CIPS
Chartered Institute of Procurement & Supply

# *Future Technologies*

## in Supply Chain and Logistics

2020

# *Introduction*

***Supply chain and distribution are facing a period of significant disruption, thanks to advances in technology that are increasing both operational efficiencies and customer demands and expectations.***

This global survey – a collaboration between CIPS, Manchester Metropolitan University (UK) and Swinburne University (AUS) – aims to better understand the attitudes and actions supply chain practitioners are taking in response to these emergent technologies.

This initiative is part of the CIPS knowledge platform. It focuses on the key questions that reveal the insights into your sector, the future and possible way forward, such as:

- Which technologies will truly change the industry landscape?
- Which technologies are just 'hype' vs those really making a difference?
- Which areas should you be focusing your efforts to remain competitive?
- How quickly do you need to be on-boarding specific technologies?

## *The survey in numbers*

We carried out the survey in February 2020.

We surveyed **445** participants from supply chain and logistics

Across **17** sectors

In **15** regions

Investigating **16 major technology streams** expected to impact the industry.

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## Foreword

### Malcolm Harrison
CEO CIPS

"The disruption caused by the pandemic has increased interest in digital technologies at a head-spinning pace, as the need to build stronger, more resilient supply chains is uppermost in everyone's minds. However, without end-to-end-transparency across all tiers and suppliers, potential weak points will remain and no amount of digitalisation can solve the problem of ignorance of slavery for instance or fraud and corruption or missing sustainability goals. Any digital programme must encompass the core values and needs of the business and also responsible procurement practice to make investments in digital worth the resource and expense"

## About the authors


### Dr Iain Reid
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Iain's experience in industry has been critical to his academic career over the last 20 years. He has worked for organisations such as Sulzer Pumps and IMI, a European Funded Project supporting over 150 Small Medium Sized Enterprises, and has secured over £1.5M on numerous SME-University collaborations. Iain developed and is program leader for the Masters (MSc) in Supply Chain, which remains the only CIPS-accredited degree programme taught solely online.


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John has worked extensively in industry, for organisations such as General Motors and Cadbury, in addition to academic institutions in the UK, USA, Ireland and Australia. Like Iain, John's experience in industry has been critical to his academic career and he enjoys working at the interface of academic theory/knowledge and real-world industry practice.

CIPS Chartered Institute of Procurement & Supply

Manchester Metropolitan University

SWINBURNE UNIVERSITY OF TECHNOLOGY
MELBOURNE, AUSTRALIA

# *Executive Summary*

***This paper reviews the perceptions and actions of the supply chain and logistics industry towards 16 emerging technologies that are expected to shape operations over the coming decade.***

Most of the technologies reviewed have similar levels of use today, with 10-30% of respondent organisations employing each technology.

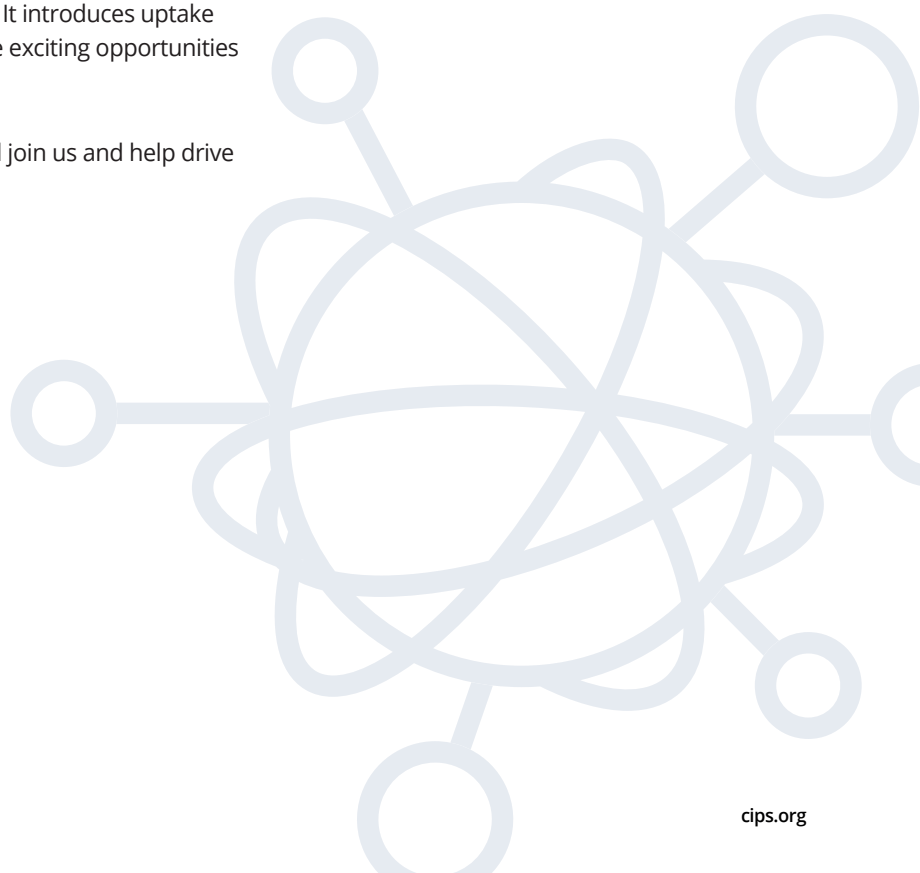
Currently, cloud computing is the most established technology, used predominantly for procurement and forecasting of supply chain and logistics requirements.

Perceptions and investments vary across the technologies surveyed. However, in all cases the expected impact of the technology was greater than the expected investment – most firms are adopting a wait-and-see approach to financial investment. Instead, most are focusing on their five year strategy, with only Cloud Computing and Big Data Analytics (BDA) being firmly established as part of the industry 4.0 provision.

Unsurprisingly, COVID-19 has accelerated the pace of change. To remain operational, many previously-hesitant businesses now actively embrace new technologies. As a result, we see increased engagement and interest. However, the opportunity now lies in going one step further in terms of changing ways of working and developing new business models. The rise of these new technologies also brings challenges as we respond to the ever-changing tech landscape to protect supply chains and customer service – without restraining innovation.

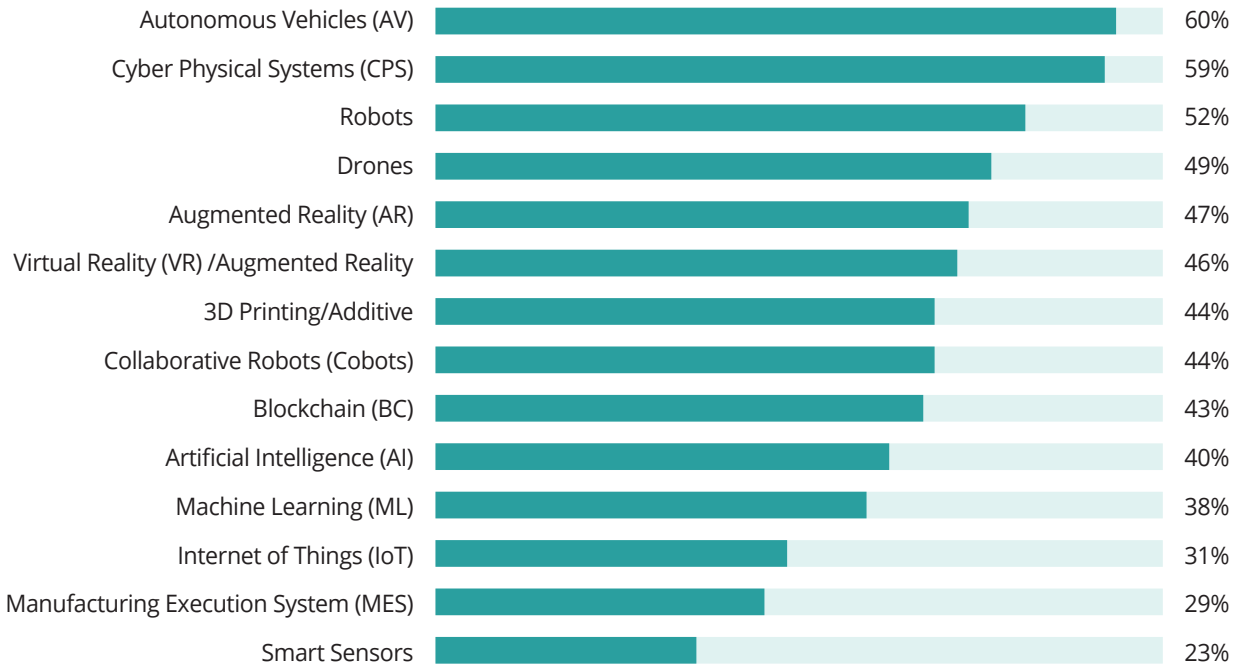
This report will provide you with a new perspective and deeper insights on Industry 4.0, as well as shine a light on emerging technology for supply chain practitioners. It introduces uptake of these new technologies and reveals the exciting opportunities Industry 4.0 has to offer.

After reading this report, we hope you will join us and help drive positive change across the profession.

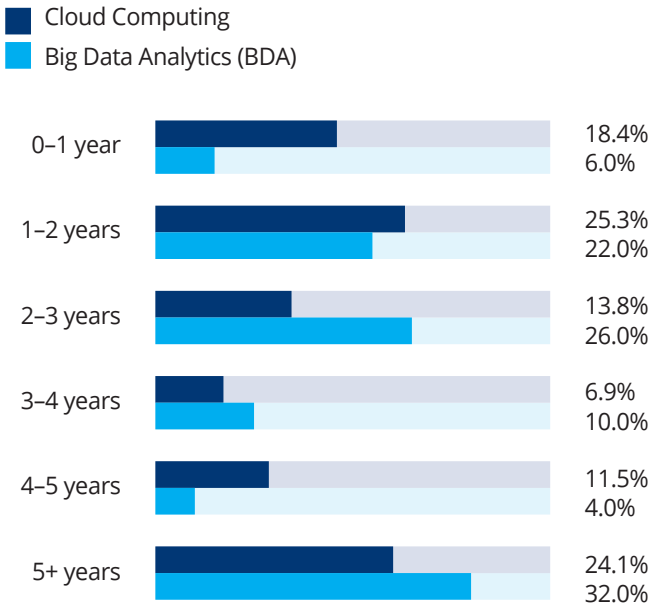


# *5 Year Plan*

The following results from our survey highlight how our respondents anticipate their technology investments to be shaped over the next 5 years, please note that this investment would be subject to sector:




The following results from our survey highlight how our respondents, who don't already have cloud computing and big data analytics technologies, anticipate the time required until their expected investment over the next 1-5 years:



# What is Industry 4.0?

Industry 4.0 represents the approach of the Fourth Industrial Revolution, where Information and Communication Technologies (ICT) form the infrastructural foundation for tomorrow's innovative industrial technologies.
We are already at the cusp of this revolution, in which the worlds of production and network connectivity are integrated through the Internet of Things (IoT) and Cyber physical systems (CPS).

For the global economy and global supply chains to achieve greater efficiency, competency and competitiveness, next-generation technologies are needed to dramatically increase the overall level of information and digitisation.

As Industry 4.0 has an important long-term strategic impact on global industrial development, there has been a growing demand for research to provide insights into its issues, challenges and solutions related to its design, implementation and management.

## How Industry 4.0 will impact supply chains

The advanced technologies involved in Industry 4.0 are restructuring entire production systems by transforming analogue and centralized workflows into digital and decentralized production processes.

Supply chains are being transformed globally by the development of a more digitalised environment, where value chains are connected and distribution systems are increasingly intelligent, autonomous and automated.

We anticipate these advancements will bring about huge improvements in the flexibility, efficiency and automation of distribution. They are welcomed by suppliers working to eliminate unnecessary production costs, improve the transport of goods and services and business performance, increase throughput, reduce cycle times and maintain quality, all in the face of changing supply chain networks.

However, organisations that are actively seeking to develop their Industry 4.0 status and strategies must begin by understanding their current level of maturity in their specific context or supply network.

## Introducing 16 supply chain and logistics technologies

We conducted this research to help managers and practitioners evaluate the Industry 4.0 priorities already in place, and identify which technologies require further leveraging. Supply chains are becoming increasingly sophisticated in the way they connect business partners, promote collaboration, diffuse innovation, enable data-driven decision making, and track movements in real time.

We evaluated 16 technologies within the context of supply chain management, products, processes and physical distribution:

1. Cloud Computing (CC)
2. Big Data Analytics (BDA)
3. Internet of Things (IoT)
4. Smart Sensors (SS)
5. Cyber Physical Systems (CPS)
6. 3D Printing/Additive Manufacturing (AM)
7. Machine Learning (ML)
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12. Drones
13. Robots
14. Collaborative Robots (Cobots)
15. Augmented Reality (AR)
16. Autonomous Vehicles (AV)

As you will see, despite specific challenges, these technologies present exciting opportunities.

## *In focus: Cloud Computing*

Rather than keeping files on a proprietary hard drive or local storage device, cloud-based storage makes it possible to save them to a remote database.

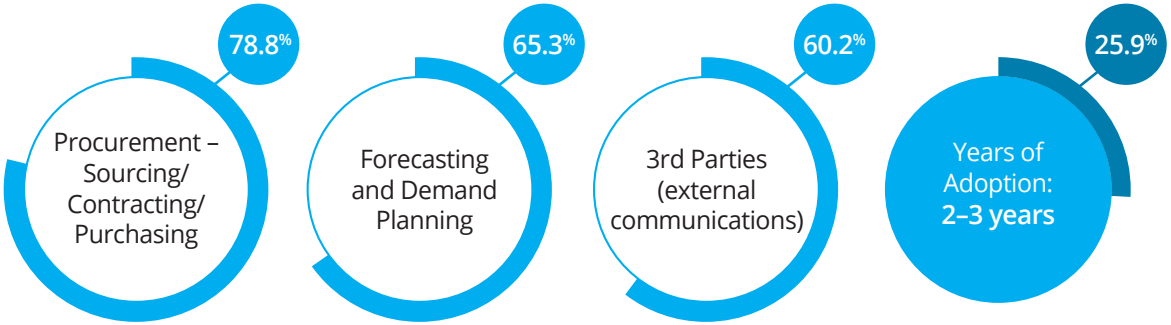
Cloud computing uses a network of remote servers hosted on the Internet to store, manage and process data, rather than a local server or a personal computer. These resources include tools and applications like data storage, servers, databases, networking, and software. If an electronic device has access to the web, it can access the data and the software programs to run it.

Cloud computing is a popular option for people and businesses, as it offers increased productivity, speed and efficiency, as well as greater performance, and robust security. But the biggest benefit is the cost-saving it brings – cloud computing is up to 40x more cost-effective for a Small and Medium Business (SMB), compared to running an in-house IT system.

### *Fun Fact*

Despite its name, data storage doesn't take place in some nebulous ether. Cloud computing is simply storing your data in another location, so that it essentially follows you everywhere, enabling you to retrieve and use information anywhere in the world.

## *Current Practice: Cloud Computing*




Respondents to the survey identified where they are currently leveraging the technology within the organisation and the number of years since the technology was adopted.

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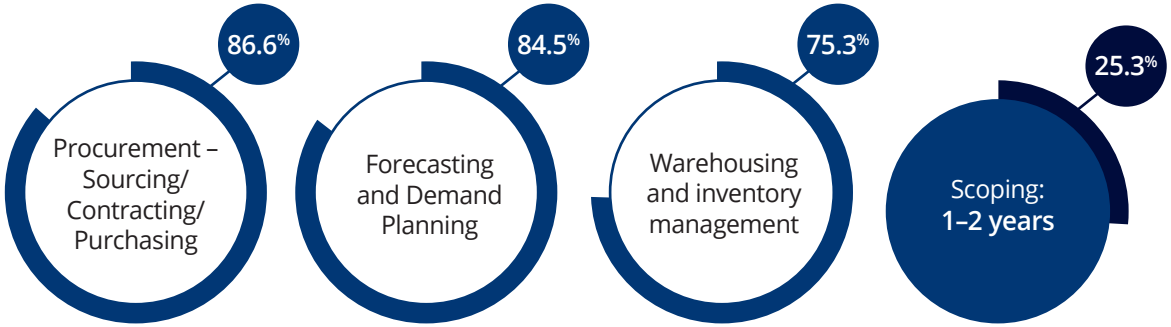
## *Future Proofing: Cloud Computing*




68.7% *(415 Respondents) adopted users

## *In focus: Big Data Analytics (BDA)*

Perhaps one of the more developed and integrated of the technology streams today, Big Data Analytics is the process of examining large datasets – containing a variety of data types – to uncover patterns, correlations, market trends, customer preferences and other useful business information.

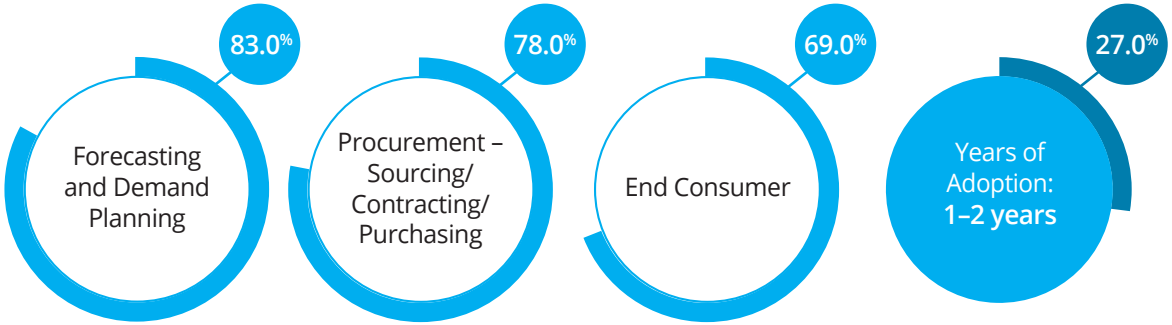
Big Data Analytics can be considered a stepping-stone to wider adoption of Machine Learning. While traditionally humans would find cause and effect relationships, this capability is progressively being handed over to AI, which requires large data sets and significant processing power.

### *Fun Fact*

Over 90% of all the data in the world was created in the past two years.

If you burned the data created in just one day onto DVDs, you could stack them on top of each other and reach the moon – twice.

## *Current Practice: Big Data Analytics (BDA)*

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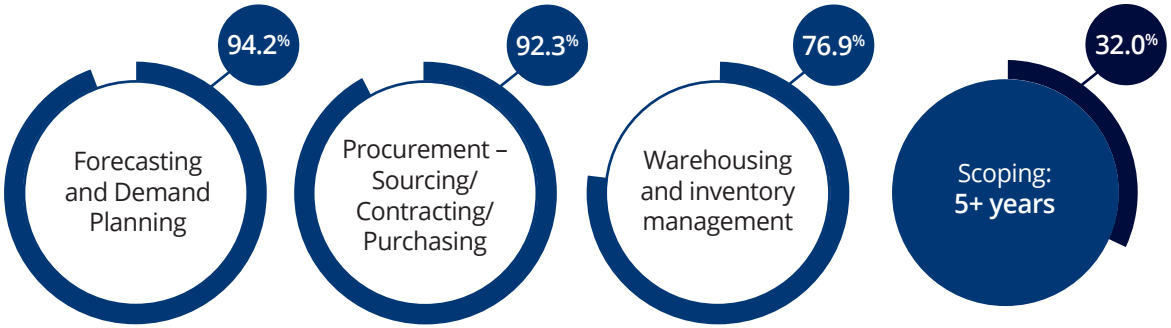


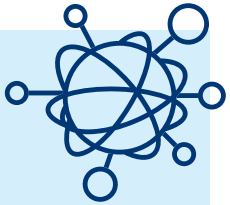
## *In focus: Internet of Things (IoT)*

The term IoT has come to represent any device that is connected and can be monitored or controlled via a network connection.

The quantity of IoT devices is projected to explode over the coming years. McKinsey estimates a 32.6% Compound Annual Growth Rate CAGR, while General Electric predicts investment in the Industrial Internet of Things will exceed $60 trillion within 15 years.

And its applications are huge – networks of objects (devices, vehicles, containers, etc) embedded with sensors, software, network connectivity and compute capability, can collect and exchange data over the Internet. For example, IoT integration into Blockchain enables the authenticity, storage and temperature conditions of food, beverages, and other premium products to be tracked across the supply chain.

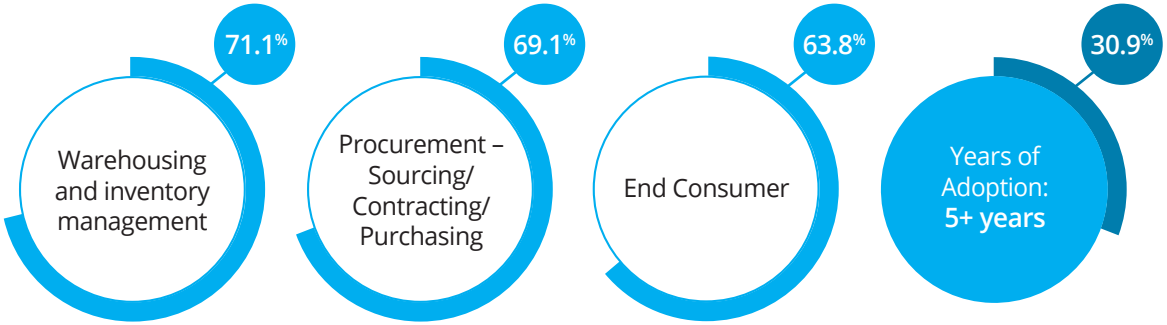
### *Fun Fact*



In 1982, a modified Coke machine at Carnegie Mellon University became the first internet-connected appliance, able to report on inventory levels and temperature conditions.

According to Business Insider, the boom of the IoT will see the number of devices that connect to the Internet rise to around 41 billion by 2027.

## *Current Practice: Internet of Things (IoT)*

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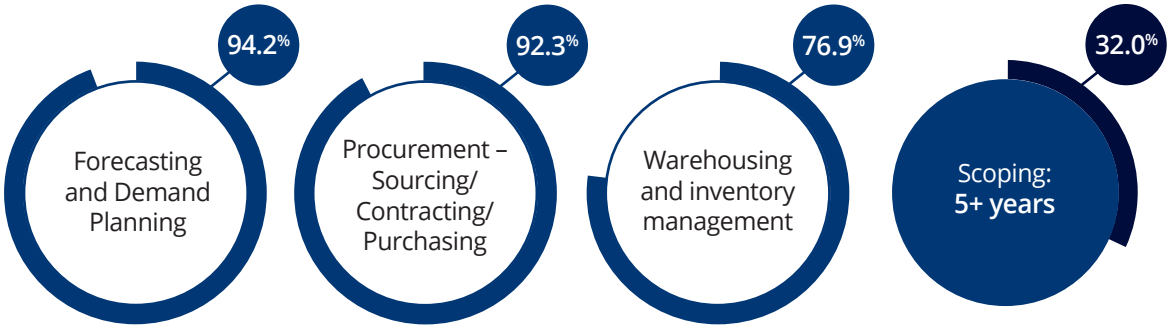


## *In focus: Smart Sensors*

A smart sensor is a device that makes it possible to accurately collect data, detect and control changes in a specific environment or asset – automatically and in real time.

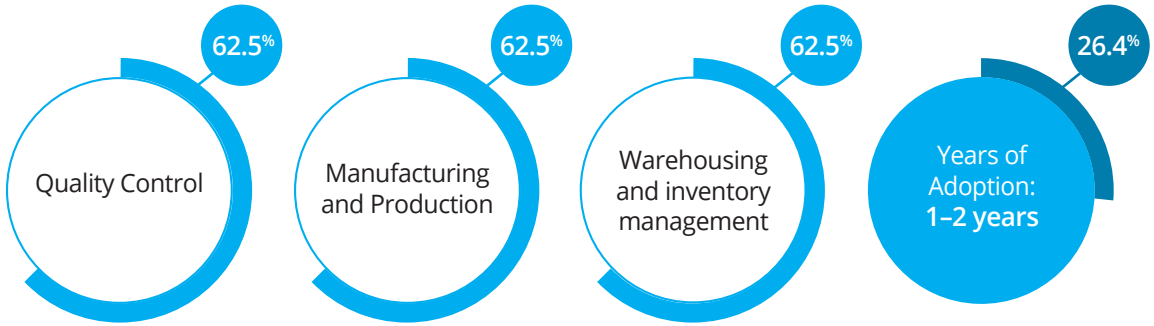
Sensors are a key factor in 'IoT' success, but these are not conventional types that simply convert physical variables into electrical signals. Multiple sensors can be combined and correlated to infer conclusions about latent problems. For example, temperature sensor and vibration sensor data can be used to detect the onset of mechanical failure.

## *Fun Fact*

Engineers at University British Columbia have developed a low-cost sensor embedded into fabric, which monitors and interprets human movements, paving the way for wearable health tech.

The global smart sensor market is set to reach $106 billion by 2027.

## *Current Practice: Smart Sensors*

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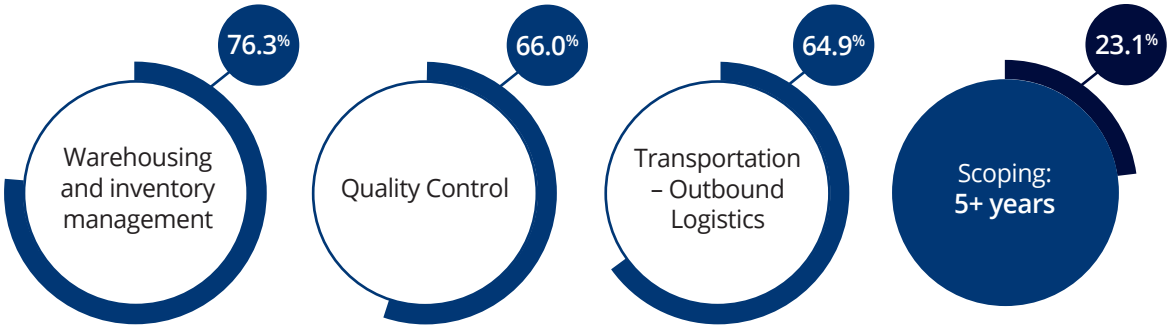


## *In focus: Cyber Physical Systems (CPS)*

Cyber physical systems integrate sensing, computation, control and networking into physical objects and infrastructure, connecting them to the internet and each other.

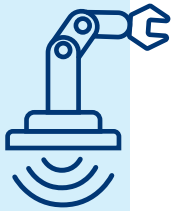
Many objects in our everyday lives are controlled by computers – such as cars, manufacturing machines and even musical instruments – which interact in some way with the physical world. That's why they are referred to as Cyber Physical Systems.

The technology often builds on the discipline of embedded systems – computers and software embedded in devices whose principle mission is not computation (think cars, toys and instruments).

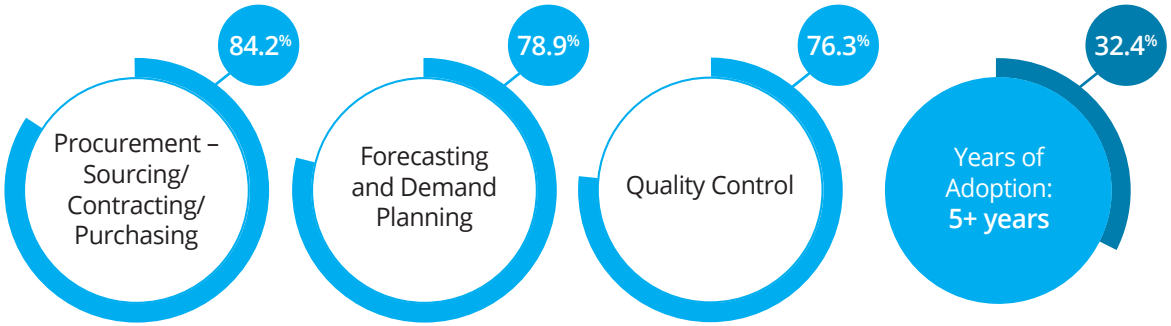
An important distinction is that CPS is concerned with exchanging information and controlling physical things, whereas the IoT networks and interconnects different things.

### *Fun Fact*

The major factors driving the growth of the global Cyber Physical Systems market are increased adoption of IoT combined with organisations increasing investment in critical infrastructure. All big industrial players are dedicating vast resources to IoT. In the US alone, Amazon, Siemens, Apple, Cisco, Bosch General Electric, Google, IBM, Intel, Kuka, Microsoft and many others are competing for a piece of the IoT.



## *Current Practice: Cyber Physical Systems (CPS)*

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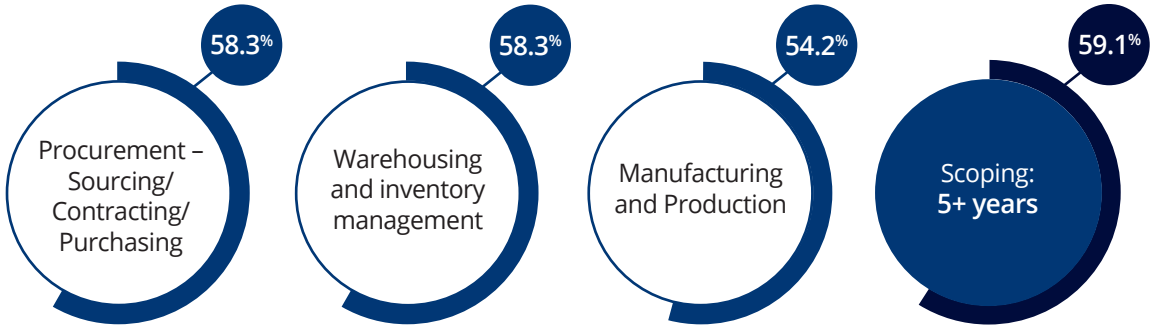


## *In focus: 3D Printing*

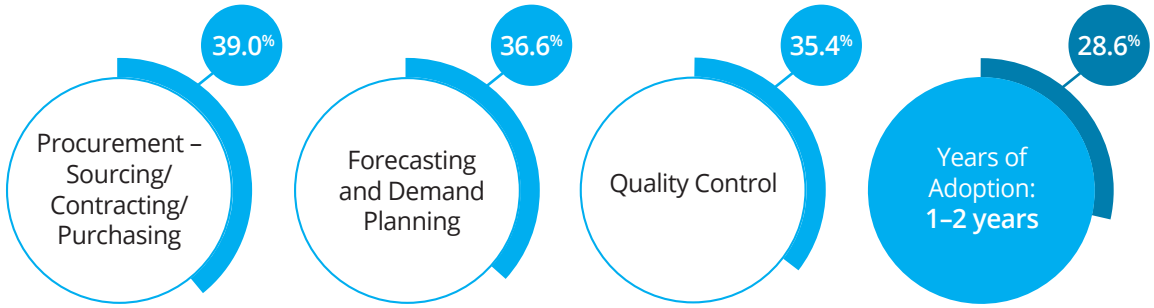
3D Printing is an additive manufacturing process used to create three-dimensional objects based on digital models or scans. Three-dimensional components are 'printed' from raw materials, layer-by-layer.

The industry has grown at a whopping 25%+ over the last 30 years, and the technology has evolved significantly in recent times, enabling printing of various alloys, metal, plastics, ceramics, and wood.

## *Fun Fact*

If you think 3D printing is just for novelty plastic gadgets, think again. The aerospace industry has some of the most stringent manufacturing requirements and is already using the technology to produce approved parts faster, stronger, lighter, and cheaper than traditional manufacturing techniques.

## *Current Practice: 3D Printing*

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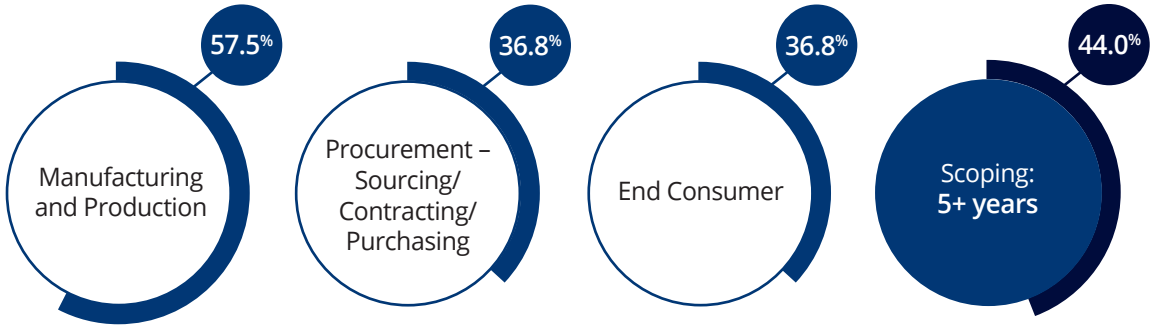


## *In focus: Machine Learning*

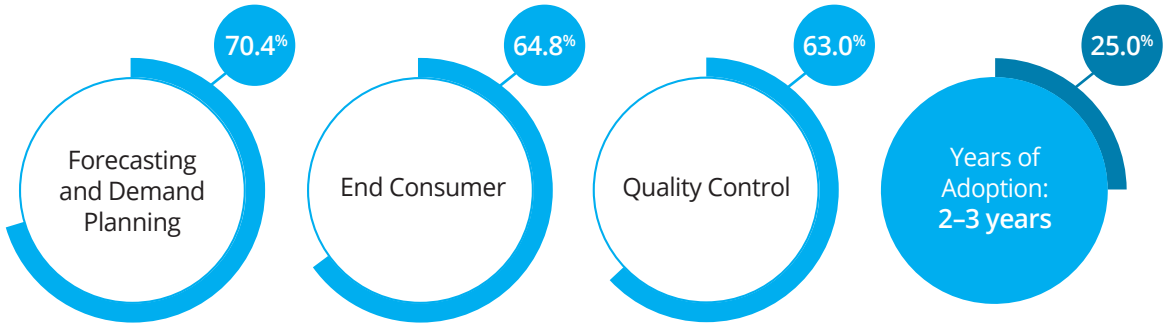
Machine learning is an essential branch of Artificial Intelligence, adopted by many top-ranked companies around the world. Machine learning focuses on developing programs that can learn when exposed to new data.

A machine-learning algorithm learns by self-optimising its parameters to achieve least error outputs to observed training data. This can involve a variety of techniques from linear regression to neural networks.

## *Fun Fact*

Language translation is critical to Facebook's user content. It works with more than 45 languages as the source or target language, and supports more than 2000 translation directions, e.g. English-to-Spanish or Arabic-to-English. The algorithm uses data to serve 4.5 billion translated post impressions every day, lowering language barriers for 600 million people who see these translated posts in their news feed every day.

## *Current Practice: Machine Learning*

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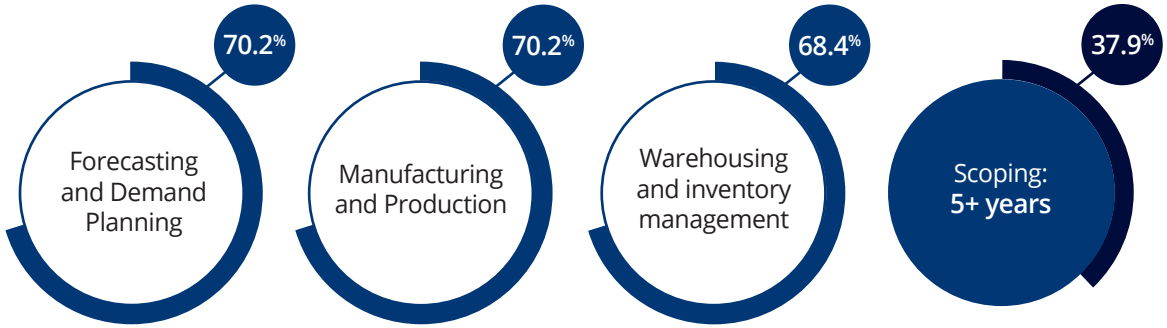


## *In focus: Virtual Reality*

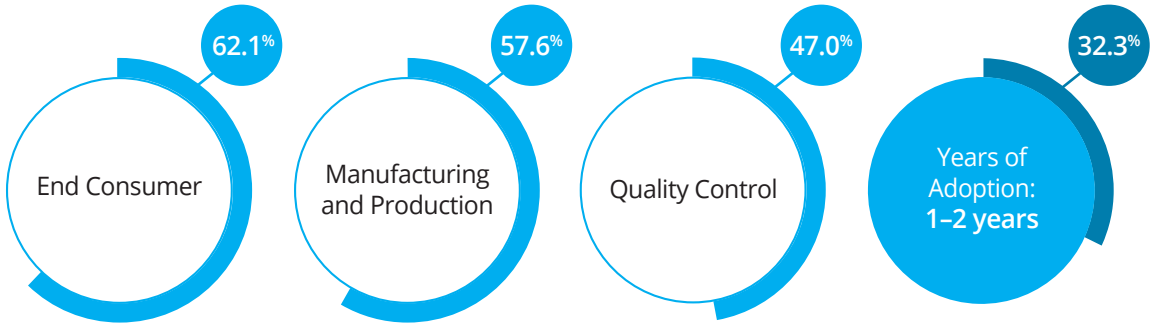
Virtual Reality (VR) involves computer-generated simulations of three-dimensional spaces, within a defined and contained space, that viewers can interact with in realistic ways.

VR is intended to be an immersive experience and requires users to wear a headset, but can include a variety of other associated equipment to further immerse the user in the virtual environment. VR experiences are already being used to take the product to the user, providing a more interactive marketing experience for retailers.

## *Fun Fact*

NASA uses virtual reality to connect engineers with devices they send into space. Using Oculus and motion-sensing equipment from the Microsoft Xbox gaming console, NASA engineers are developing ways to control a robotic arm with gestures made by an operator back on Earth.

## *Current Practice: Virtual Reality*

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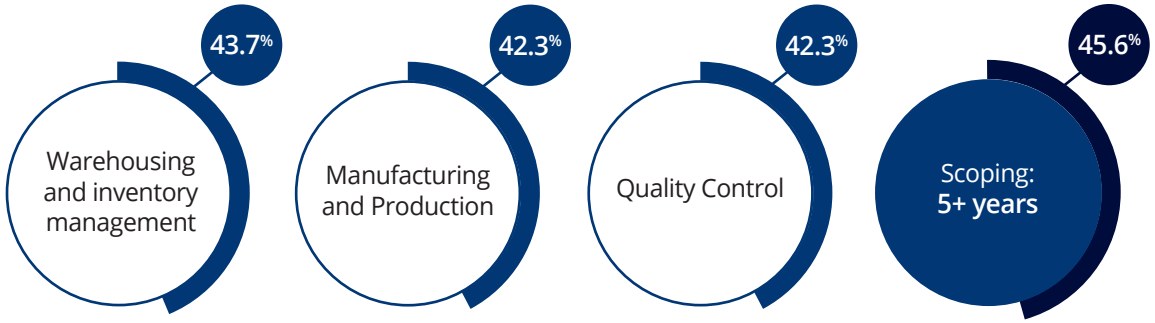
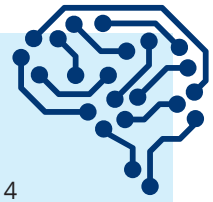


## *In focus: Artificial Intelligence (AI)*

Artificial intelligence are algorithms capable of performing tasks that traditionally require human intelligence, such as controlling and monitoring warehouses, food supply chains and sustainability in supply chains. It can also revolve around price, sales and segmentation, and to a lesser extent on promotion, product and place.

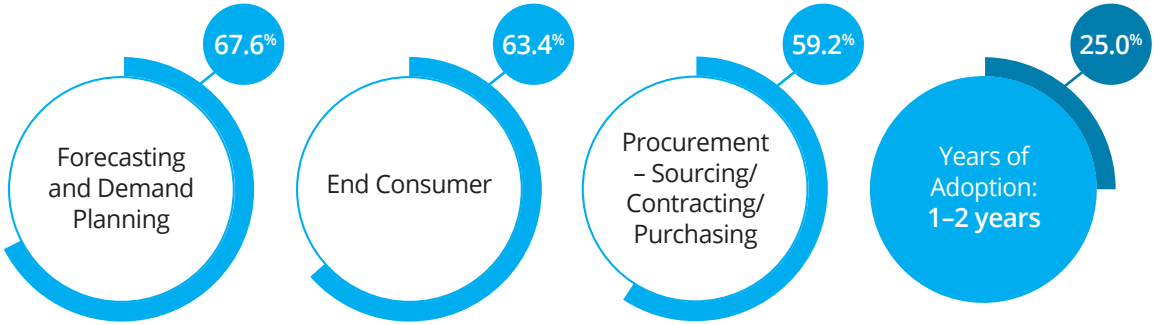
AI is an umbrella concept that is made up of numerous subfields. One such subfield is machine learning, which focuses developing programs that can learn when exposed to new data. Machine-learning algorithms learn by self-optimising its parameters to achieve least error outputs to observed training data.



### *Fun Fact*

In 2016, Google's "Alpha Go" AI beat the World's second best Go player Lee Chang-ho, 4 games to 1. Go is a seriously complex board game – with more move combinations than there are atoms in the universe. A year later, newer version "Alpha Go Zero" taught itself without any data from human games. From zero knowledge it defeated 18-time world champion Lee Sedol at "Alpha Go" 100 games to 0 after just three days of training!

## *Current Practice: Artificial Intelligence (AI)*

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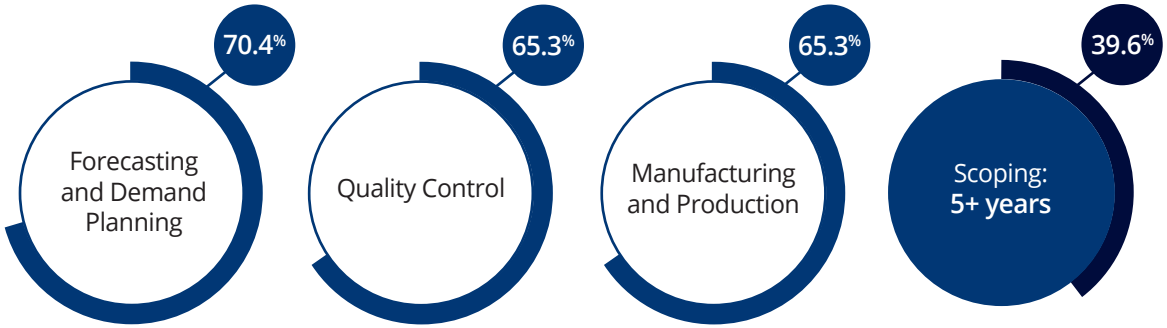


## *In focus: Manufacturing Executive Systems (MES)*

Manufacturing execution systems (MES) are used in manufacturing to track and document the transformation of raw materials to finished goods.

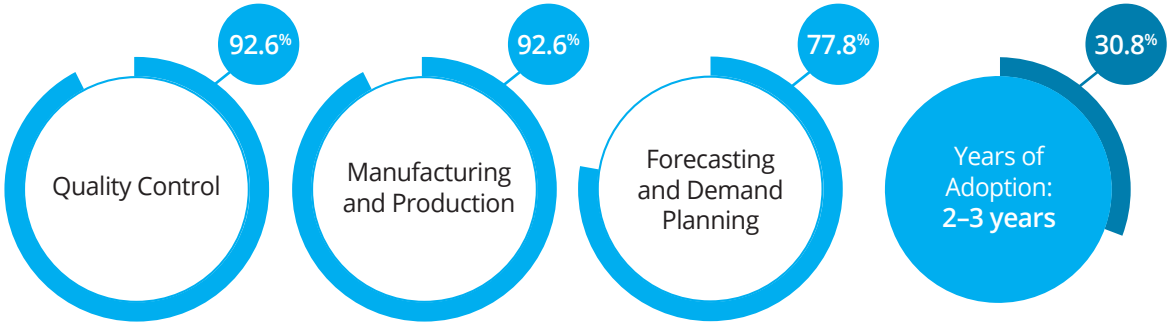
MES provides information to help decision makers understand how current conditions on the shop floor can be optimized to improve production output, enabling the control of multiple elements of the production process (eg. inputs, personnel, machines and support services).

MES can operate across multiple function areas – product life-cycle, resource scheduling, order execution and dispatch, production analysis and downtime management for overall equipment effectiveness (OEE), product quality, or materials track and trace.

### *Fun Fact*

Think of it as the missing link between ERP, the shop floor, and all the other software systems used to manage a manufacturing business. MES provides a higher level of production visibility and job tracking than ERP.

## *Current Practice: Manufacturing Executive Systems (MES)*

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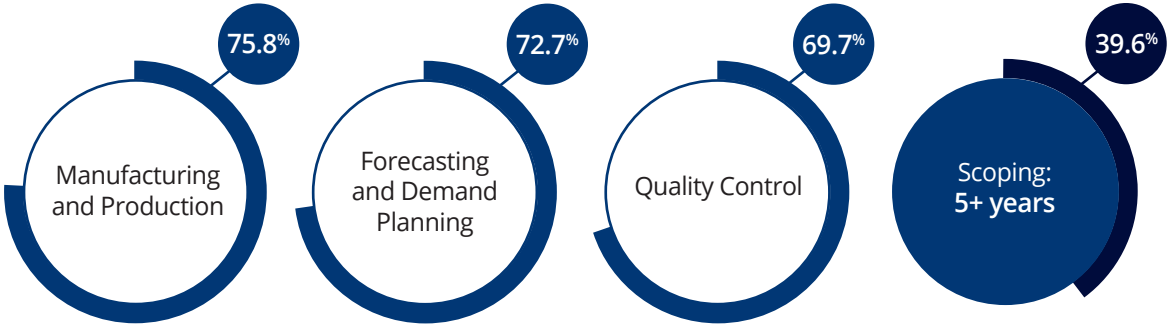
## *Future Proofing: Manufacturing Executive Systems (MES)*



## *In focus: Blockchain (BC)*

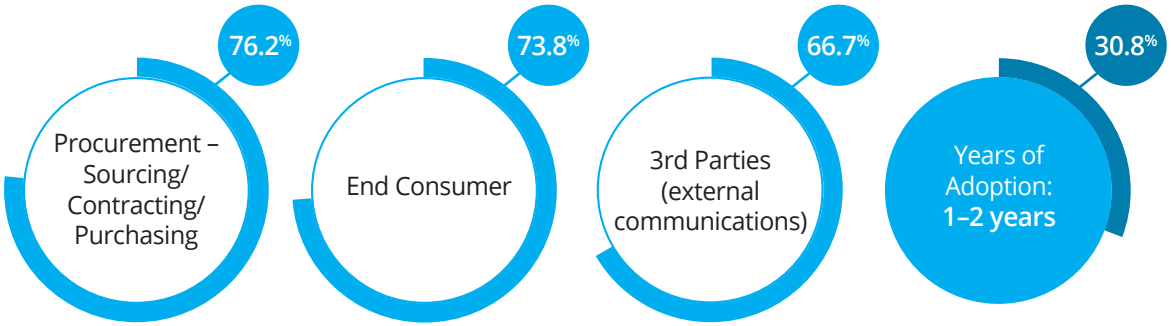
Blockchains are distributed electronic ledgers that use software to record and confirm transactions with speed and certainty. The ledger is backed up across multiple computer systems, which must agree to new transactions. This process allows for certainty and immutability in data, all with the latest set of cryptographic security.

Blockchain becomes exciting when taken beyond just a record of transactions, and overlaid with computer programs built into the 'blocks'. These 'Smart Contracts' allow for extremely efficient process automation, from processing payments, legal contracts and insurance claims, to certifying loans and company funding via Initial Coin Offerings (ICOs).

### *Fun Fact*

It is not just Bitcoin and cryptocurrencies. Real world functional applications exist and are rapidly growing in scope and feasibility. Companies using the technology today include Maersk to automate shipping admin processes, Chai Vault to tackle the counterfeit wine industry, Walmart to track meat produce from China to the US and BHP to tracking material samples across the supply chain.

## *Current Practice: Blockchain (BC)*

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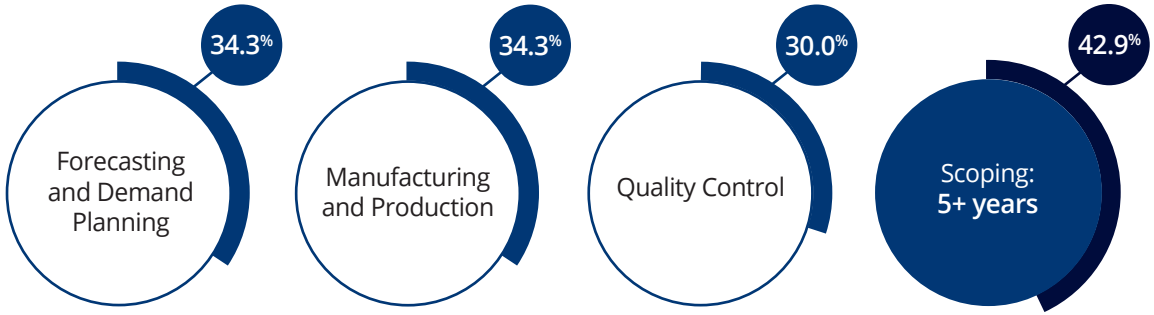
## *Future Proofing: Blockchain (BC)*

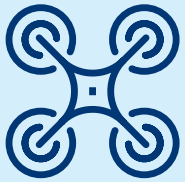


## *In focus: Drones*

Drones – which can operate autonomously, via a predefined flight plan or be controlled remotely – are unmanned air or water-based devices and vehicles.

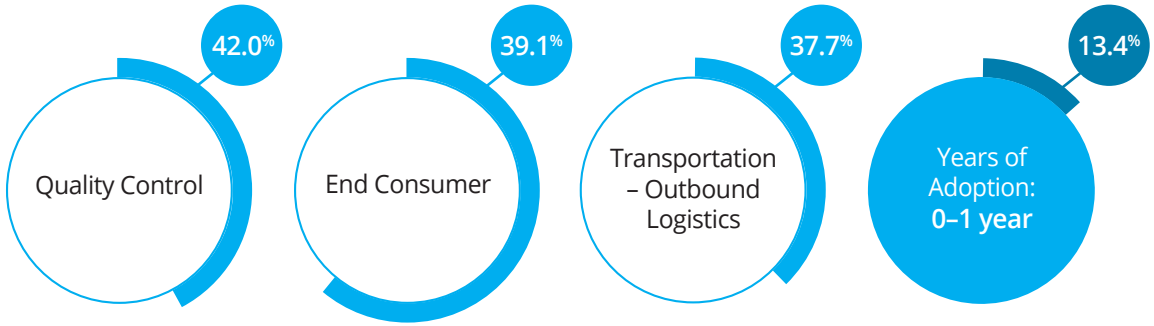
In supply chain and logistics, drones are being trialled to bridge the 'last-mile' in delivering products to a customer's doorstep, backyard or balcony. They are also currently used to monitor agricultural crops and count warehouse stock.

## *Fun Fact*



In December 2016, Amazon CEO Jeff Bezos confirmed that the company had completed its first fully autonomous drone delivery. It happened in the UK, where a customer named Richard ordered an Amazon Fire Stick and a bag of popcorn, and had the goods delivered to his doorstep, in the Cambridgeshire countryside, just 13 minutes after submitting the order.

## *Current Practice: Drones*

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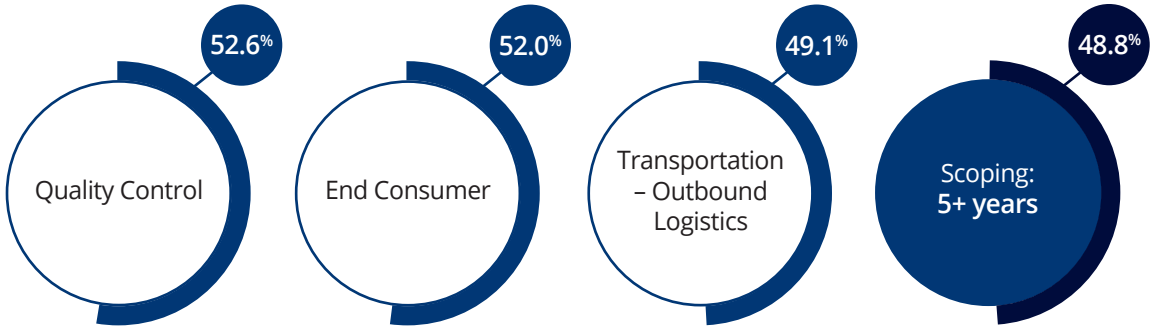
## *Future Proofing: Drones*



## *In focus: Robots*

Robots can be defined as electro-mechanical machines or virtual agents that automate, augment or assist human activities, autonomously or according to a set of instructions.

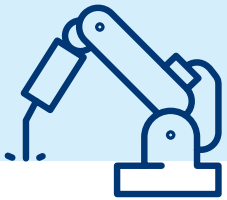
Robots – including Autonomous Guided Vehicles (AGVs) – can significantly reduce reliance on intensive and repetitive labour, which leads to safer workplaces, increased throughput, and reduced expenses.

Thanks to these benefits, and the lowered costs of implementation, more manufacturing, warehousing, distribution and storage companies are turning to automation technologies to innovate their organisations.

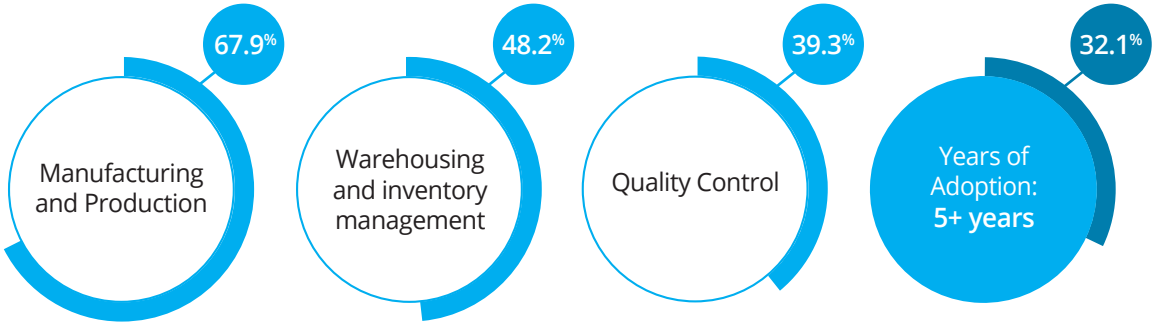
### *Fun Fact*

Amazon's revolutionary Kiva Robots boast autonomous routing algorithms that allow quicker picking processes in their DCs. Since acquiring Kiva Systems in 2012, Amazon have installed over 30,000 Kiva Robots.

Kiva Robots are a form of AGV capable of picking up entire shelves. They take the shelves to packing stations where humans simply select the item required at arm's reach, the robot then takes the shelf back to its original position without any human command or interaction.



## *Current Practice: Robots*

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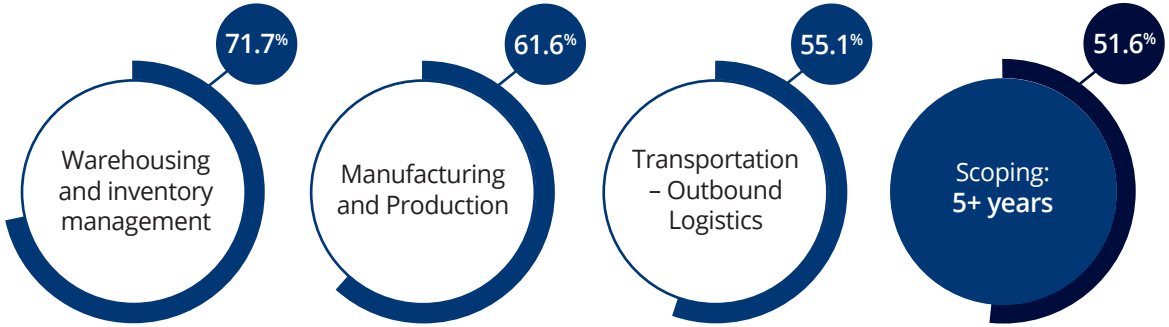
## *Future Proofing: Robots*



## *In focus: Collaborative Robots*

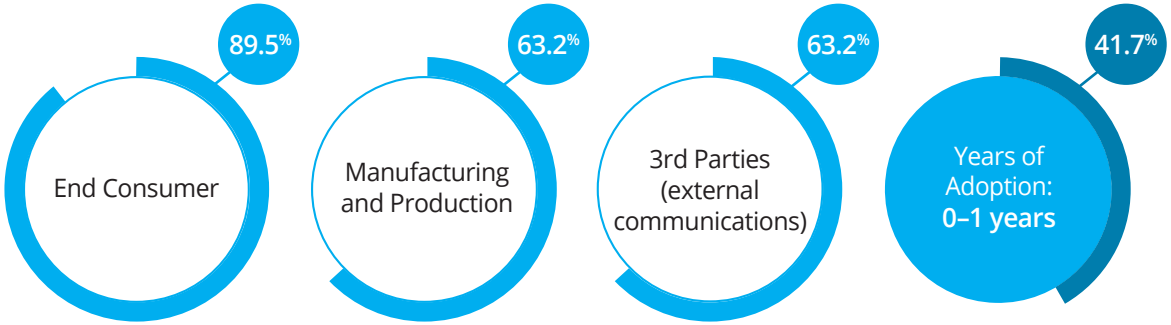
Cobots, or collaborative robots, are robots intended for direct human-robot interaction within a shared space, or where humans and robots are in close proximity. By working side by side with humans, cobots can take on the more-strenuous, mundane and repetitive processes, freeing the human operator to do other value-adding tasks.

Collaborative robots currently represent only about 5% of global industrial robot sales, but they are becoming more widely available. Until now, automotive companies have led the charge. But the ability of cobots to create a more productive work environment means it won't be long until forward-thinking companies in other industries get on board.

### *Fun Fact*

The collaborative-robots market is predicted to reach US$3.3 billion by 2022. Ford Motor Company is currently trialling cobots in its Cologne assembly plant in Germany to help workers fit shock absorbers to the company's Fiesta model.

## *Current Practice: Collaborative Robots*

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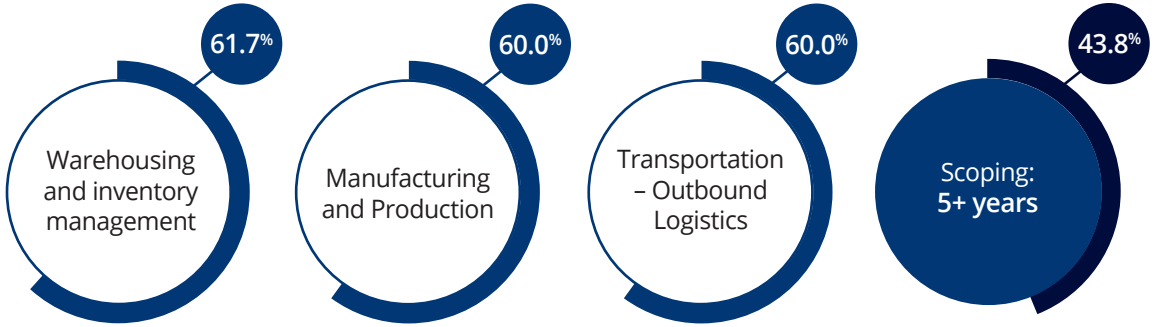


## *In focus: Augmented Reality (AR)*

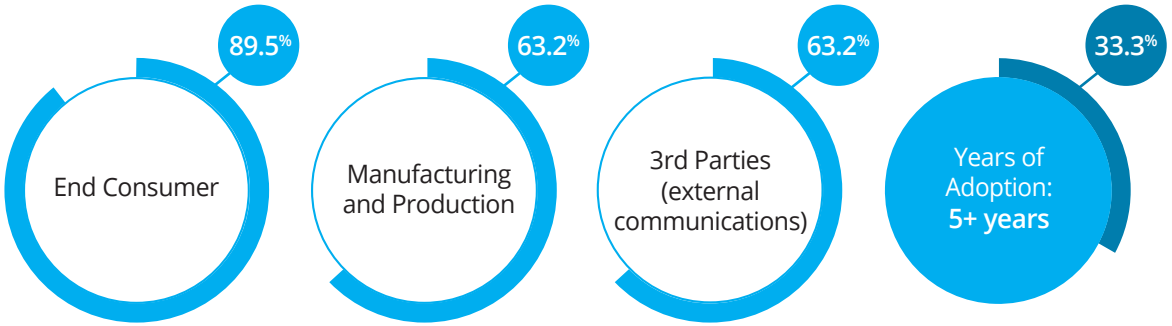
Augmented reality is the overlaying of digital information (such as videos, graphics and images) onto the real world. Unlike VR which creates a whole other world, AR adds sounds, videos and graphics – both 2D and 3D – to create an enhanced sensory experience.

While still in early stages of development, AR could be used to resolve supply chain challenges, make warehousing operations more efficient, and enable machine maintenance training or learning to operate in hazardous environments far safer.

### *Fun Fact*

AR has really been around for some time. An American computer scientist at Harvard University, Mr. Ivan Sutherland, created the first head-mounted display system back in 1968.

## *Current Practice: Augmented Reality (AR)*

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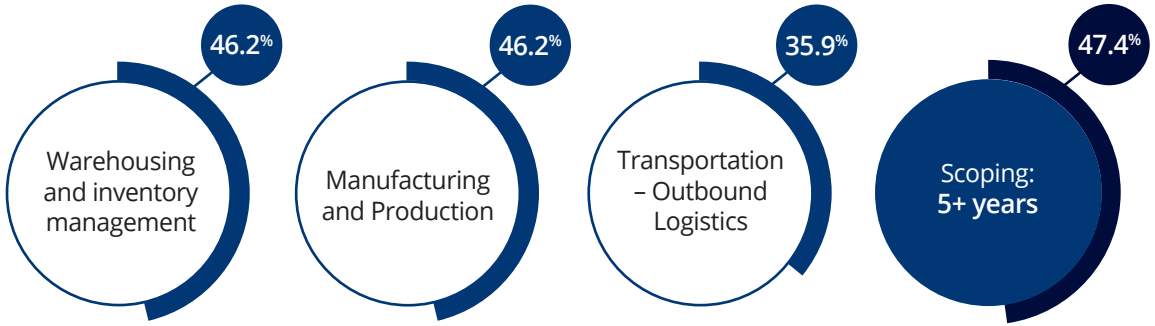


## *In focus: Autonomous Vehicles (AV)*

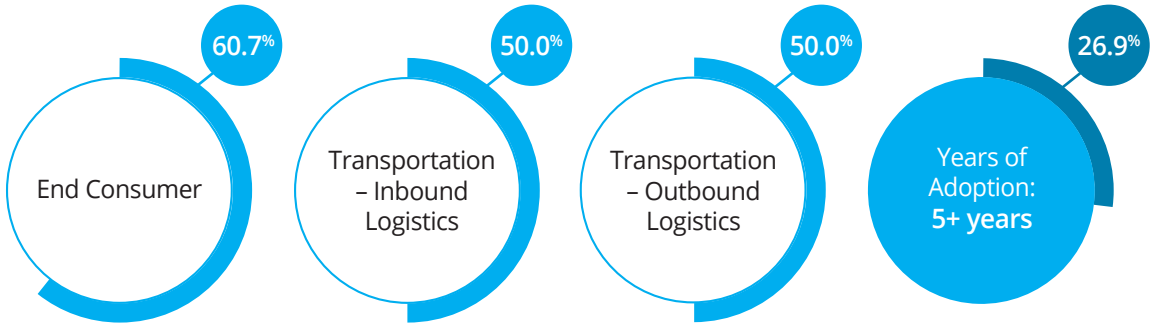
As we know, supply chain and distribution are facing significant disruption. They are expected to have a significant impact in the logistics industry over the next 5-10 years, from reducing trucking freight costs and improving customer service offerings, with the ability to transport 24 hours a day.

The AV sector (along with many of the other technology streams) crosses over into robotics technology (for example, warehousing AGVs), and we expect the borders separating these technologies to blur further in the future, as many of the streams cross pollinate.

## *Fun Fact*

Autonomous trucks have been operating on Australian mines for over nine years. Currently, the Australian government is supporting the rollout of autonomous vehicles onto public roads. Australian Transport Ministers and the NTC are busily working on having an end-to-end regulatory system in place to support a safe, commercial deployment.

## *Current Practice: Autonomous Vehicles (AV)*

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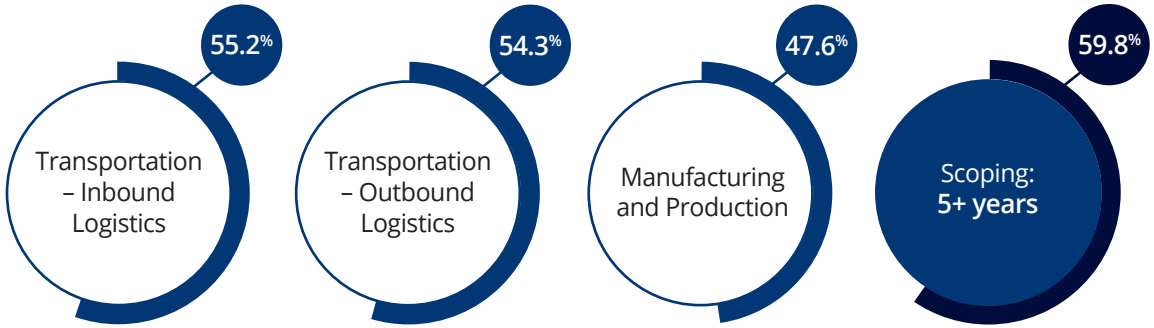


## *To recap…*

Autonomous vehicles (AV) are unmanned ground vehicles As we know, supply chain and distribution are facing significant disruption, with advances in technology increasing both operational efficiencies and customer demands and expectations.

We ran this initiative to shine a light on the technological insights in your sector, the future, and the possible way forward, focusing on:

- Which technologies will truly change the industry landscape?
- Which technologies are just 'hype' vs those really making a difference?
- Which areas should you be focusing your efforts to remain competitive?
- What are the projected timelines proposed to technology on-boarding?

So, what have we learned?

## *What we know – the state of now*

Industry 4.0 technologies are without question changing the landscape of supply chains and logistics. Where introduced, they have increased production efficiencies – and show the potential to influence social and sustainable developments.

As always, we need to better understand and evaluate the scope and value of adopting specific technologies, to make sure they offer significant contribution and efficiencies to working practices.

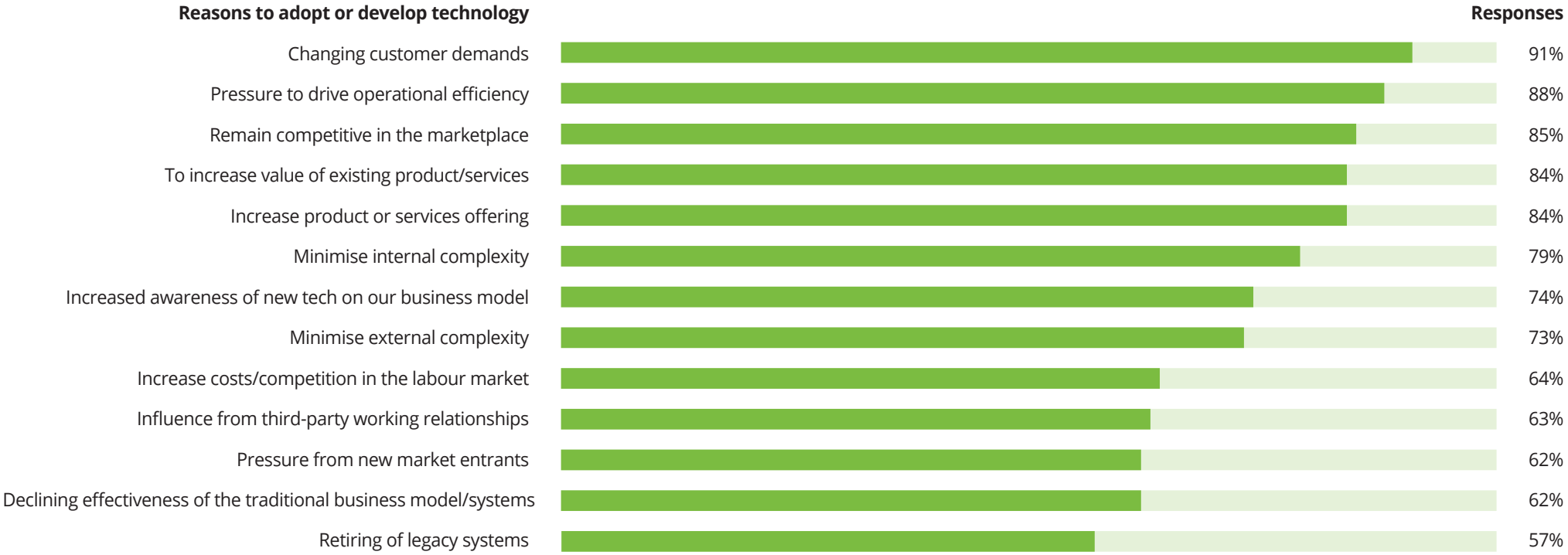
Our analysis enables us to reflect on the scope and scalability of these technologies in light of previous Industry 4.0 research – and draw conclusions on the contribution, limitation and direction of existing practices.

# *Looking back – 2019*

In our 2019 Future technologies survey, we measured the awareness of the 16 technologies among supply chain and logistic professionals:

## *Looking back – 2019*

We then looked at the different business needs or wider industry pressures that would lead an organisation to introduce or develop these technologies. The responses proved interesting:



# *Evolving out of crisis*

The emergence of COVID-19 in 2020 has majorly impacted global supply chains, restricting the movement of goods and forcing many staff to work from home in an attempt to slow the spread of the virus. As a reaction to this, supply chain firms have had to adapt and find alternative ways of operating, including digitalising existing processes.

As supply chains recover from the impact of COVID-19, we expect to see a sudden acceleration of interest in digitalisation and automating tasks and processes traditionally conducted by humans. Firms will increasingly look to Industry 4.0 technologies as sources of innovation to increase their resilience in the wake of an extreme disruption.

Leveraging Industry 4.0 across key functions of the supply chain will enable organisations to gain a competitive advantage. Those who are 'digitally ready' to design, control and communicate with these emerging digital technologies will set the pace for uptake – leading to significant implications for future investment, consumption, growth, employment, and trade.

**Areas of the organisation leveraging Industry 4.0 Technologies**

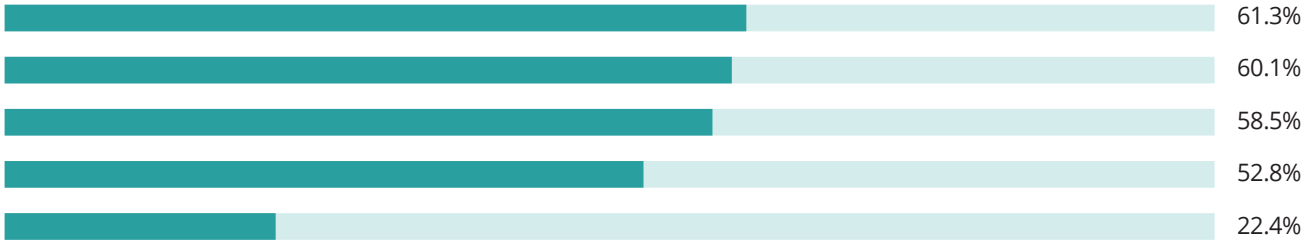
## *What will influence adoption of technology in the future?*

Traditionally, investments in new technology are driven by strategic key performance indicators, to increase service quality, customer satisfaction, delivery performance, supply chain transparency and ultimately greater market share.

We can see that organisations are increasingly looking to their supply networks for innovative new ways to achieve process improvement, increase performance, and innovate their business models. Hence the growing interest in Industry 4.0 technologies as a way to increase flexibility, optimise decision making, raise quality standards and improve efficiency and productivity – to increase the overall value proposition to better meet customers' demands.

"Those operating in supply chains are in a good position to reap the benefits of these new technologies, with 66% already focusing on service delivery models."

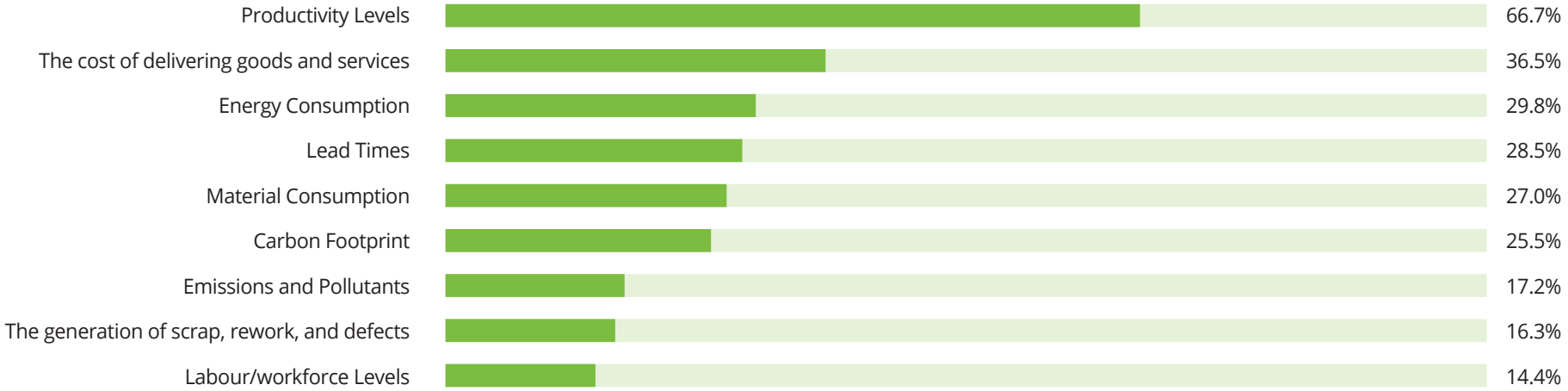
**Improvements in organisational performance as a result of as a result of future technology adoption**




***Total Responses 504***

## *What will influence adoption of technology in the future?*

**Operational performance as a result of future technology adoption**




***Total Responses 466***

While the co-ordination and consolidation of the Industry 4.0 ecosystem is a major challenge, the gap in expected impact-to investment suggests there are opportunities for businesses to get ahead of the curve to leverage these technologies.

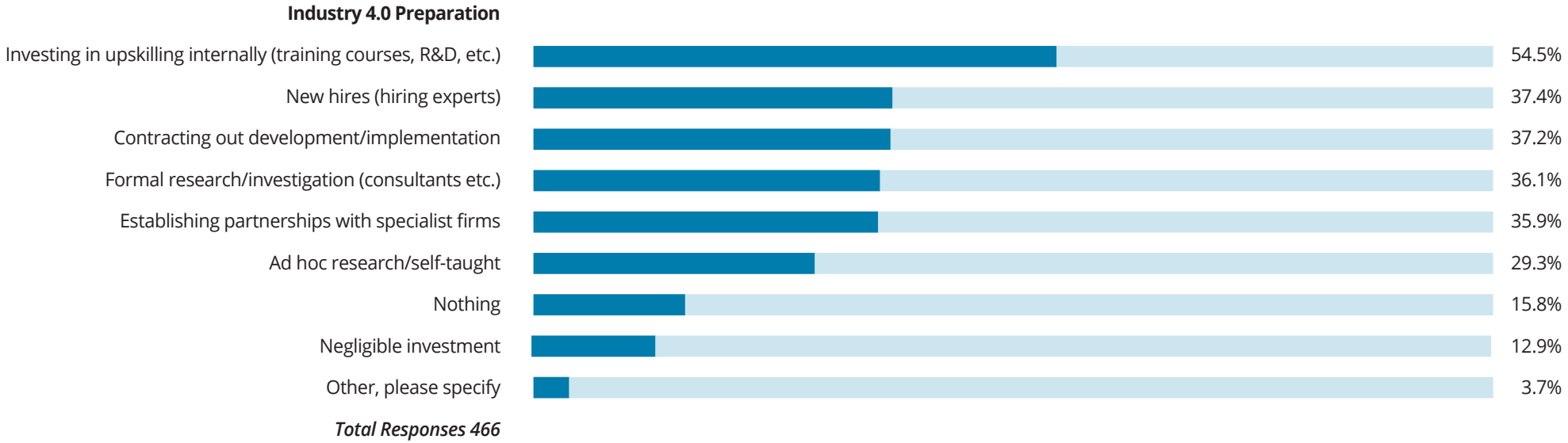
# *Preparing for Industry 4.0*

Industry 4.0 technologies will play a valuable role in the creation of smarter, better-connected supply chain networks, offering greater supply chain transparency, real-time tracking, better forecasting, critical thinking improved judgement, a reduction of inefficiencies, and an increased automation of repetitive tasks.

However, one of the big barriers to progress is the lack of appropriate skills to conceptualise, design and support the deep interdependencies of Industry 4.0 technologies across complex supply chains.

Yet, as one of the fastest growing employment segments, technology is driving the highest demand for new talent – and the supply chain and logistics sector is no exception, as it looks to fill resource and capability gaps. This presents clear opportunities for universities, students and graduates, and other training providers.

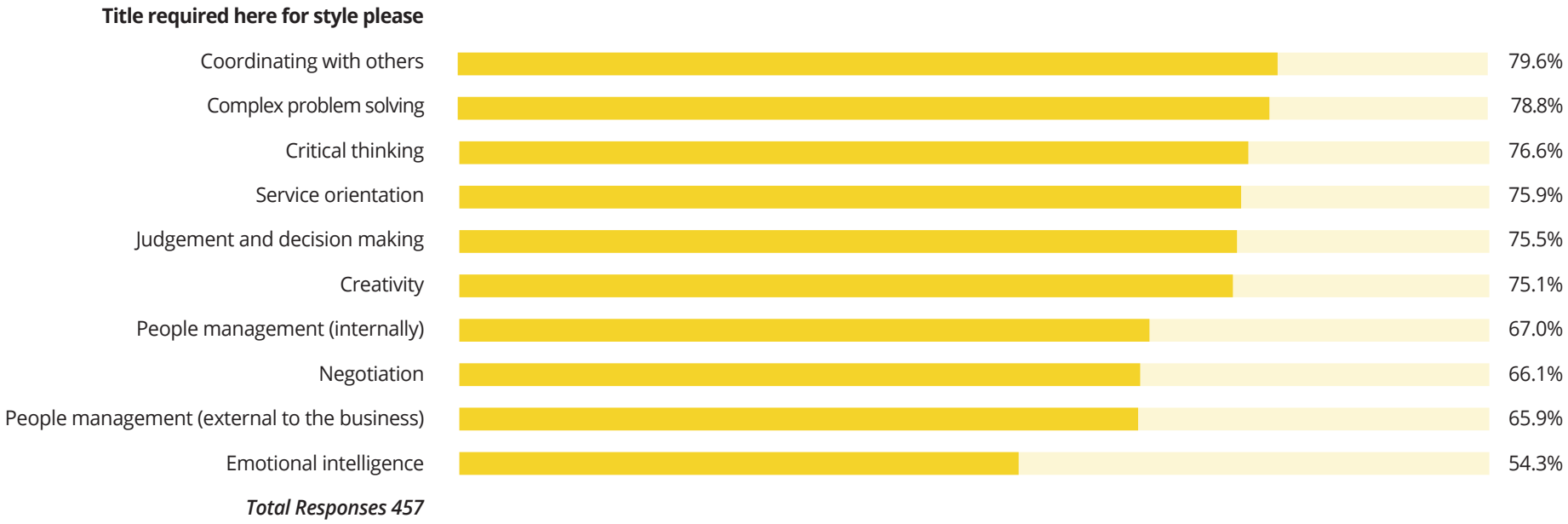
The following survey results highlight the steps organisations are taking in order to prepare for industry 4.0



## *Preparing for Industry 4.0*

To conclude, it's clearly vital that organisations need to provide adequate training and hire appropriately-skilled staff who can leverage the full potential of these technologies.

The following survey results highlight the skill sets that organisations require in order to support industry 4.0 activities



# Conclusions

## 90% of respondents have one or more concerns with emerging technologies.

A key contribution of this research is the identification of significant gaps between the expected impact of Industry 4.0 technologies and investment forecasts in those areas. In a number of cases, while certain technologies were expected to impact particular organisations and sectors, the investment predications for those technologies were surprisingly low by comparison. Similarly, we found the extent of current preparatory measures to be low, despite significant predicted digital disruption. These observations have practical implications for supply chain managers, could influence investment planning and recruitment strategies, and may provide potential sources of future competitive advantage.

We have identified potential sources of innovation throughout the supply chain, sectors where particular technologies are predicted to have the greatest impact, and the nature of improvements those technologies are anticipated to generate. We expect to see a reduced demand for human labour in some areas, along with the requirement for new skills in others, which can help inform future education and training needs.

We have a clearer overview of current adoption rates, preparatory measures and impact predications across the suite of Industry 4.0 technologies across various organisations and sectors. The scope of Industry 4.0 adoption through the eyes of supply chains practitioners encourages further debate and investigations into this fascinating topic, which now takes centre stage since the Covid-19 pandemic.

The top cause for concern across respondents was security and hacking. This is not surprising given the volume of reported cases of cybercrime and personal data leaks.

Following security and hacking, the next top two areas of concern centred on loss of jobs and the associated societal change issues at risk from technological automation and Artificial Intelligence.

There are undoubtedly areas governments and organisations will need to actively tackle to manage the great technology-driven economic shift we are now experiencing. Given the expected impacts of these technologies, it may be appropriate for governments to undertake similar investments to firms to ensure as smooth a societal transition as possible.

We hope this report's timely findings can inform both government policy makers and industry practitioners, as they prepare their new digital roadmaps for the challenging years ahead.

# *In sum*

## *What will each sector expect to invest most in over the next 5 years?*

### *Big Data Analytics*

- EDUCATION & TRAINING
- CONTRACT MANAGEMENT
- TRANSPORT
- CONSULTING

### *Blockchain*

- CONTRACT MANAGEMENT

### *IoT*

- IMPORT/EXPORT
- WHOLESALER
- RETAIL
- GOVERNMENT

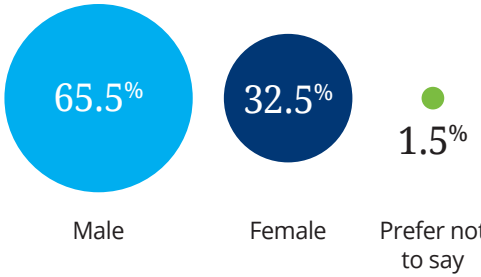
### *Robotics*

- MANUFACTURING

# *Our respondents – an overview*

The participants surveyed were an array of supply chain and logistics professionals, spanning 17 different sectors, representing all workforce age brackets and supply chain sectors.

- Procurement – Sourcing/Contracting/Purchasing
- Forecasting and Demand Planning
- Quality Control
- Manufacturing and Production
- Transportation – Inbound Logistics
- Warehousing and inventory management
- Transportation – Outbound Logistics
- End Consumer
- 3rd Parties (external communications)




***Total 458 Responses***

| Operations | % |
|---|---|
| Local | 12.7 |
| Regional | 8.7 |
| National | 27.5 |
| International | 51.1 |

***Total 458 Respondents***

| Turnover | % |
|---|---|
| Up to 5 Million USD | 26.8 |
| 5–10 Million USD | 13.6 |
| 11–20 Million USD | 7.5 |
| 21–50 Million USD | 11.9 |
| 51–100 Million USD | 10.8 |
| 101–250 Million USD | 4.6 |
| Over 250 Million USD | 24.8 |

***Total 455 Responses***

| Time working in a supply chain/procurement role? | % |
|---|---|
| 1–7 years | 36.50% |
| 8–14 years | 28.00% |
| 15–21 years | 16.60% |
| 22–18 years | 9.40% |
| >29 years | 9.40% |

***Total 458 Responses***

## *About the collaborators*

Manchester Metropolitan University and Swinburne University are world-class institutions, committed to creating social and economic impact through science, technology and innovation, where a desire to innovate and bring about positive change is the key motivator for students and staff.

Manchester Metropolitan University's new Master of Operations and Supply Chain Management, and Swinburne's new Master of Supply Chain Innovation course (the first of its kind in the world), both challenge students to think more innovatively about today's supply chains.

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