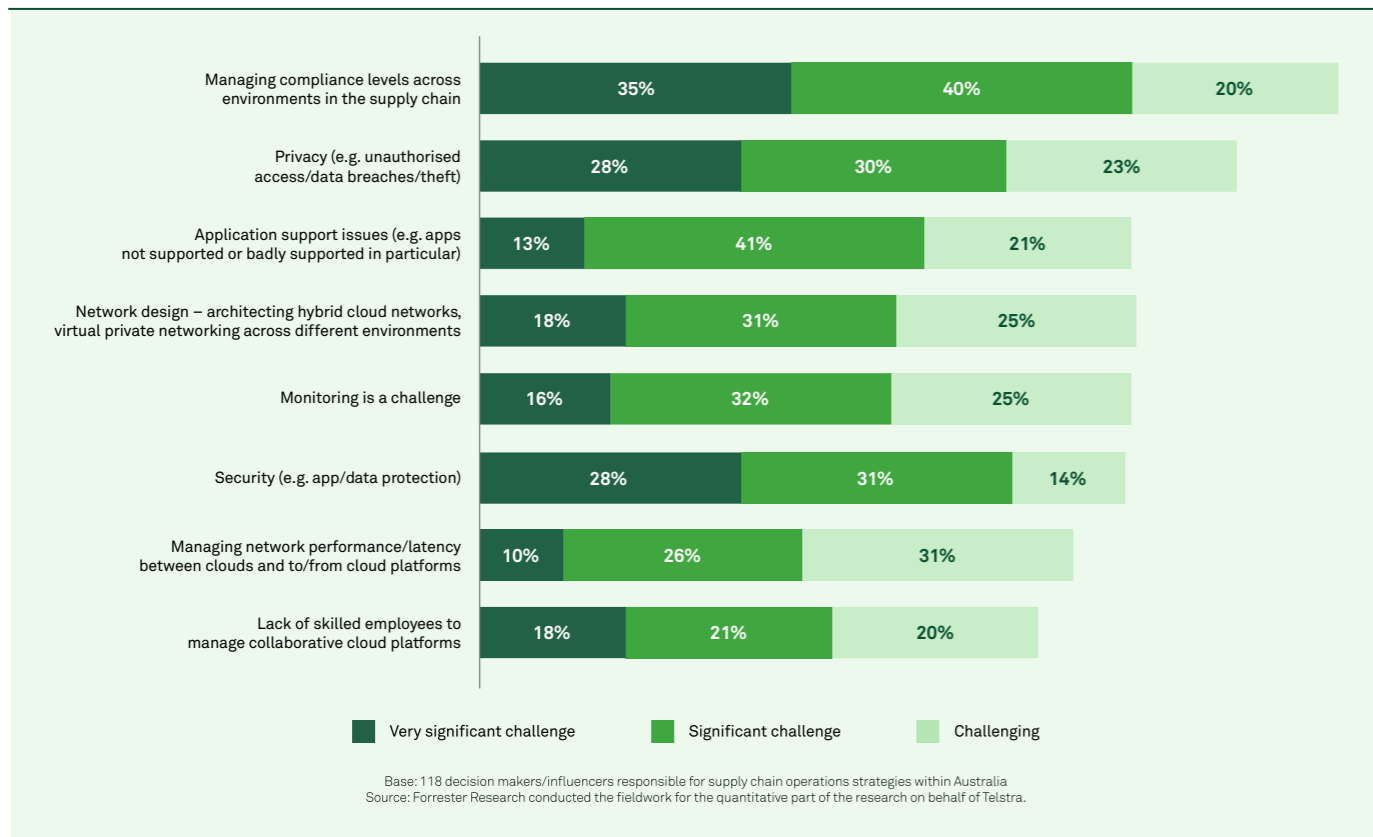
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Relational barriers to collaboration

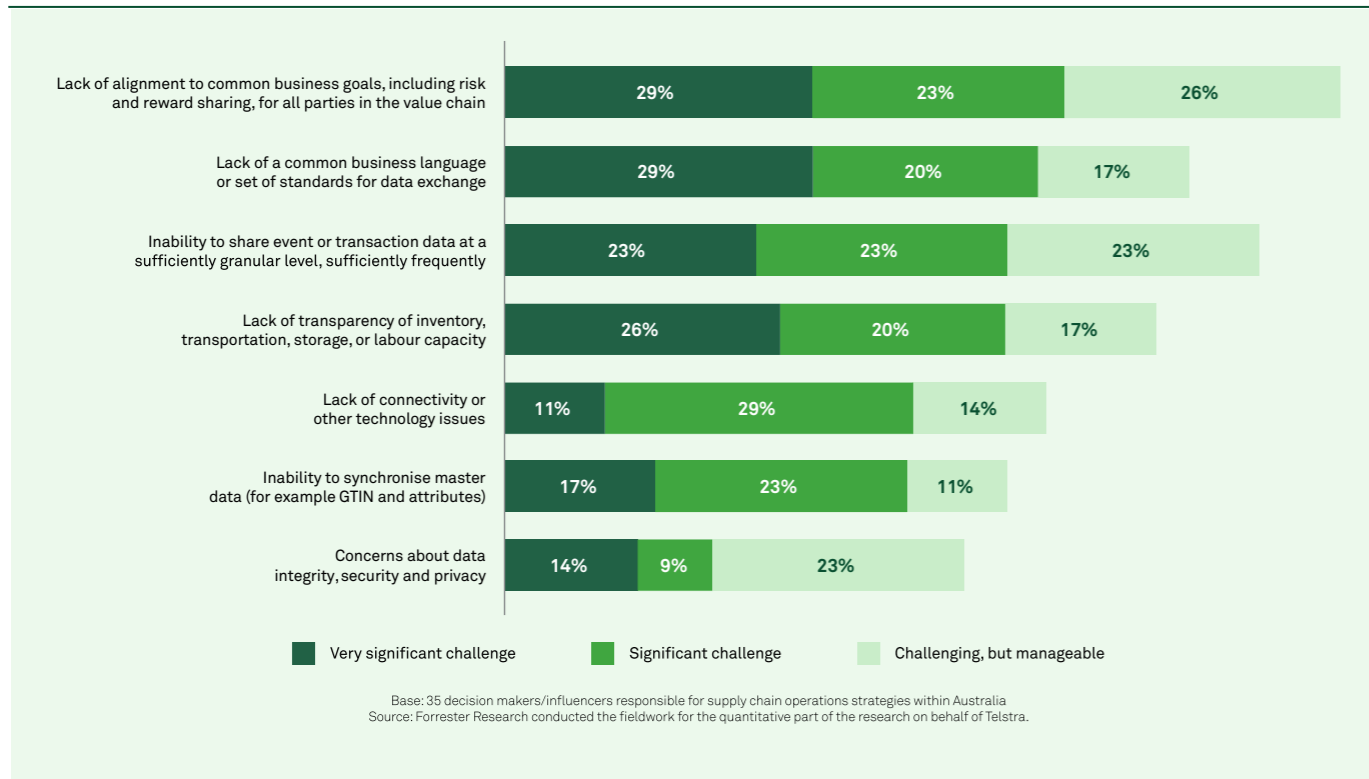
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“Which of the following factors are barriers to collaboration between your company and your supply chain partners?”

(Showing percentage of respondents electing “Very significant challenge,” “Significant challenge,” or “Challenging, but manageable”)



In our interviews, the idea of having fewer but deeper relationships was seen as a way to facilitate collaboration.

“I very much favour a model where you’ve got a really core group that you’re building deep relationships with and then you’re topping up with anything that they can’t service you on. Because I think it’s difficult for them to get deep understanding of your business and vice versa if you don’t have a smaller pool that you can grow over time with.”

In the upstream world of transport/logistics and manufacturing, there is also the issue of incentives to collaborate. If supply contracts are based on fixed fees for delivery of KPIs, then there is often no commercial reward for a partner who may see opportunities to improve a process. Some of our respondents said that sharing the rewards from improvements in the supply chain is a way to change this.

“Sometimes you sit there and you go, ‘I’d love to do all this work, but you know what, I get no value if I do find improvements.’ I think it will change when you start the commercial arrangement and say, ‘You know what, if we could improve the supply chain we’d both get a dollar each out of it.’”

“I think gain share works if you have an honest cultural environment that says ‘I respect the fact that both of us have to make money and that’s just the reality.’ If you walk into every meeting and the first part of the conversation is, ‘You guys are making a fortune,’ you sit there and think, ‘I don’t need to hear this again. I have a right to make money and my job is to help you make money.’”



3.4. Our research: Conclusions

3.4.1. Collaborators need to align

Collaboration requires a coalition of the willing. Our research shows that there appears to be no problem with willingness to collaborate in the retail supply chain. The major barrier appears to be one of execution i.e. alignment between the parties on business objectives. This is not surprising in the sense that supply chain organisations have inherently different business drivers e.g. a manufacturer generally benefits from scale and would like as much time as possible to respond to changes in demand, whereas a retailer generally benefits from its ability to respond to demand in the short term and therefore prefers short lead times and flexible order quantities.

As we saw in our interviews, alignment on objectives can also be an issue internally with different departments within the same company often having different and contradictory drivers underlying their work.

Even though business drivers and objectives may be different, the competencies of an organisation and a supply chain are complementary. Manufacturers, transport/logistics companies and retailers are in the business of combining to get goods and information from point of production to point of consumption and sometimes back again. When competencies are complementary, the conditions exist for organisations to create something bigger than the sum of their individual parts. This is the promise of the theory of collaborative advantage⁹, which differs from the Porter's theory of competitive advantage¹⁰ in attributing value creation to a network rather than an individual entity.

Aligning business objectives can be achieved through old-fashioned talking or through facilitated design thinking sessions, but for it to be operationalised incentives need to be aligned. The coalition will not remain willing if one party takes the lion's share of the spoils. For data-driven supply chains to be adopted, it's important the benefits of collaboration are shared equitably¹¹ and not just realised by one party (usually the retailer).

3.4.2. Data is the new oil but only when it can be used

Oil, generally thought to be the product of decaying organic material held in sedimentary rocks, has been with us for millions of years. However, oil only became useful when we gained the ability to refine it in the nineteenth century. It was then that oil did indeed transform every industry especially by facilitating the development of the motor car and the aeroplane.

Likewise, data has been with us since retail began. If we could take a time machine back to the great markets of ancient history, we would see transactions being made, customers being served, supplies being ordered and delivered, and invoices being paid – all generating data. What's changed in recent years is our ability to capture and store data, analyse it and share it with others – in other words, to make it useful.

Our ability to turn data in to a usable resource mirrors the breakthrough in oil refining in the nineteenth century. Unfortunately, our research shows that data may not yet be as usable as we would like to think. Our respondents said: data is easy to collect but hard to manage, there are problems making it compatible across different apps, the tools to analyse it are in some cases immature, and the problems multiply when we attempt to share it across multiple platforms in the cloud. It seems we are not quite at the point of being able to use data to fuel our supply chain in the same way we can use refined oil to fuel our cars.

Data needs to be accessible and useable. Overseas we are seeing retail enterprise systems being rewritten from the ground up with exposed APIs to facilitate easy and quick access internally and externally. We are also seeing the emergence of data exchanges that facilitate the sharing of data between multiple supply chain players, as well as the use of blockchain technology that helps verify hands-offs between supply chain actors. These developments hold the promise of overcoming current concerns with technology, making data useful and assisting in the adoption of data-driven supply chains.

3.4.3. Data is a resource that needs securing

Resources can be tangible (operand) or intangible (operant). Vargo and Lusch introduced the idea that value is created when 'operant' resources are applied to 'operand' resources to create value. They used the microprocessor as an example of an operand resource (silica) turned into something valuable through the application of an operant resource (knowledge). Data is an intangible or operant resource, but when deployed in the supply chain it can be used to replace inventory, fixed assets, labour even physical locations through better sensing of and responding to demand. Data is therefore potentially as valuable as any of the tangible assets on a balance sheet and needs to be protected accordingly.

Overseas there have been a number of high profile attacks on retailers, mainly targeting consumers' personal information. The retail supply chain is arguably even more vulnerable because of its interaction with large numbers of SMEs who are less likely to have their data protected.

The Australian government conservatively estimated the cost of ransomware to the Australian economy to be approximately A\$1 billion per year. It's therefore not surprising that supply chain actors cite security as their number one barrier to adopting a data-driven supply chain. To remove this barrier, supply chain businesses should consult a trusted partner in cyber security to ensure shared data is protected and the benefits of data-driven collaboration are not lost.



3.4.4. This vehicle needs extra drivers

The Apollo space programme took men to the moon for the first time. Many of the men selected to be astronauts had been fighter pilots or test pilots so were highly skilled in flying. Unfortunately, getting to the moon needed more than just flying skills and today it is acknowledged that without the contribution of mathematicians (many female), the journey to the moon could not have been made.

Likewise, the transition to data-driven supply chains requires the traditional skills of supply chain professionals, but it also needs mathematicians. It is mathematicians or data scientists who will interrogate the data and build the algorithms that turn supply chain data into useful business information. Our research showed that these skills are in short supply in the retail supply chain. Data science is predominantly the domain of PhDs, an academic credential not traditionally associated with the retail ecosystem. Online retailers like Amazon have

long recognised the benefit of PhD data scientists in their businesses. Traditional retail companies now also need to fill this skills gap. Forming closer ties with universities who have pipelines of PhD students and have post-doctoral students as potential project resources may be a logical first step.

Find out more about how PhD-accredited data scientists are transforming Target USA.

See the case study on page 32.



Otto: Using predictive analytics to place inventory in the network

Retailers have always collected information about their customers, but long gone are the days of handwritten notes and Excel spreadsheets and human intelligence to make sense of it all. Today, the future can be glimpsed at the Otto Group headquarters in Hamburg, where the German e-commerce merchant is using Artificial Intelligence, big data and machine learning to make quick and accurate decisions that reverberate along the length of their supply chain.

Of course, companies – most notably Amazon – have been using these technologies for years to understand consumer tastes, personalise websites and recommend products. At Otto today, these same tools are also being used to automate business decisions that extend far beyond customer management. The most crucial of these for Otto is trying to lower the number of product returns, which cost the company millions of euros every year.

The company knew from traditional data analysis that customers were less likely to return products if they arrived within 48 hours. Anything longer was risky: if a customer saw the product cheaper elsewhere, or could get it faster, they might be tempted to cancel the Otto order and force the company to bear the shipping costs. That's an expensive risk for a business built on e-commerce.

The Otto team also knew that customers prefer getting all their orders at the same time, but since Otto sells merchandise from numerous brands, the company was faced with a choice: delay sending until all of a customer's order could be shipped together, or send lots of different boxes at different times.

Enter a deep-learning algorithm from Blue Yonder (a start-up in which Otto owns a stake). This algorithm is capable of analysing around three billion historical transactions and 200 variables i.e. the day of the week, the weather, advertising campaigns, actions or range adjustments, previous orders, and any other factors that could influence a purchasing decision. As a result, stock can be optimally adjusted to demand and sales, customer satisfaction and earnings can be increased.

“The digital revolution is still at its very beginning, a few hours after the big bang.” – Dr. Rainer Hillebrand, a Member of the Executive Board, Corporate Strategy, E-Commerce & Business Intelligence at the Otto Group.

The AI brain at Otto now does this for every item in the range, and the information is then automatically shared with the supply chain. It knows which products need to be ordered from the manufacturer and in what quantities, and which products are not likely to be required for a while. As a result, in most cases, when a customer places an order, the goods are already in the warehouse, which speeds delivery time. Best of all, Otto only has to store as many items as they need – reducing leftovers at the end of a season, waste and the need for storage.

The AI system has proved so trustworthy – predicting with 90% accuracy what will be sold within the next month – that today it purchases around 200,000 items a month from third party brands with no need for human involvement or decision-making.

The benefits? Surplus stock that Otto needs to hold has been reduced by 20%. Product returns are down by two million items a year. And customers get their orders more quickly, which improves both immediate satisfaction and the likelihood of repeat business.

Professor Dr Rainer Hillebrand says he's confident data will remain the driving force in retail in the future: “The opportunities to collect and store data and make them usable by algorithms will go from strength to strength. After the smartphone success story – 50% of our business now runs via mobile devices – the next big topic will be conversational commerce and going beyond touch with chatbots and voice input playing a major role in the purchasing process.”¹⁵

The University of Sydney Business School has a national and international reputation for research and education in managing data-driven supply chains. The Business School is home to the Institute of Transport and Logistics Studies (ITLS) where an experienced supply chain team, under the leadership of Professor Behnam Fahimnia, works on a range of supply chain projects, specialising in the effective use of data for more informed supply chain decision-making. The team collaborates with local and international industries for research in three interrelated areas: (1) **Data analytics:** understanding what data to sense and through what channels, data cleansing and clustering, data

analysis using innovative analytical predictive models, blockchains and data security; (2) **Innovative decision-support tools:** dynamic optimisation models to improve supply chain efficiency, visibility, resilience and sustainability, enable integrated decision-making, allow effective cooperation and information sharing; (3) The human factor: evaluating the consumer behaviour changes and incorporating the findings into the decision-support tools, understanding and formulating the behaviour of supply chain decision makers. ITLS is also well recognised for supply chain education through its renowned practice-oriented Master of Logistics and Supply Chain management

3.4.5. Smaller businesses need allies

The retail supply chain is populated with many SMEs and they represented about half of our research sample. Our respondent SMEs actually saw more benefit to a data-driven approach to supply chain management than their enterprise counterparts, but were less advanced in deployment. Data-driven supply chains represent a threat to smaller businesses as they are less likely to have the necessary resources, both financial and human, to undertake a deployment programme.

Without the ability to participate in the data-driven supply chain, the risk is that SMEs become relegated to low-value, old world, transactional relationships with their customers and suppliers. SMEs must look for allies in the technology sector who can provide them access to the data-driven supply chain data as a service. This may mean subscribing to data capture services that show the movement of goods and people in a market, data analysis services or data exchange services without the capital cost of technology or the human cost of hiring permanent employees.

Target USA: A systems led approach to data-driven retailing

Not many retail IT teams include dozens of people with PhDs working as data scientists, but this is exactly the case for U.S. retailer, Target (no affiliation with Target Australia).

Tom Kadlec, Target's Senior Vice President of Infrastructure & Operations, says democratise access to compute and data is the bloodline of future technology. This, combined with the ever-increasing contribution of data science and IT product management is vital for a company determined to delight its "guests" by harnessing the power of innovation and technology to make the shopping experience as seamless as possible.

What started a couple of years ago as a rigid organisational shift is now a core internal belief that data and the capacity to produce, move, abstract or consume, it is not (and should not be constrained to) anyone. In addition to decentralising access to the data, the retailer fundamentally changed its compute approach – now enabled with fast, simple provisioning from the cloud to the endpoint device.

Target also invested in CI/CD to deliver data, apps, and fixes across a ubiquitous cloud platform via data centre to the edge of its upgraded network. By leveraging cloud computing and moving data processing to the edge, automated or manual actions can be triggered from or consumed in real time on a store team member's handheld device.

From making sure that the right stock is in-store and priced correctly to equipping team members with the information they need to serve guests better, data plays a critical role every step of the way.

Target has taken a ground zero approach to the challenge of modernisation – something few companies would consider, no matter how inefficient their existing IT silos. In a process Kadlec describes as 'decomposition', all the company's systems are being broken down, simplified, completely rewritten from the ground up and then exposed to an API.

This means that data can be shared quickly and simply within the organisation, and is readily available to developers in a useable form. New applications, for example, can be stood up in minutes. Kadlec feels if Target is to become a truly data-driven retailer then this is an essential first step.

Tasked with leading the effort to modernise and enhance Target's technology foundation, Kadlec sees a key focus of his role as providing the organisation with data on the four pillars of the organisation: Guests, Team Members, Assets and Products.

"Today, we have any number of ways of sensing a wide array of information and the resulting data is flowing not in trickles, but in waves," he says. "We have the capacity to hold, correlate, calculate and compute at high volume and speed – to manage information by recognising and retaining the intelligence – and letting the rest go."

And the business benefits are evident, if yet to be fully realised. Better-informed and freed-up team members can serve guests more productively. Assets including inventory are available and used more effectively to enhance the guests' in-store experience.

Broadened use of RFID across Target stores in the apparel and home categories has vastly improved visibility of what inventory is in-store. Cameras are also used to check for out-of-stocks.

Meanwhile, AI is being used to scan transactions, monitor digital devices in the network and allocate the right staff to the right tasks, amongst many other vital activities. The flow of data is constant.

Today, the main focus is on their stores, which Target sees as a guest interaction point, but also as a distribution centre for digital fulfilment. And with 1300 stores within 10 miles of 90% of the American population, the company's footprint provides a clear strategic advantage over Amazon. The recent acquisitions of Grand Junction and Shipt have now given the company extra capacity in last mile deliveries.

Target technology is now serving its guests in stores, on their devices and extending the retail experience to their very doorstep.

About Target

Target Corporation is an upscale U.S. discount retailer that provides high-quality, on-trend merchandise at attractive prices in clean, spacious and guest-friendly stores. Target has 1,829 stores in the United States; 39 distribution centres in the United States; 350,000+ team members worldwide; an online business at Target.com; and global locations in India.



Smartphones and Network Design

Network design has always been part of supply chain management. Placing retail stores, distribution centres and other resources in optimal proximity to customers can be a key source of efficiency and agility in the supply chain. Traditionally, decisions on network design take into account sales and various demographic inputs like trade area census information, proximity of major infrastructure performance and location of competition, etc.

The problem with all of this data, apart from sales, is that it consists of a series of historical snapshots – sometimes up to five years old – and normally requires the services of a demographer to interpret them. Now, the smartphone can provide more dynamic and contemporary inputs to network design.

By understanding the movement patterns of smartphones in a market and linking them to 'Helix Personas' 16 Telstra's Location Insights service can provide not only demographic, but also behavioural and psychographic profiles of customers as they move in a geography, in virtual real time.

It can also give a true assessment of the efficacy of infrastructure and the true reach of trade areas. Given the high term costs of five-year leases for both retail and industrial premises, this is valuable data.

If the information you require is more granular e.g. "Where do individual customers of my competition shop and how can I enhance my offer to capture them?" then Near's Allspark¹⁷, a Telstra Ventures investment, can help anonymously identify these targets, attribute behaviour to the movement of their smartphone and provide a platform to send them key messages.

Linfox migrates its fleet to IoT

For Linfox, one of Australia's largest logistics companies, the role of data today is critical, and only likely to get more so. Said Linfox CEO, Mark Mazurek: "Linfox has a significant fleet and warehouse network. Data is central to keeping our business compliant, safe, efficient, profitable, and most of all, connected."

Mazurek also sees the benefit for Linfox's customers. "Data – and better presentation of it – is enabling greater transparency and visibility in our operations. This, in turn, is allowing us to better meet our customers' needs, making their operations more responsive. In time, this will allow us to provide services and add value further up the supply chain," he said.

Reflecting today's sharpened focus on data in the supply chain, Linfox has recently partnered with Telstra and MTDData to upgrade its FoxTrax system by implementing an advanced telematics and management solution. The Internet of Things (IoT) technology will be rolled out to the whole Linfox truck fleet and will deliver advanced transport and logistics data and quality benchmarking information to enhance public and driver safety on Australian roads.

Telstra's IoT solution will include Samsung tablets mounted into Linfox heavy vehicles so drivers can access logbooks and complete safety checklists, and have capability, in some vehicles, for in-cabin recording of road safety incidents. Telstra will deliver IoT solutions to the Linfox fleet over Australia's largest and fastest mobile network – based on national average combined 3G/4G mobile speeds.

"Heavy vehicle safety is a key issue within the logistics industry and the community. Partnering with Telstra and MTDData allows us to better monitor and measure safety compliance throughout our fleet, coordinate our vehicles efficiently, reduce congestion on the roads and ensure a higher level of safety for the community. Our upgrade of FoxTrax and investment in MTDData also allows us to be ready for the future implementation of electronic work diaries (EWD) and unlock the value of our new Transport Management System," said Mazurek.

The confidence brought by MTDData's expertise in delivering IoT solutions for the heavy vehicle industry, coupled with the coverage and capability of the Telstra mobile network, created a compelling solution for Linfox.

Beyond this, Linfox can see Vehicle to X technology enabling greater efficiency through connected transport networks. "Telstra and MTDData are showing leadership in this area. Ultimately our partnership with them allows us to leverage technology to be ready for future changes in our industry," said Mazurek.

The strategic alliance comes just three months after Telstra's acquisition of MTDData, which provides Telstra with advanced technology and deep domain expertise in Connected Vehicle solutions.

Michelle Bendschneider, Executive Director of Global Products, Telstra commented, "Linfox is one of Australia's largest and most successful logistics companies and we are committed to supporting its efforts to achieve safer and more efficient supply chains.

"We are on a journey with our customers, from connectivity to M2M to IoT. Our ambition in Telstra is to help our customers become digital enterprises by translating data into insights that empower outcomes," said Bendschneider.

Mazurek is optimistic about what future technologies may offer too. "Supply chain management is evolving rapidly. This will continue with the introduction of new technology, processes and platforms. Combined, these technologies will improve the efficiency, visibility and responsiveness of supply chains to meet the demand of consumers. We're particularly focused on greater automation of many parts of the supply chain and what this will ultimately allow us to deliver to our customers."



4. New technologies connecting retail supply chains

Both local and global market pressures are driving organisations to seek much greater levels of efficiency. Meanwhile, more aware and better-informed customers are pushing retail supply chains to create compelling new customer experiences. To deliver on both demands, supply chains must become smarter and more collaborative. Undoubtedly, data needs to flow more efficiently between supply chain partners – but that will not be enough. The organisations that will thrive in the era of the data-driven supply chain will be those that can most effectively manage their data supply chain and can effectively collaborate with their supply chain partners around that data.

Technology already plays a critical role in providing those capabilities. Looking forward, three key questions then become:

1. What new forms of data will drive efficiencies and new customer experiences?

The Internet of Things (IoT) is rapidly reshaping our ability to understand what is happening in the physical world – whether that is in-store, in the supply chain or elsewhere.

2. How do we use the massive amounts of data required to drive optimisations and create those new customer experiences?

Organisations are often challenged by the amount of data they already gather in-house. Both supply chain collaboration and IoT can radically increase the amount and diversity of data. We'll look at how Artificial Intelligence techniques, including machine learning and deep learning, help gain insights when data sets challenge human analytical capabilities.

3. What are some of the technologies that can take supply chain collaboration to new levels?

We'll look at two approaches that may improve the information required for collaboration: blockchain and data exchanges.

4.1. Instrumenting the data-driven supply chain: The Internet of Things and IoT networks

The Internet of Things is simply the extension of a 50-year trend of devices becoming more network connected and more intelligent. What is undoubtedly accelerating is the rate at which new compatible devices are being network connected.¹⁸

A raft of new in-store IoT devices and capabilities are shaping both store operations and the customer experiences they can deliver. The data that they generate about customers and their interactions with marketing and products is also helping to reshape supply chains.

Perhaps the capability finding the greatest range of applications is computer vision. Low-cost, high-quality application-specific cameras backed by advanced AI-based image and video processing make computer vision a realistic tool to apply to many retail problems. Computer vision built into intelligent shelving systems can monitor stock levels and gather customer intelligence including dwell time, demographic profiling and even sentiment via facial analysis. The confluence of commoditised robotics and computer vision means autonomous or semi-autonomous robots can patrol stores, analysing shelf stock levels and measuring planogram compliance.

Computer vision, augmented by other sensors, can be used to enumerate items that consumers pick from shelves almost as accurately as a standard checkout process (see Bingobox below) and can be used to understand consumer responses to advertising, store layout and product presentation. In the supply chain, computer vision is being used for stock identification and to examine stock for defects before dispatch to the shop floor.

Even one of the most basic of supply chain activities, stock tracking, is undergoing something of a renaissance. Tracking technologies are nothing new – short-range passive technologies, including passive RFID and optical codes, have been used for years.

Narrowband cellular technologies

Mobile networks were traditionally designed to support devices such as smartphones, which require high bandwidth broadband connectivity. However, many IoT devices only transmit small amounts of data – often infrequently. Also, the price point of broadband chipsets has typically inhibited their use in mass deployment IoT devices.

Two new mobile network technologies: **4G Cat-M1** and **Narrowband IoT (NB-IoT)**, now being deployed by Telstra, are purpose-built to support low data rate IoT applications. These technologies offer much lower power consumption and a much lower chipset cost. In most cases, these technologies are a software upgrade meaning mobile operators can deploy coverage using their existing mobile infrastructure.





Short-range technologies require investment to deploy readers at key data gathering points, such as vehicles and loading docks. They are not well suited to multi-modal, multi-party supply chains as all participants need to implement, support and integrate readers. Unlike short-range technologies, narrowband cellular technologies allow compatible tagged stock to be connected to a pervasive wide area cellular network – offering the potential for cheaper end-to-end tracking. Mobile network based compatible devices are particularly interesting for sensitive freight such as fresh produce and pharmaceuticals. As they are active devices, they can allow for near real-time monitoring of environmental parameters such as temperature, humidity, light exposure, and exposure to physical shock. This can enable supply chain operators to react quickly when handling limits are breached by changing routes or expediting replacement stock to avoid stock-outs (for example, see Exhibit 2). Active tracking and condition monitoring have been possible for years using 3G and 4G technology. However, narrowband technologies provide much longer battery life, lower device costs and are smaller (so can fit in more places e.g. on packaging rather than swing tags).

Exhibit 1: BingoBox

When we talk smart stores, conversation usually focuses on Amazon's Amazon Go bricks and mortar store.¹⁹ But Chinese based start-up, BingoBox, is tackling the crowded convenience store market by using IoT enabled, AI-driven unmanned stores.

Customers use their smartphone to gain entry. As the customer leaves, their goods are scanned via RFID and charged to their WeChat Pay or Alipay account.

BingoBox has trialled a combination of smart shelves and cameras to remove the need for RFID tagging. They claim a 99% accuracy rate and have announced they will adopt that approach. The same data will feed their Fan AI platform to drive targeted advertising and marketing offers.

By removing checkouts and automating inventory management, BingoBox believe a team of four staff members can manage up to forty BingoBox stores.²⁰

Exhibit 2: Peloris

IoT has the power to reshape supply chains. Australian Peloris Global Sourcing has used IoT to help create a whole new market – exporting fresh milk to China.

Long customer clearance times and the inability to tightly control handling of fresh milk in transit had previously made fresh milk shipments from Australia to China problematic.

With help from Telstra and M2M Connectivity, Peloris implemented continuous end-to-end IoT monitoring of location, temperature and other condition data that has helped Peloris achieve endorsement from China's Inspection and Quarantine Bureau for rapid border clearance of food imports. Shipments that would have taken weeks to clear can now be cleared in thirty-six hours.

While the supply chain for Peloris terminates in an export market, the same approach can be used to optimise handling of other sensitive products such as fresh produce and pharmaceuticals.²¹

4.2. Intelligent data-driven supply chains: Artificial Intelligence, Machine Learning and Deep Learning

We know that more data is being produced than ever before²² and the rise of IoT will only accelerate this. We also know that data-centric supply chain collaboration is vital and we'll need to deal with a flood of data from our supply chain partners, not just our own. So how can we drink from this fire hose to produce useful and actionable insights?

While AI as a field of study dates to 1956,²³ the terms 'machine learning' and 'deep learning' have landed in popular lexicon (and an awful lot of marketing collateral) more recently. To understand their impact, we need to understand what these terms really mean.

The traditional approach to the development of analytical models is resource intensive: highly skilled analysts explore datasets, identify features, develop hypotheses and iteratively build models tested on small sets of data. However, the sheer volume, variety and velocity of data generated by modern business make it infeasible for humans – even skilled analysts – to identify the complex relationships and extract any useful insights. To overcome the bottleneck of human processing, algorithms were developed that generate models directly from data – machine learning

Machine learning algorithms take in large amounts of data from which humans manually select relevant features that the algorithms then use as a basis to learn how to create predictive models.²⁴

Deep learning is a further specialisation of machine learning that removes the need for humans to manually identify relevant features.²⁵ Instead, deep learning algorithms construct an 'artificial neural network' (based on one model of how the human brain may work) to autonomously learn which features are needed to make more accurate predictions or more useful insights.

Machine learning algorithms and techniques are very active research areas, but much of the spectacular adoption of AI is not due to research, but rather commoditisation. Major cloud technology providers now offer highly capable, cloud-based, consumption-priced machine learning capabilities, coupled with massive on-demand compute and storage capacity. It's now entirely feasible for organisations to launch sophisticated deep learning based analysis of their data with very little development and investment required.

Commoditisation and democratisation of AI is enabling retailers and their supply chain to base decisions on massive data sets that characterise consumer behaviours and preferences. Exhibit 3 shows a very direct example of this. That same trend is enabling rapid advances in areas such as voice-based natural language understanding. A generation of consumers are being trained by mainstream devices (such as Amazon's Echo, Google's Home and Apple's HomePod and platforms such as Facebook chatbots) to interact with services by natural language. This has already driven the creation of a whole new channel – 'conversational commerce'.²⁶

Exhibit 3: Project Muze

Project Muze²⁷ is an experiment Google conducted with Zalando, a German fashion platform. Google used their TensorFlow platform to train a neural network using preference information regarding colours, textures and styles from over 600 fashion experts. Google combined this with data from their yearly Fashion Trend Report – an analysis of fashion-related searches on Google's search platform.

The model was then used to generate a range of designs that Zalando will use as the basis for a range of real world designs.

While Project Muze is an experiment, it does point the way to a future where supply chains will be driven by AI techniques that analyse vast amounts of data on consumer preferences.

Exhibit 4: Singles' day

Alibaba generated a record CNY168.2B (AU\$33B) during 2017's Singles' Day sale – an increase of 39% on 2016.28 While Alibaba enlisted celebrities including Nicole Kidman and Pharrell Williams to hype the event, 29% of Alibaba's success was driven by AI.³⁰

AI powered advertising for the event, with Alibaba's marketing platform automatically generating over 400 million customised banner ads and around 60 billion personalised product recommendations.³¹ Reportedly, 95% of customer inquiries were handled by Alibaba's AI powered chatbot during Singles' Day.³²

Alibaba also used AI to prepare for the sheer volume of transactions. In-house and partner systems were stress tested and AI used to conduct cluster analysis of results – reducing the time spent identifying problems and allowing better prioritisation of issues.³³

4.3. Retail supply chain collaboration: Blockchain and data exchanges

You may wonder how blockchain – a technology conceived to power the (in)famous cryptocurrency Bitcoin – has been hyped as an answer to many problems in retail supply chains. A blockchain is simply a database that continuously processes data and transactions, with copies distributed across many parties and reconciled using automated consensus algorithms. Once data is entered into a blockchain, it is extremely difficult to change, meaning that parties can rely on this immutable data.

Supply chains run on trust, which, in turn, is built on relationships. Transacting organisations must either have trust in each other (often based on long experience or reputation) or they must rely on intermediaries trusted by all parties. Blockchains enable trust without a direct or indirect relationship between transacting parties. If one party makes a commitment or records an event such as a delivery, there is an immutable record visible to all relevant parties.

Blockchain and smart contracts

An interesting development in blockchains is 'smart contracts'. Entries in a blockchain don't have to be simple passive records. They can be active agreements that execute pre-agreed actions when agreed criteria are met. For example, a smart contract might instigate payment when a blockchain records a corresponding delivery has been made. Smart contracts are agreements instantiated in software.

It is still early days for smart contracts. For broad adoption, a robust, widely accepted language is needed to define smart contracts – no such language exists. Security models for smart contracts are still being developed – several high-profile breaches resulting in theft or disruption of cryptocurrencies have been traced to flaws in smart contract implementation. However, and perhaps most importantly, the legal status of smart contracts and their relationship to other legal agreements has not been thoroughly tested.

Some of the areas where blockchains are likely to have impact in the mid to long term include:

- **Traceability and provenance**
Retailers are under increasing pressure to demonstrate the origin and path to market of the goods they sell. The retailer often has no direct relationship beyond the manufacturer or distributor, and detailed origin and production certifications rarely flow along the supply chain. Blockchains have been proposed as a good way to record the origin and path to market.
- **Fraud protection/minimisation**

Significant economic harm is caused by product fraud. Fake products can be sold through unscrupulous retailers or retailers who are unaware of product fraud in the supply chain. Blockchains can record features that provide strong evidence of product authenticity, which can then be matched against the actual product received.

- **Visibility and transparency**

Consumers and investors increasingly want to understand the origin of a product and the path it has taken to market. In complex supply chains, blockchain may provide a mechanism to give consumers and investors proof of ethical and sustainable origin and production practices.

- **Digital advertising**

Digital advertising cost is still largely based on display and click-through. Bots and other techniques³⁴ can emulate genuine ad views and click-throughs, thereby inflating advertisers' costs. Similarly, advertisers may want proof their ads have not been placed with content that may have a negative impact on their brand. Blockchain-based advertising marketplaces are being developed to ensure legitimate presentation of ads and whitelisting of inventory sources.



Exhibit 5: Food transparency

Walmart, JD.com, IBM and Tsingshua University have partnered to create the Blockchain Food Safety Alliance to enhance food traceability and safety in China. The four will collaborate to create data standards and will use blockchain to provide real-time, end-to-end traceability. This will encourage accountability and give suppliers, regulators and consumers insight into how food is handled. The aim is a step-change improvement from existing fragmented and paper-based data sharing systems.³⁵

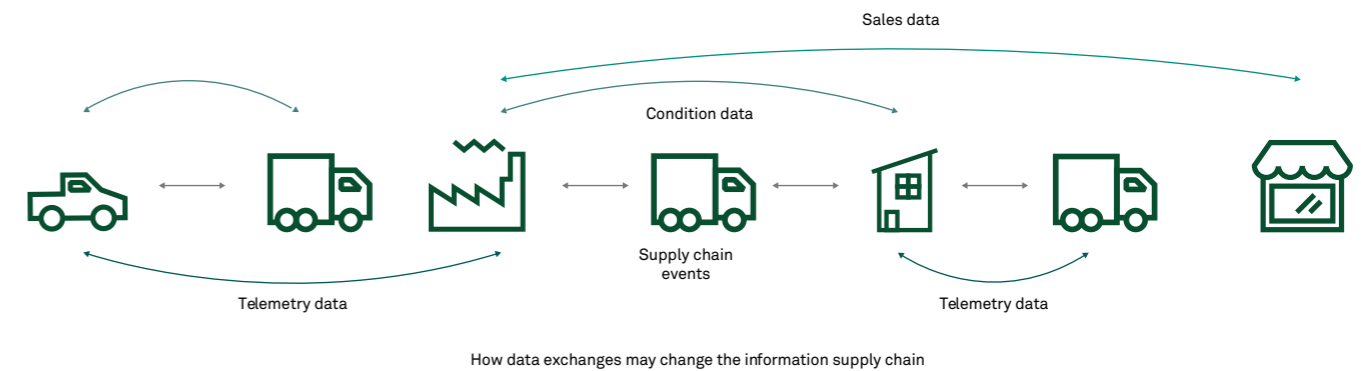
Exhibit 6: Supply chain tracking

Maersk are working with IBM to develop a digital global trade platform utilising blockchain to provide more transparency in the movement of goods across borders and trading zones. More than US\$4 trillion in goods are shipped each year, and the shipping industry carries over 80% of all consumer goods. The World Economic Forum estimates that reducing barriers in the international supply chain could boost global trade by nearly 15%.³⁶

Another fast-moving approach to data-driven supply chain collaboration is the concept of a data exchange. **Data exchanges** are digital platforms where data from supply chain participants and others can be brought into an integrated, privacy-controlled, rights-managed environment close to massive scale storage and compute capability, enabling participants to build data-driven solutions that unlock new value and capabilities for themselves and others. Data exchanges are the hub for 'Data Communities' – ecosystems that share, add value to and derive value from common data.



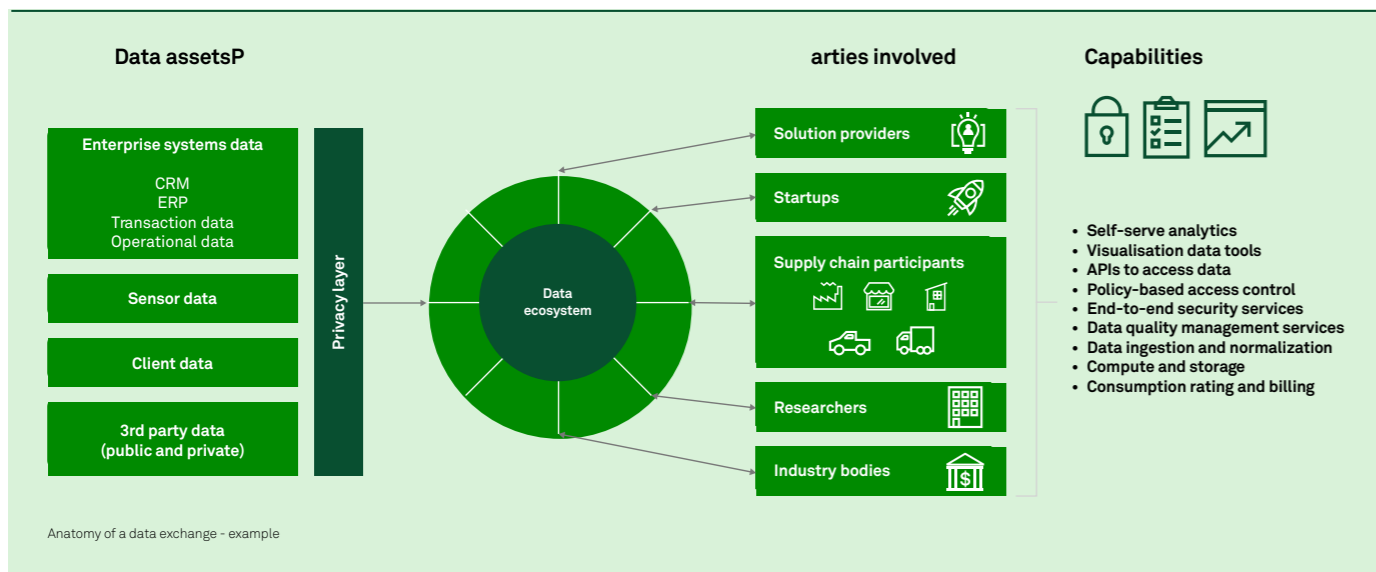
Figure 02. How data exchanges may change the information supply chain



How data exchanges may change the information supply chain



Figure 01. Anatomy of a data exchange - example



We know participants need timely access to data from across the supply chain to optimise operations. Often much of that data is not accessible, is not shared in a timely manner, or is shared by expensive means such as manual processes and bespoke integration. In fact, for all too many supply chains, the primary data integration tools are still telephone, email and man-hours.

Data exchanges have the potential to solve many of these problems by:

- Providing a single common interchange interface
- Radically reducing the cost of on-boarding new analytical solutions and data sets
- Reducing operating costs – particularly expensive data activities such as normalisation and data quality management

Like blockchain, data exchanges are a work in progress. Work is needed to develop acceptable and secure data ownership and commercial models.

As data exchanges are ecosystem-centric, their utility is largely based on network effect and there are few industries in which a common data exchange has

reached the critical scale required to be deemed industry infrastructure

5. Conclusion

The emergence of new technologies to capture, analyse and collaborate with data promises a new era of supply chain management, but our research shows there are some barriers to be overcome.

To unlock the promise of a data-driven future, supply chain actors need to align objectives with partners, find a way to secure the data they share, find new skills to make data useful and win the familiar organisational arguments around investment priority. The world will not wait. Already we can see online retailers like Amazon, Alibaba and OTTO using supply chain data to gain significant advantages over their rivals, and traditional retailers like Walmart and Target USA are catching up.

In the end, it may be traditional retailers with their established networks of stores and distribution centres, ability to collect online and offline data on consumers, analyse markets using movement data from smartphones and a customer base willing to do some of the last mile work of the supply chain that have the most to gain. What can be said with more certainty is that the big gains in retail have and always will come from taking share from competitors or operating more efficiently. The data-driven supply chain promises both.

5.1. About the author



Gareth Jude is the Global Retail Industry Executive at Telstra. Gareth has spent most of his career in a variety of senior roles in retail, including two years as CEO of a sporting goods retailer and seven years with Woolworths.

Gareth has a Masters degree in Business from University of Technology, Sydney and Research from Macquarie University and is currently a PhD candidate at University of Sydney.

A strategist and international speaker, Gareth has authored six thought leadership research reports in to the digital disruption of the industry.

These include:

- How you can join the Omnichannel shopper in transforming Australian Retail
- How mobility is changing the rhythm of Australian Retail
- The personal supply chain
- Innovation in retail
- Spacetime marketing

Gareth has also spent a number of years consulting to retailers and teaching retail at Sydney, Macquarie, UTS and Shanghai Jiao Tong Universities.

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Warren Jennings

Warren Jennings is the General Manager, Emerging Technology and Incubation in Telstra's Chief Technology Office. He has decades of experience in developing strategies, products and service offerings that combine emerging technologies and mature technologies from a wide variety of disciplines to solve real-world issues for organisations and their customers.

Warren has Honours Degrees in science and engineering from Monash University and a Masters degree in Electronic Commerce from Deakin University.

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20. <https://technode.com/2017/09/28/bingobox-unveils-new-ai-tech-for-its-unmanned-stores/>
21. For more information see <https://exchange.telstra.com.au/internet-of-things-transforms-agriculture-industry/>
22. It’s estimated that 90% of the world’s data was generated in the last two years and 2.5 quintillion bytes of data (that’s 2.5m terabytes!) is generated each day (<https://www.ibm.com/blogs/insights-on-business/consumer-products/2-5-quintillion-bytes-of-data-created-every-day-how-does-cpg-retail-manage-it/>)
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35. <https://www-03.ibm.com/press/us/en/pressrelease/53487.wss>
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