

AI AND ROBOTICS AUTOMATION IN CONSUMER-DRIVEN SUPPLY CHAINS

A rapidly evolving source
of competitive advantage



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EXECUTIVE SUMMARY

The linear models of many consumer goods supply chains have remained largely unchanged for decades – they rely on bulk materials and produce standardised products in large centralised factories to maximise economies of scale.

Now, however, this traditional model is fundamentally changing. We're shifting towards consumer-led, data-driven, highly complex supply networks. These are operated by a more age-diverse workforce where employees move from company to company every three to five years. The consumer increasingly drives innovation from the heart of the supply network, rather than being on the receiving end of a supply chain.

These shifts demand mass product customisation, more accurate supply chain planning and synchronisation, and faster multichannel retail responsiveness that go far beyond the abilities of the typical workforce and infrastructure. They require instant visibility, quick decision-making and increased flexibility across the whole network. This will enable innovation, ensure optimum service levels and deliver growth at low cost.

Recent advances in Artificial Intelligence (AI) and Robotics automation have the potential to overcome these challenges and revolutionise supply chains.

PA Consulting Group and The Consumer Goods Forum, through this End-to-End Value Chain Learning Series paper, show that behind the hype, the adoption of AI and Robotics automation is an inevitable evolution you can't ignore. It will become a major source of competitive advantage.

Change will happen, but not overnight. The only way to learn how AI and Robotics automation best fits your culture and your strategy is to experiment. In order to capitalise on the opportunities, you should:

- **tailor and constantly evolve your strategy**
- **align your strategy to the business ecosystem**
- **adapt your workforce to collaborate with, not compete against, machines**
- **implement changes in an agile way**
- **protect your organisation against the risk of cyber attacks.**

To put these opportunities in context, we explain the disruptive consumer trends driving AI and Robotics automation. We emphasise how this requires supply chains to evolve into truly consumer-driven networks. We also define the core cyber and physical aspects of the technology and give examples of relevant applications in supply chains. And we explore the potential impact on the workforce and offer suggestions on how organisations can prepare themselves.

AI and Robotics automation in supply chains offers great potential for organisations that are willing and able to embrace it. This paper will help you find out how to make it work for your organisation.

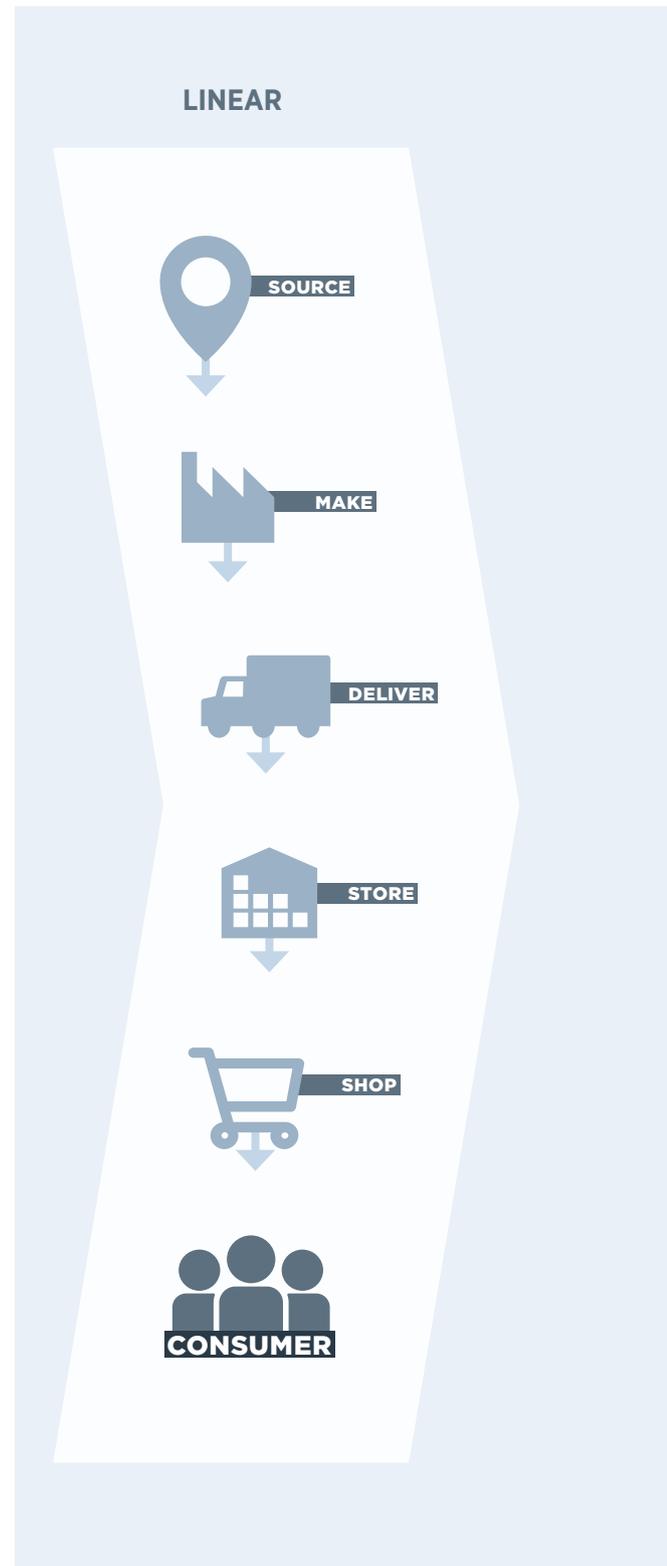
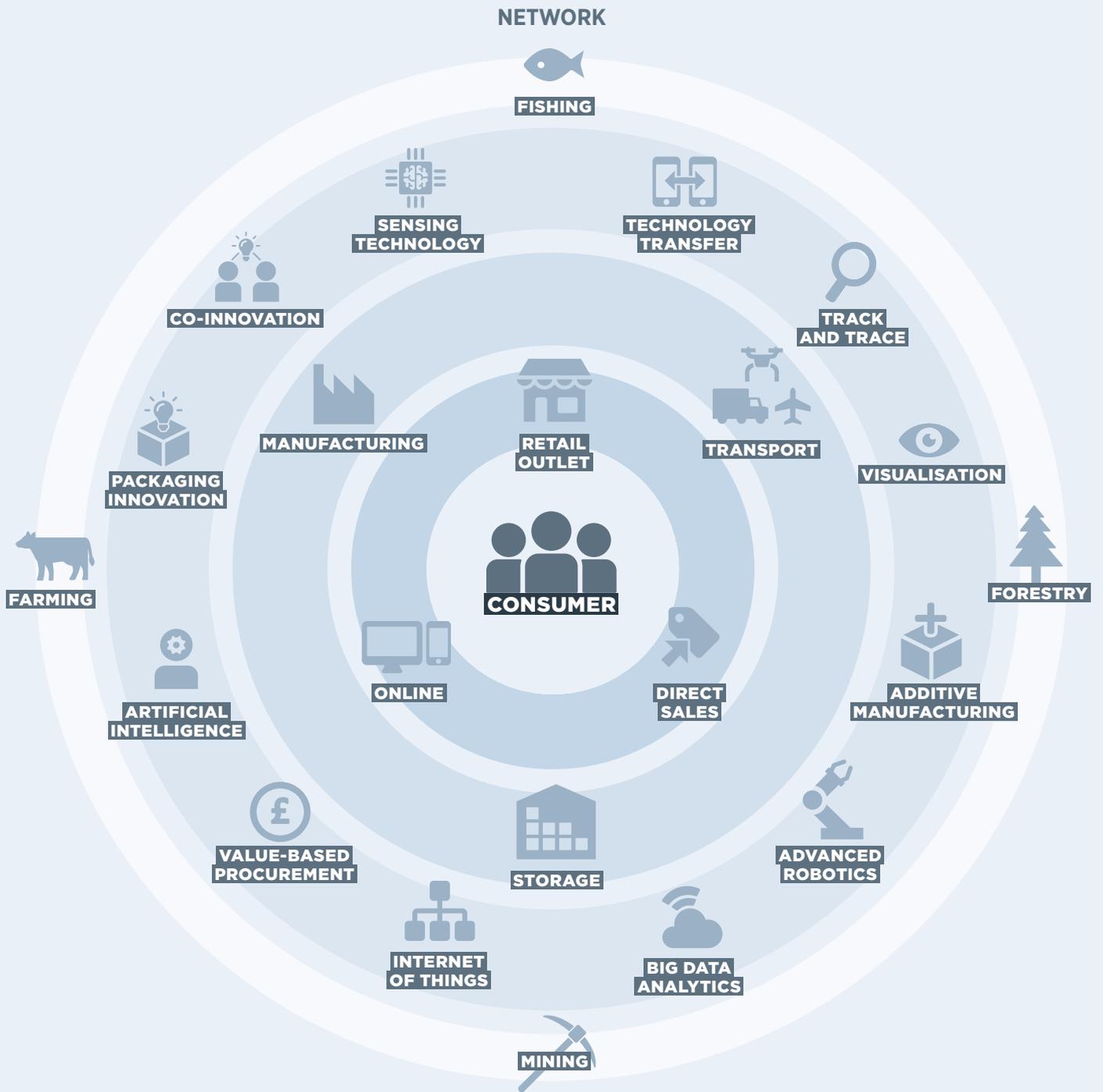


Figure 1: The transformation from linear supply chain to consumer-driven supply network

Source: PA Consulting Group



1 THE WORLD IS RESHAPING

Section highlights:

- Socioeconomic trends and rapidly developing technologies are driving overwhelming changes in consumer and retail needs.
- Consumer goods supply chains are expected to reduce costs and become more flexible.
- Managing this increasing complexity is beyond the current abilities of workforce and infrastructure, making automation through AI and Robotics an urgent need.
- The fourth industrial revolution is making AI and Robotics automation technology more affordable, practical and useful.
- The ability to leverage AI and Robotics automation in supply chains will become a major source of competitive advantage.

Socioeconomic megatrends are revolutionising society

Changes to the way people interact, work and behave are challenging organisations to rethink their strategy to remain competitive. From connected homes to smart retail, every aspect of people's lives will be affected by the increasing ability of consumers, businesses and governments to connect to, and control, everything around them.¹

A modern workforce, more stringent pollution regulations, health-conscious consumers, intensified competition, the rise of start-ups, rapid urbanisation and continuously evolving technology are driving fundamental changes. We've segmented these megatrends into four groups below:



1. Changing demographics

The number of older workers is set to increase in line with rising life expectancy. The result will be a more costly, age-diverse workforce. By 2025, millennials could make up as much as 75 per cent of the workforce.² It's already common for employees to change jobs every three to five years, posing a significant risk to investment in training and development. In addition, Brexit and the reshoring trend in the United States could result in resource scarcity.



3. Sustainability and new consumer desires

Rising energy costs and climate change drive a need to improve sustainability by lowering CO₂ emissions, improving energy efficiency and developing reusable or recyclable packaging. Informed consumers are demanding more quality and transparency from products, and some are prioritising ingredients over brands. Manufacturers are investing in circular economy business models to improve efficiency and exploit the growing consumer demand for sustainable products and services.



2. The rise of innovation and start-ups

Companies now routinely harvest information on customers, which offers new opportunities for start-ups. A recent Global Entrepreneurship Index report observed a 22 per cent increase in product innovation and an 11 per cent increase in start-up skills since 2016. This suggests the global population is becoming better educated and is able to identify more opportunities to create new products.³



4. The shift to a digital economy

Digital technology is revolutionising most, if not all, industries, business models, products, processes and organisations. Rapidly evolving technology and a borderless connected world are raising consumer awareness and expectations, which makes demand even more volatile and hard to respond to. This has presented an opportunity for AI-based automation to enter the workforce and enhance the consumer experience.

¹ New study reveals how a variety of companies can generate new revenue from asset tracking | BI Intelligence | May 2016

² The millennial generation shaking up the workplace rules | BBC | February 2016

³ Global Entrepreneurship Index report 2018 by the Global Entrepreneurship and Development Institute

Flexibility and responsiveness are critical to meet changing consumer demands



Figure 2: Increasingly novel and volatile consumer-driven challenges

Source: PA Consulting Group

AI and Robotics automation can offer solutions now

With limited use of data and concerns over cybersecurity, current supply chains are only partially automated. People must still perform a significant number of slow, manual tasks and the daily management of a complex network of interdependent activities. As a consequence, the efficiency of current supply chains is limited by the human component.

The next generation of productivity and flexibility improvement will be achieved through AI and Robotics

automation. By making supply chains smart, AI and Robotics automation will bring a step change to operations and management, and reduce much of the menial work of monotonous processing.

Organisations are starting to act. Leaders are adopting AI and Robotics to automate their processes, deliver high-quality products, increase manufacturing capabilities, provide better customer service and efficiently manage supply chain processes.

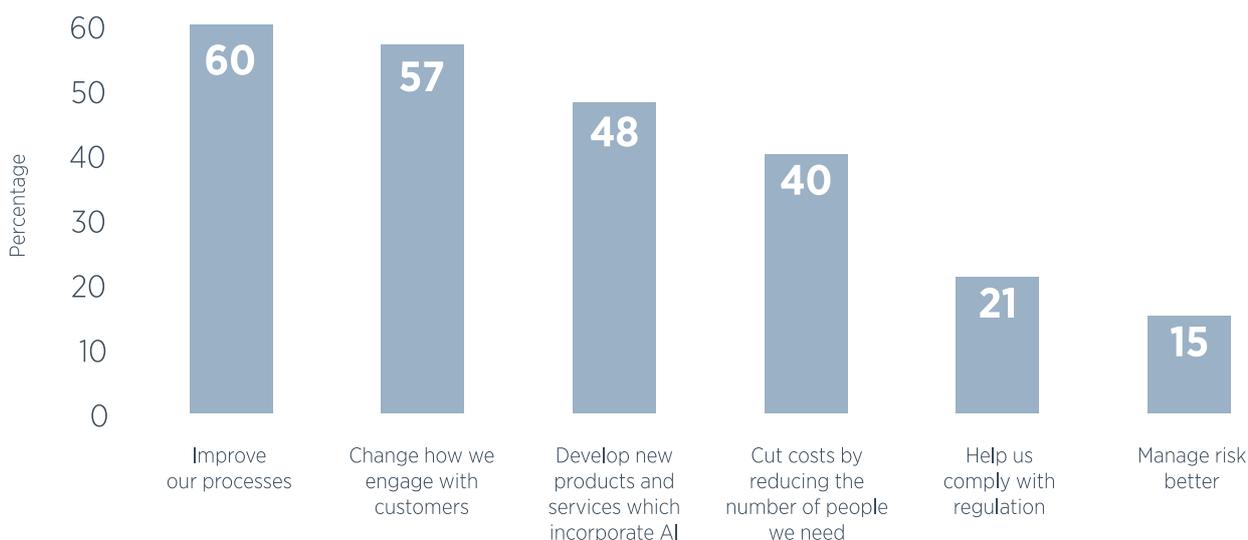


Figure 3: How organisational leaders plan to use AI

Source: Source Global Research

In a recent Source Global Research (SGR) report,⁴ business leaders said the top three areas where they want to leverage AI are efficiency (60 per cent), customer engagement (57 per cent) and developing new products (48 per cent) – all of which add up to improved growth. In PA's view, being seen by stakeholders as innovative is also an important motivator for investment in AI.

From the same survey, it's clear that cutting costs isn't the primary driver for most organisations that are considering AI. It's about improving the business and the way it interacts with customers.

Tech executives, such as CIOs, see AI primarily as a means of raising productivity, while their CXO colleagues look at the growth potential. PA believes AI and Robotics can address both, with automation tools cutting costs and cognitive tools enhancing the business.

Advances in machine-generated data and technology are making AI and Robotics automation more humanised

Modern computing has revolutionised our ability to process and analyse vast quantities of information. Up to now, this has largely been done through algorithms devised and programmed by humans. In the future, further advances in autonomous machine learning will supersede our abilities in this area.

Information storage has moved from human memory to the written word and, comparatively recently, into digital format. While 2002 was the first year global digital storage capacity exceeded analogue, by 2007 almost 94 per cent of information was encoded digitally,⁵ and the digital universe is doubling every two years.⁶ According to IDC, machine-generated data (as a percentage of the digital universe) will rise from 11 per cent in 2005 to 42 per cent in 2020.⁷

With the vast majority of information now stored, processed and increasingly generated by machines, AI and Robotics automation has the potential to free humans from laborious and time-intensive data processes.

This is further catalysed by the Internet of Things (IoT). Less expensive sensors, open source software, real-time and powerful cognitive computing power, and advanced

vision systems are making AI and Robotics automation more scalable, affordable and practical for working with humans.

This means AI and Robotics automation will become cheaper, deliver better quality and become more reliable than human labour where speed, repeatability, accuracy, safety and flexibility are critical. Intelligent systems are now able to make decisions without human intervention, learning from past experiences and identifying trends and opportunities where humans lack the relevant capacity to assimilate the data and make risk-based decisions.

Repetitive processes, such as transactional activities, planning, physical handling and performance monitoring can be automated so teams can focus on more valuable activities such as innovation, growth and unexpected exceptions.

In principle, AI and Robotics automation has the potential to increase the workforce performance, drive anticipation of future scenarios, increase speed to market and enhance supply chain flexibility to deal with uncertainties. Some examples of AI and Robotics automation's potential applications can be found on pages 30–31.

5 Global data storage calculated at 295 exabytes | BBC | February 2011

6 Extracting Value from Chaos | New IDC Digital Universe study, sponsored by EMC | 2014

7 Global data storage calculated at 295 exabytes | BBC | February 2011

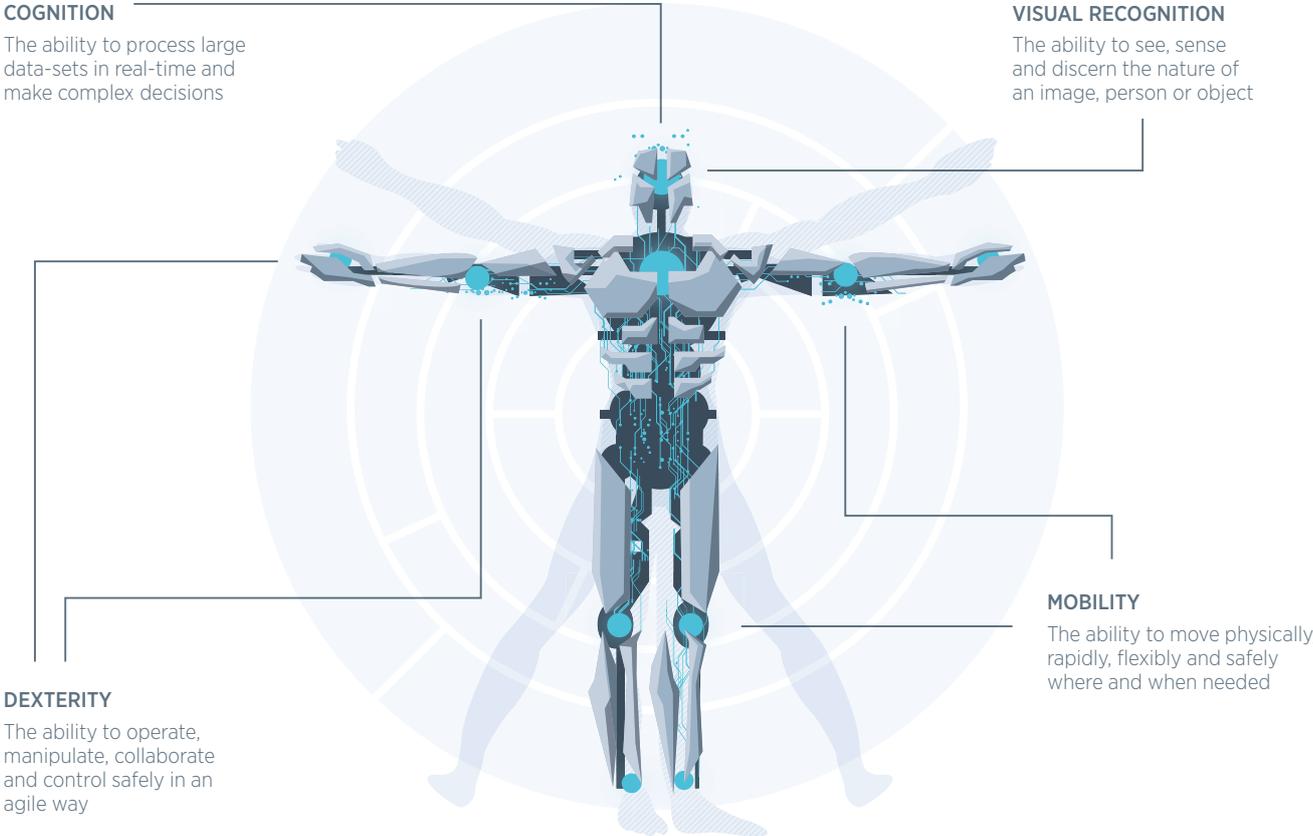


Figure 4: The humanisation of technology

Source: PA Consulting Group



AMAZON

Automated drone deliveries

The logistics industry is ripe for automation. If drones can deliver 8.5 per cent of parcels by 2025, they would cut CO₂ emissions by 15 million tonnes and prevent up to 4,000 road accident deaths.⁸

Amazon has tested its delivery drone⁹, which can carry a 2.3kg package at 50mph, in the UK. Eventually, it's hoped these drones will automatically locate the recipient using smartphone data, with an estimated 400 million deliveries a year.

In April 2016, Amazon was awarded a patent¹⁰ for an airborne fulfilment centre. This floating warehouse would stay at an altitude of around 45,000ft, dispatching a drone when an order is placed. This would use less power than if the drones had to take off and land.

8 Robotics and drones: automation on the rise | World Economic Forum

9 www.amazon.com/b?node=8037720011

10 www.cnn.com/2016/12/29/amazon-flying-warehouse-deploy-delivery-drones-patent.html

2 WHAT IS AI AND ROBOTICS AUTOMATION?

Section highlights:

- The ability of systems and machines to learn from seemingly structured and unstructured data, to take independent decisions and to perform actions automatically.
- The massively increased potential to automatically generate new insights from the vast amount of information generated, every day.
- AI and Robotics enable two types of automation:
 - Rules-based automation uses defined datasets to handle large, repetitive clerical tasks with predefined responses.
 - Intelligent automation can use cognitive learning, communication, motion and visual recognition to handle complex tasks by mimicking human decision-making.
- The automation market is growing rapidly with multiple competing vendors, making it important to consider carefully the capabilities and scalability of individual suppliers.

AI and Robotics

AI and Robotics automation has been developing for decades – think of Microsoft’s old paperclip assistant or robot arms on production lines.

Robots and process automation that use AI are capable of self-diagnostics, self-adjustment and independent decision-making.

Improvements to AI technology also mean robots could soon seek ways to improve their own efficiency, make recommendations on how to manage day-to-day operations and be useful in complex situations.

AI-based automation is versatile and has applications across the end-to-end value chain. New breakthroughs in AI technology can automate material development, forecasting, material flows, material handling, production, asset care, quality release, product launches and omnichannel experience. Expert data mining also offers predictive and prescriptive decision-making advice, training and assistance.

AI and Robotics automation continuum

The automation continuum ranges from simple rules-based tasks to intelligent systems, depending on the technologies used.

Rules-based automation draws results from structured data based on a predefined set of rules and responses. The scope of automation is therefore limited and there’s no genuine machine-learning intelligence.

Intelligent automation uses cognitive technologies to adapt and draw results from unstructured and semi-structured data from many sources. It can handle complex tasks by mimicking the human decision-making process and build new rules to adapt to different scenarios.

	RULES-BASED AUTOMATION	INTELLIGENT AUTOMATION
	“If X do Y”	“Build rules adaptable on the fly”
DRIVERS	<ul style="list-style-type: none"> • Immediate cost savings • Operational efficiency 	<ul style="list-style-type: none"> • Consumer value • Competitiveness • Compliance and risk management
EXAMPLES	<ul style="list-style-type: none"> • Simulation of a claims manager entering data from paper/image to a system, translating data between legacy systems that can't be integrated using codes 	<ul style="list-style-type: none"> • Detecting consumer’s voice, analysing historic patterns to trigger actions, estimating repair costs by analysing images and making operational decisions.
APPLICATIONS	<ul style="list-style-type: none"> • Robotic process automation (RPA) • Business process management systems* • Business rules management systems* 	<ul style="list-style-type: none"> • Chatbots • Cognitive agents • Physical (collaborative) robots

Figure 5: Types of AI and Robotics automation

Source: PA Consulting Group

* These topics aren’t covered by this paper as they are already well-established in the industry.

Understanding the key components and capabilities of AI technology

There are many different ways of describing and classifying AI technologies. Below are some of the more commonly referred to categories and capabilities:

INTELLIGENCE (Narrow) AI	LEARNING Machine and deep learning	COMMUNICATION Natural language processing	MOTION Robotics	RECOGNITION Computer vision
AI is an intelligent program that mimics the cognitive functions of a person. Narrow AI only focuses on achieving specific goals, such as supporting certain business decisions and processes using defined data sets.	Machine learning uses algorithms to 'learn from experience' and make decisions. Deep learning uses artificial neural networks that mimic the brain to create predictive models from huge amounts of data.	Natural language processing (NLP) is software that can derive meaning and sentiment from speech and text, and generate language-based responses.	Robotics technology gives AI a physical presence, spatial awareness and movement in the real world.	Often coupled with machine learning, computer vision can analyse images and videos to make an assessment of the situation.
eg cancer diagnosis from medical data	eg Google's AlphaGo program beating the world Go champion	eg virtual agents such as Amazon Alexa	eg factory machines, self-driving cars and drones	eg identifying objects from photos and facial recognition
RULES-BASED	INTELLIGENT			

Figure 6: Key components of AI technology

Source: PA Consulting Group

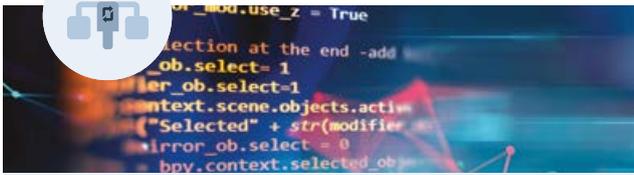
Core uses of AI and Robotics automation technology

Below and opposite are some of the ways AI and Robotics automation technology is applied today. But as technology advances, more tasks will be automated, more insights will be gained and more possibilities will open up.

RULES-BASED AUTOMATION	INTELLIGENT AUTOMATION		
RPA is a rules-based automation bot that relies on predefined instructions using narrow AI. It uses the same interfaces a human would to perform repetitive and data-driven clerical tasks with high speed and accuracy.	Chatbots and virtual assistants are quickly becoming common in customer-focused businesses. Using NLP and basic machine learning, they can interact with customers and solve their requests.	Cognitive agents combine technologies to address more complex challenges. They can think and reason, and use deep learning/ cognitive computing to prescribe future needs.	Physical robots have been around for decades, but can now work collaboratively with humans using machine learning, motion, recognition and NLP components of AI technology.
Robotic process automation (RPA)	Chatbots or virtual assistants	Cognitive agents	Physical (collaborative) robots
CYBER (SOFTWARE) ROBOTICS			PHYSICAL ROBOTICS

Figure 7: Core uses of AI and Robotics automation

Source: PA Consulting Group



Robotic process automation (RPA)

RPA is a rules-based automation software that enables transaction processing across multiple systems and applications without human interaction. In its simpler forms, it doesn't interfere with the IT infrastructure of the organisation, and hence doesn't need a large IT transformation project to implement. The software is able to mimic how a user would interact with an application.

RPA architecture includes a modelling capability to define the process executed by the software, and a controlling capability to provide version control and monitoring using narrow AI.

RPA is well suited to processes that are typically outsourced to business process outsourcing providers as they're repetitive and standardised with high transaction volume.



Chatbots and virtual assistants

Chatbots and virtual assistants use AI to converse with people through both speech and text. They let people ask questions and receive answers in natural language.

The ability to understand the intent of a question, and answer it in numerous ways, can help across business functions, processes and sectors – for example, in customer support and helpdesks.

Natural Language Processing (NLP) and Machine Learning can be used to create a chatbot. To do this, these technologies use a retrieval-based model (using a set of predefined responses based on customer inputs) and a generative model (machine translation technology) analysing customer inputs to generate suitable responses.



Cognitive agents

Cognitive agents use more sophisticated automation software. Conversations are bidirectional and don't rely on a predetermined script. They use NLP alongside machine and/or deep learning to respond to requests that involve thinking, learning and reasoning.

In an ideal automated system, cognitive agents act as the user interface. Machine learning helps the cognitive agent to analyse data to find patterns, draw conclusions, make predictions and prescribe actions to RPA software and chatbots. It's therefore very useful in planning and forecasting activities.

Organisations re-engineer and reiterate cognitive agents to suit their business processes. They're extensively used for data mining, analysis and research. Cognitive agents also assist financial advisors, contact centre agents, field engineers and clinical advisory staff.



Physical (collaborative) robots

Physical robots have been used for decades in the manufacturing industry. However, advances in AI have opened new possibilities in manufacturing and supply chain operations.

Robots with sensory and AI capabilities are better able to understand the physical environment by processing visual, auditory and proximity data. They're able to imitate human movements by observing them. This makes it possible for physical robots to work collaboratively with people.

Robots equipped with self-learning software can discover how to perform a task on their own, even finding new solutions to the problem. Through reinforcement learning, robots can improve their performance over time. That means people can train robots more quickly whenever a new task is in scope.

Rules-based and intelligent automation vendors

Organisations are under enormous pressure to digitise operations. Prevalent options include rules-based automation (eg RPA) and intelligent automation (eg cognitive agents).

RPA solutions are considered to be the most mature segment of the cyber robotics market. Most organisations take their first step towards automation with RPA, which works with their existing interfaces to automate routine business and supply chain processes.

They're marketed as easy to implement, with limited need for integration with the rest of the IT architecture. However, when trying to scale up, many organisations run into problems with deviations from standard procedures, increased governance needs and inflexible configurations.

Automating inefficient processes blindly would jeopardise transformation efforts. Organisations should optimise their business processes first so they can get the most from any RPA solution. Then obvious candidates for RPA, such as back-office and support processes, should be examined to achieve early business benefits.

Enterprise automation can't be achieved by buying off-the-shelf RPA software on its own. Typically, integrators have to work with hardware and software vendors to implement an RPA solution.

PA has assessed rules-based and intelligent automation technology vendors to give an idea of market leaders, strong performers, contenders and aspirants in this space (see Figure 8). The RPA market is consolidating with a handful of strong vendors, such as IBM, IPsoft, UiPath, Celaton, CognitiveScale, Automation Anywhere and Blue Prism.

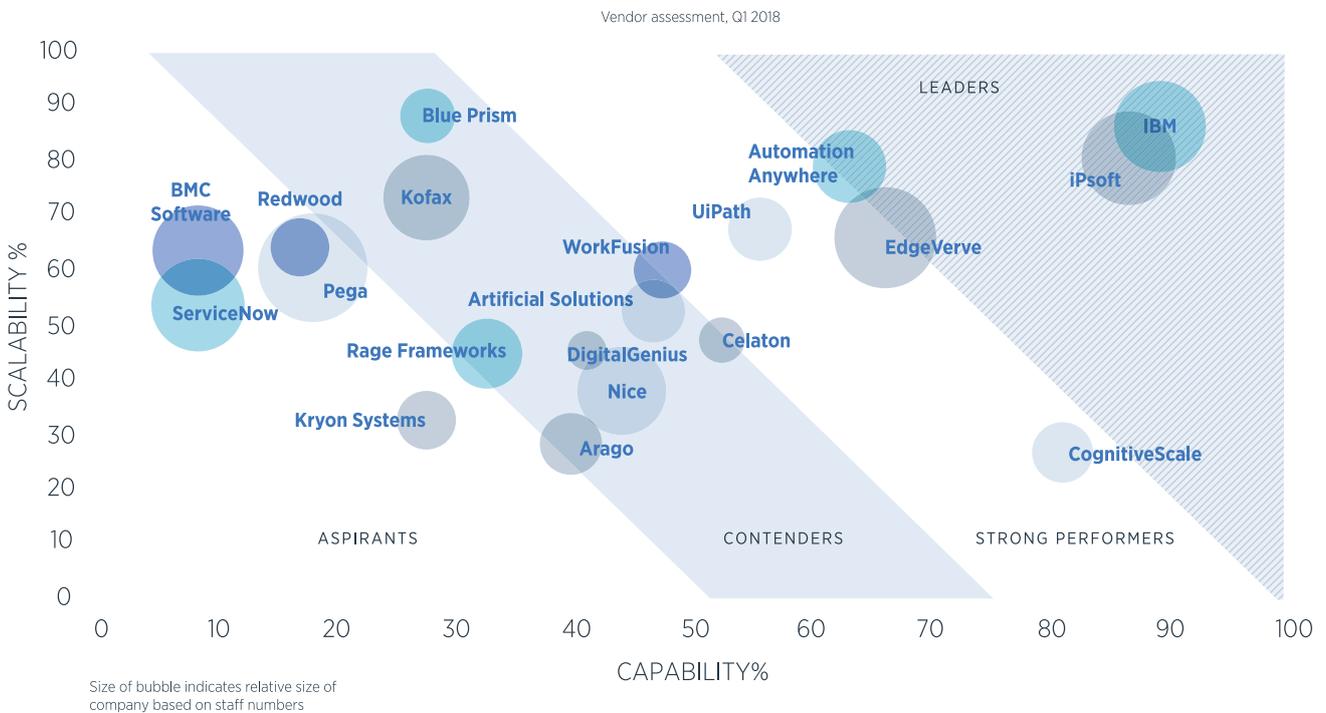


Figure 8: Rules-based and intelligent automation vendor assessment

Source: PA Consulting Group. For additional information on the above chart, contact PA (see page 53).

Physical (collaborative) robot vendors

Industrial robots have a wide range of functions in manufacturing facilities. They can tend machines, handle materials, weld, cut, assemble, wash, paint, remove material, pick, pack and palletise.

Collaborative robots, or cobots, are developing rapidly. Advances in sensors and AI technology are revolutionising the physical robotics market for manufacturing and logistics operations.

The latest robots are portable, easy to program and safe to work alongside people. They're used predominantly to improve productivity and efficiency by assisting human workers, rather than replacing them.

According to Barclays Equity Research, the market for collaborative robotics will reach \$12 billion by 2025, while the cost of cobots will decline 3–5 per cent annually until 2025.¹¹ IDC says cobots will work three times faster than current robots.¹²

IDC also predicts that by 2020, 45 per cent of newly-installed industrial robots will be equipped with at least one intelligent feature, such as predictive analytics, health condition awareness, self-diagnosis, peer learning or autonomous cognition. And by 2021, AI that supervises and coordinates industrial robots will boost their efficiency by 30 per cent.¹³

This advancing technology is improving the usability, reliability and flexibility of cobots. Some key cobot vendors include ABB, Rethink Robotics, Kuka, Fanuc, Epson Robots, Universal Robots and Yaskawa Motoman. PA has assessed industrial robot vendors to give an indication of market leaders, strong performers, contenders and aspirants in this space (see Figure 9).

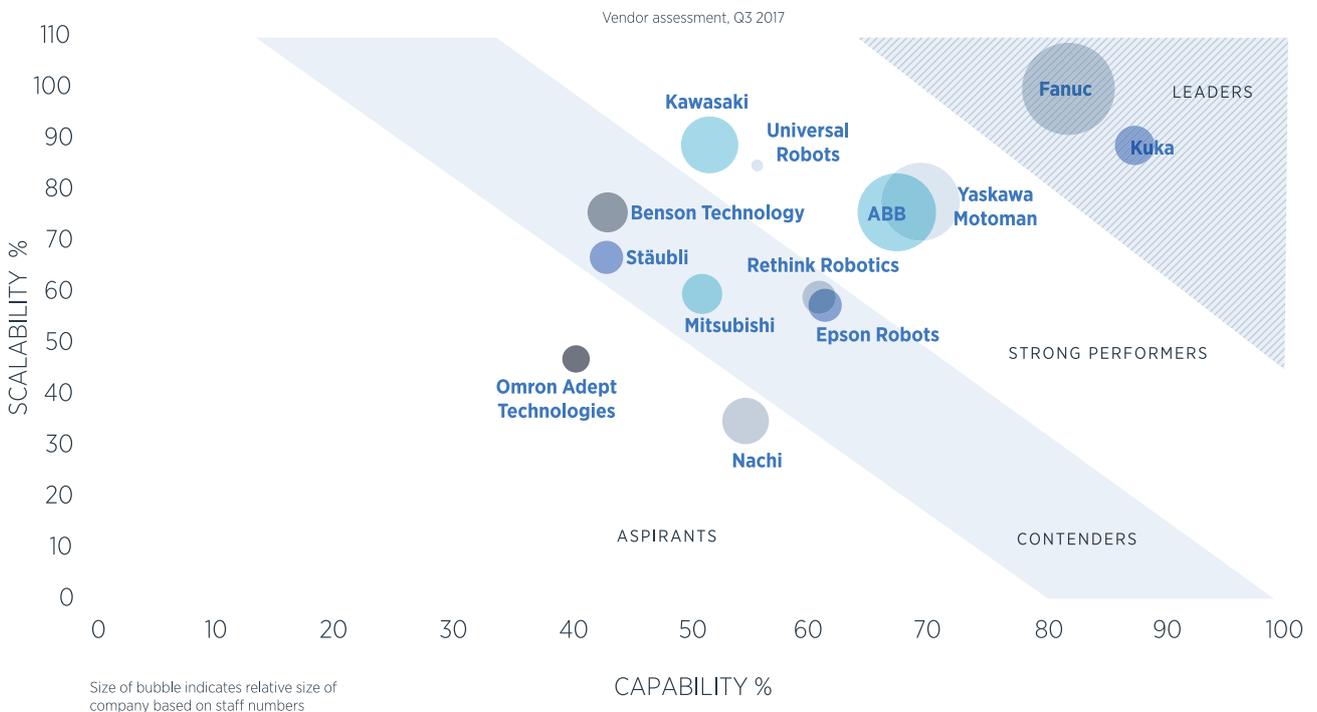


Figure 9: Industrial robots vendor assessment

Source: PA Consulting Group. For additional information on the above chart, contact PA (see page 53).

11 Rise of the cobots: By 2025, the market for collaborative robotics is expected to reach \$12 billion | *Plastics Today* | February 2017

12 IDC Unveils its Top 10 Predictions for Worldwide Robotics for 2017 and Beyond | *IDC* | December 2016

13 IDC FutureScape: Worldwide Robotics 2018 Predictions | *IDC* | November 2017



RABOBANK

Using AI to recognise customers and increase sales

Data generated by customers applying for a mortgage with Rabobank was held in different formats. The format depended on whether they went into a branch, contacted the call centre or visited a website. PA helped Rabobank link the three sets of data for the first time, helping the bank pinpoint customers who didn't complete the application process.

This insight meant sales teams could direct their effort to maximise sales by contacting customers who needed support. Rabobank was so impressed with the results from this work, they've since applied the same approach to increase sales and improve the customer experience for over 25 different products.

Source: PA Consulting Group

3 WHAT DOES IT MEAN FOR SUPPLY CHAINS?

Section highlights:

- With increasing supply chain digitalisation, AI and Robotics automation will become an arena where organisations can differentiate competitively and drive growth.
- AI and Robotics automation could become the autopilot behind a supply chain, which handles planning and fulfilment, designs products, monitors inventory levels, optimises sourcing, synchronises production and maintains machinery.
- Some supply chain software can already compare multiple scenarios and make recommendations.
- Using consumer data and connecting to smart machines, AI could autonomously predict, prescribe and execute actions more accurately than before.
- Leaders in supply chain must build their organisation's capability to harness more data than ever before.

The possibilities go far beyond manufacturing

Supply chains rely on and generate large quantities of data at every stage of the journey. As such, they're natural candidates to benefit from AI and Robotics automation. The growing maturity of AI and Robotics technologies means new opportunities are opening

across end-to-end supply chains. Leaders in supply chain should prepare their processes and infrastructure to embrace AI and Robotics automation technology. This means building their organisation's ability to harness more data than ever before.



Imagine your supply chain becoming truly autonomous. Leveraging enterprise-wide cloud and big data platforms, connected through the IoT and robust cyber security to your external network and ultimately your consumers. An integrated supply chain that orchestrates itself using real-time prescriptive planning, with autonomous

reconfiguration of production lines for demand and capacity changes enabled by connected machines. Imagine GPS-guided agricultural equipment that plants, fertilises and harvests crops. Manufacturing machines that maintain themselves predictively and can be configured remotely. Inventory that is self-optimised by connecting to your sourcing and distribution activities.

And smart products and retailing environments that predict what consumers want and when they want it enabling you to respond and serve with pace and flexibility to suit their needs.

This vision of integrated, autonomous flow is only possible when you use AI and Robotics automation in the right way.

An illustrative vision of the next generation supply chain

Imagine your supply chain becoming truly autonomous...



Figure 10: The next generation supply chain

Source: PA Consulting Group



CYBER SECURITY AND DIGITAL TRUST

Smart distribution is warehouse and transport automation which creates high-speed fulfilment centres that autonomous storage, handling and transportation systems. It leverages advanced execution systems and robotics in and between warehouses and delivery points. It provides flexible assembly, packaging and printing machines to enable late-stage customisation.

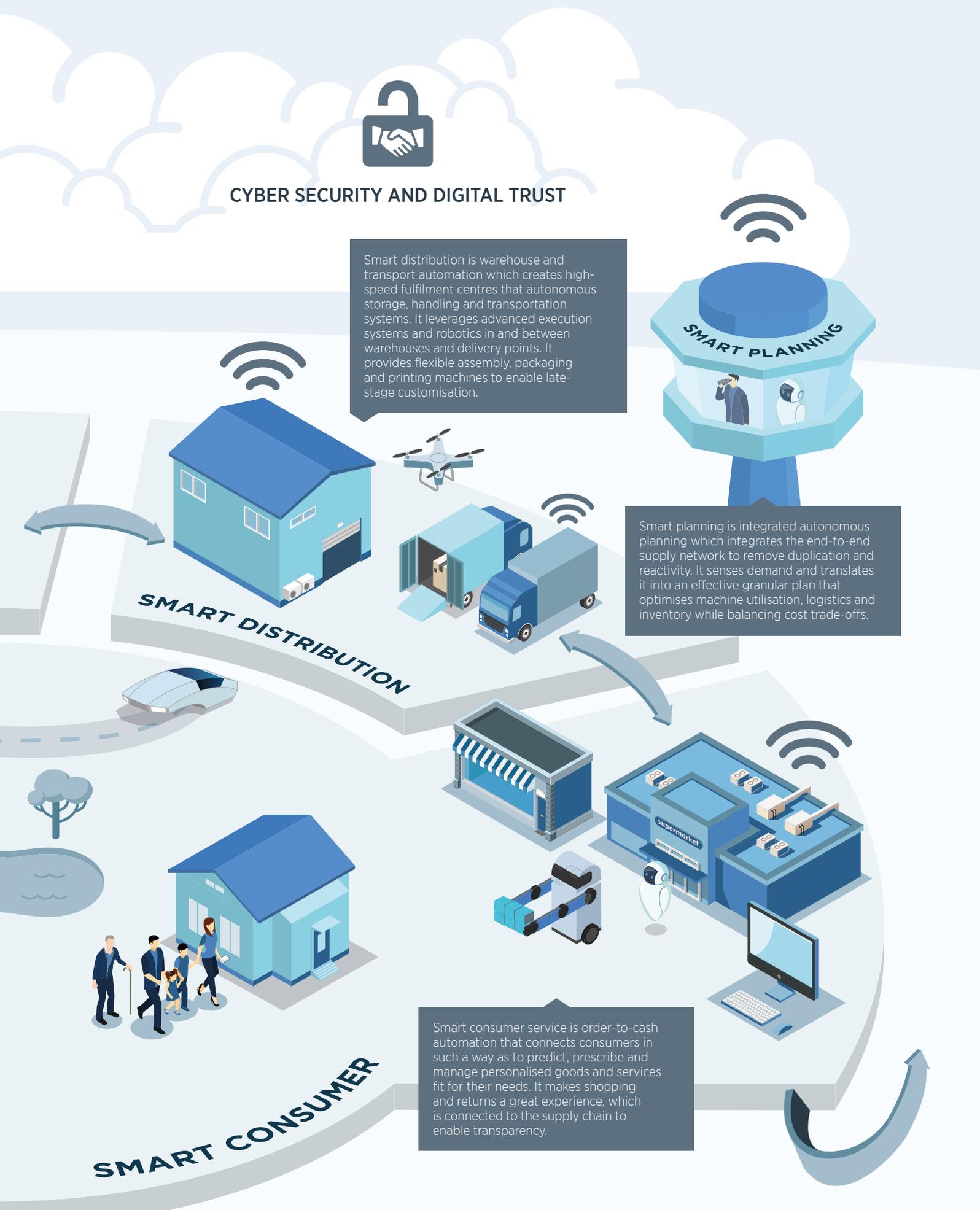


Smart planning is integrated autonomous planning which integrates the end-to-end supply network to remove duplication and reactivity. It senses demand and translates it into an effective granular plan that optimises machine utilisation, logistics and inventory while balancing cost trade-offs.

SMART DISTRIBUTION

SMART CONSUMER

Smart consumer service is order-to-cash automation that connects consumers in such a way as to predict, prescribe and manage personalised goods and services fit for their needs. It makes shopping and returns a great experience, which is connected to the supply chain to enable transparency.



This inevitable transformation offers big opportunities

With AI and Robotics automation, organisations can aggregate and analyse masses of data autonomously, drive supply chain responsiveness, offer customisation, develop new products and services, and accelerate time to market. There’s no doubt AI and Robotics automation

in supply chains will have sizeable benefits. Some companies, bloggers and writers have predicted the size of the prize, but it will vary between organisations and situations, and can only be quantified when organisations have specific plans, and targeted use cases.

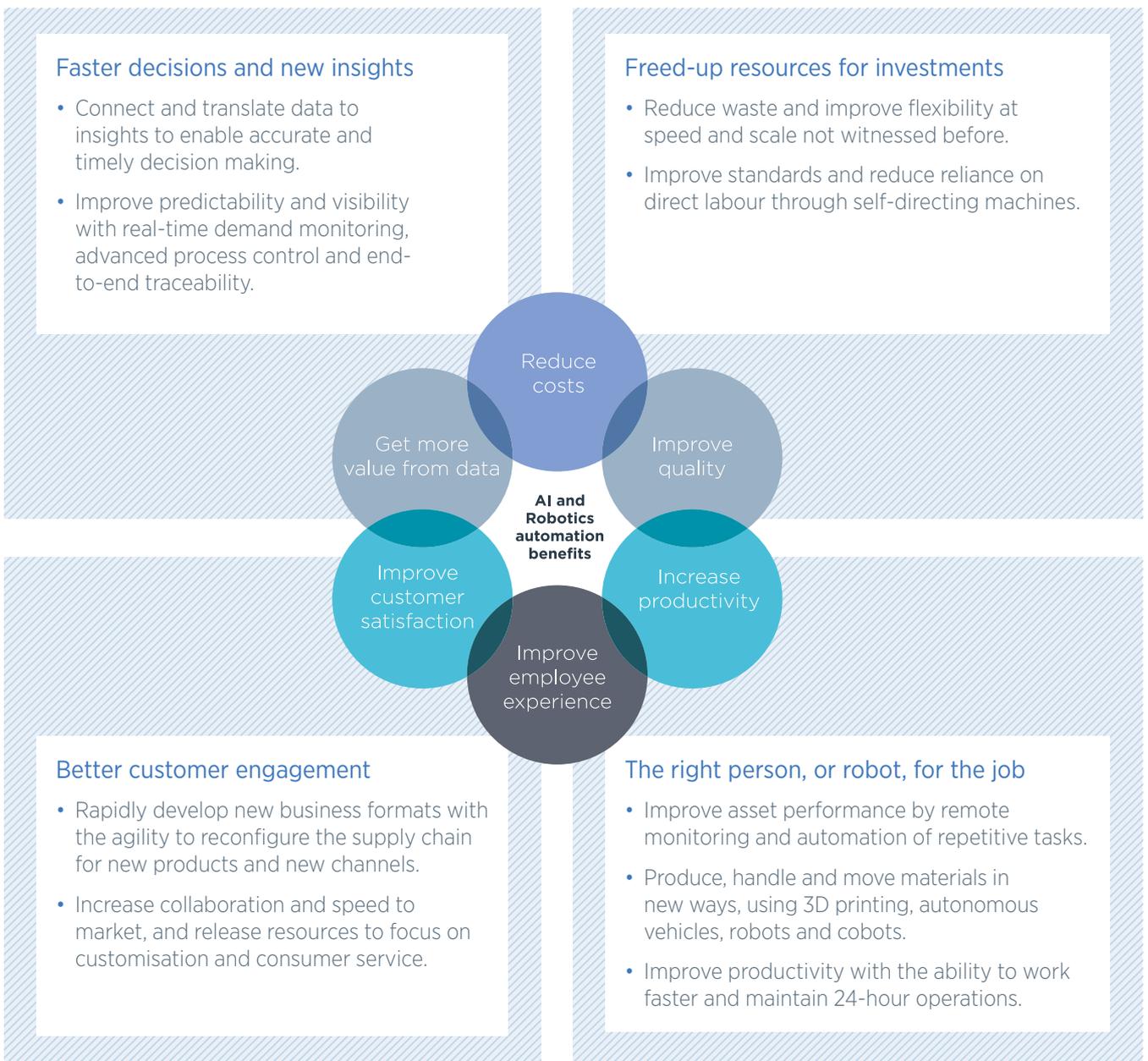


Figure 11: AI and Robotics automation benefits

Source: PA Consulting Group

Robotics and automation are becoming more important to supply chains

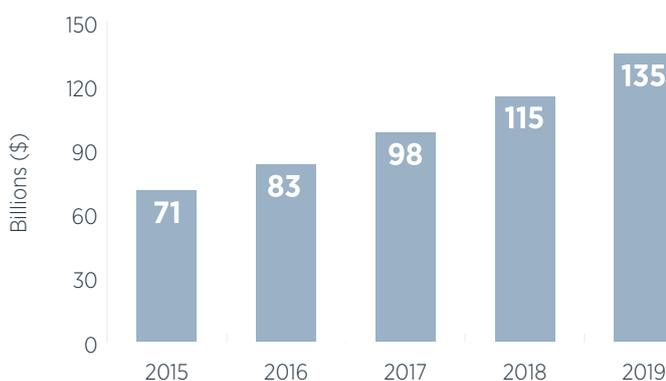
A study by MHI and Deloitte in 2016¹⁴ found more than half (51 per cent) of supply chain and logistics professionals believe robotics and automation will provide a competitive advantage. This is up from 39 per cent in 2015.

Yet only 35 per cent of respondents said they have already adopted robotics in their supply chains. This figure is expected to rise to 74 per cent by 2025.

IDC predicts, by 2021, 30 per cent of G2000 manufacturers will have deployed cyber-physical robotic systems, resulting in a 10–20 per cent improvement in productivity. And by 2020, 30 per cent of the top 100 retailers will be using or piloting robots within the ship-from-store fulfilment process, helping to reduce the cost of ship-from-store orders by up to 20 per cent.¹⁵

IDC estimates the global annual investment in robotics will rise from \$71 billion in 2015 to \$135 billion in 2019, emphasising the increasing importance of this technology.¹⁶

Gartner's report of 2015, *Predicts 2016: Reimagine SCP Capabilities to Survive*, found supply chain organisations expected the level of machine automation in their processes to double by 2021. Technology and digitisation have already had a major impact on supply chains, and much has been made of the likely impact of the IoT in the coming years. The rise of AI should work alongside this to significantly reduce the need for people in the supply chain. If handled correctly, this could improve safety and efficiency, and enable transparency between supply chain partners so inventory can be managed more effectively, helping to cut costs. It will also boost profits from capital equipment and improve environmental performance.¹⁷



According to Bank of America Merrill Lynch (BAML), Global Research, the AI and Robotics market will grow from \$58 billion in 2014 to \$153 billion in 2020, with \$14 trillion to \$33 trillion in combined cost reductions in manufacturing and healthcare, cuts in employment costs and other efficiency gains. By 2025, according to BAML, robots could be performing 45 per cent of manufacturing tasks, against about 10 per cent in 2016.¹⁸

Figure 12: Global annual investment in robotics

Source: Business Insider

14 Robots Gain Traction With Supply Chain Managers | The Wall Street Journal | April 2016

15 IDC FutureScape: Worldwide Robotics 2018 Predictions | IDC | November 2017

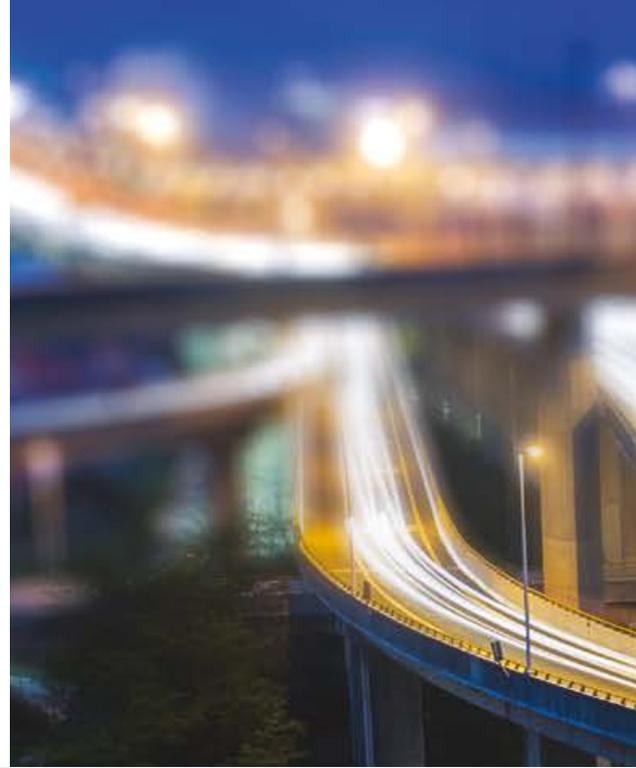
16 Supply chain companies seek competitive advantage with automation | BI Intelligence | April 2016

17 How Supply Chains Are Adopting AI | Innovation Enterprise

18 Mrs Watanabe bets on robots to rule | Financial Times | June 2016

How companies are creating supply chains of the future

The rapid maturation of AI and Robotics automation technology is already helping supply chains sense, orchestrate and react to situations with extraordinary detail, speed and accuracy. Below are some examples of where the technology is being used to create the supply chains of the future.



Digital farming

AI and Robotics start-up Blue River Technology developed a 'see-and-spray' machine that uses computer vision to

identify plants in the field and spray herbicides only on weeds, rather than the broader field. This has reduced herbicide use by up to 90 per cent.¹⁹ The company also uses machine learning to make spraying equipment more precise and cost-effective.



Supply chain visibility and predictability

Capitalising on machine learning, IBM has launched Watson Supply Chain to create supply chain visibility and gain supply risk insights. The system uses cognitive technology to track and predict supply chain disruptions by gathering and correlating data from disparate sources, such as social media, weather forecasts and historical records.²⁰



Inventory optimisation

ToolsGroup's supply chain optimisation software uses machine learning to optimise inventory management. The software begins

by creating a baseline forecast for the new product and then learns from early sell-in and sell-out demand signals. It layers this output to determine more accurate demand behaviour, which feeds through to optimised inventory levels and replenishment plans.²¹



Automated purchasing recommendations

Technology firm Sentient uses machine learning to offer recommendations to e-commerce shoppers based on image recognition. Rather than using text searches and attributes like colour or brand, the software finds visual correlations between items the shopper is browsing through visual pattern matching.²²



Smart manufacturing

Siemens' Amberg factory in Germany is not only highly automated, but also intelligent and self-sufficient. Computers handle 75 per cent of the value chain autonomously. Using the IoT, parts in the production process can feed back to the machines and tell them the specific production requirements. Siemens is taking AI very seriously across all its divisions, investing more than \$1 billion into start-ups.²³

Figure 13: AI and Robotics automation examples

19 John Deere ploughs a new furrow with algorithmic acquisition | Financial Times | September 2017

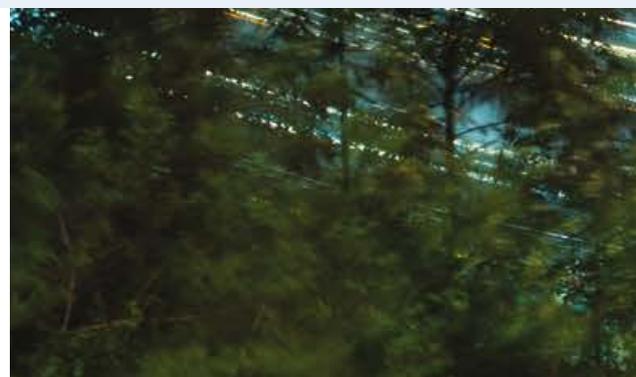
20 Artificial intelligence and future supply chains | SCM World | January 2017

21 Ibid

22 Ibid

23 From zero to hero in two years - AI is one of the biggest digital disruptors in supply chain | SCM World | CBR | March 2017

24 Artificial Intelligence and Future Supply Chains | SCM World | January 2017





Real-time logistics

TransVoyant's machine-learning technology can collect and analyse one trillion events each day from sensors, satellites, radar, video cameras and smartphones. In logistics applications, its algorithm tracks the real-time movement of shipments and calculates their estimated time of arrival, factoring in weather conditions, port congestion and natural disasters.²⁴



Automated fulfilment

Amazon is widely recognised as a leader in automated fulfilment. DHL has invested in a multi-customer automation system that uses advanced robotics in its Advanced Regional Centre in Singapore. DHL will also begin a pilot test using a collaborative autonomous robotics at a life sciences facility in Tennessee. The robots, made by Locus Robotics and called LocusBots, are being tested as a picker companion for piece picking order fulfilment in the warehouse.



Self-driving trucks and delivery carts

AI is at the core of self-driving vehicles such as Uber's self-driving truck, which has already made its first delivery of 50,000 cans of Budweiser beer. In 2017, a fleet of self-driving trucks from firms including Daimler, Volvo, and Scania were tested on the roads of Europe, and their introduction is predicted to significantly reduce road accidents. Self-driving parcel delivery carts are getting media attention as well. The Starship robot buggy, invented by Skype co-founders, could let small businesses send up to 9kg of goods to local customers.



In-store retail automation

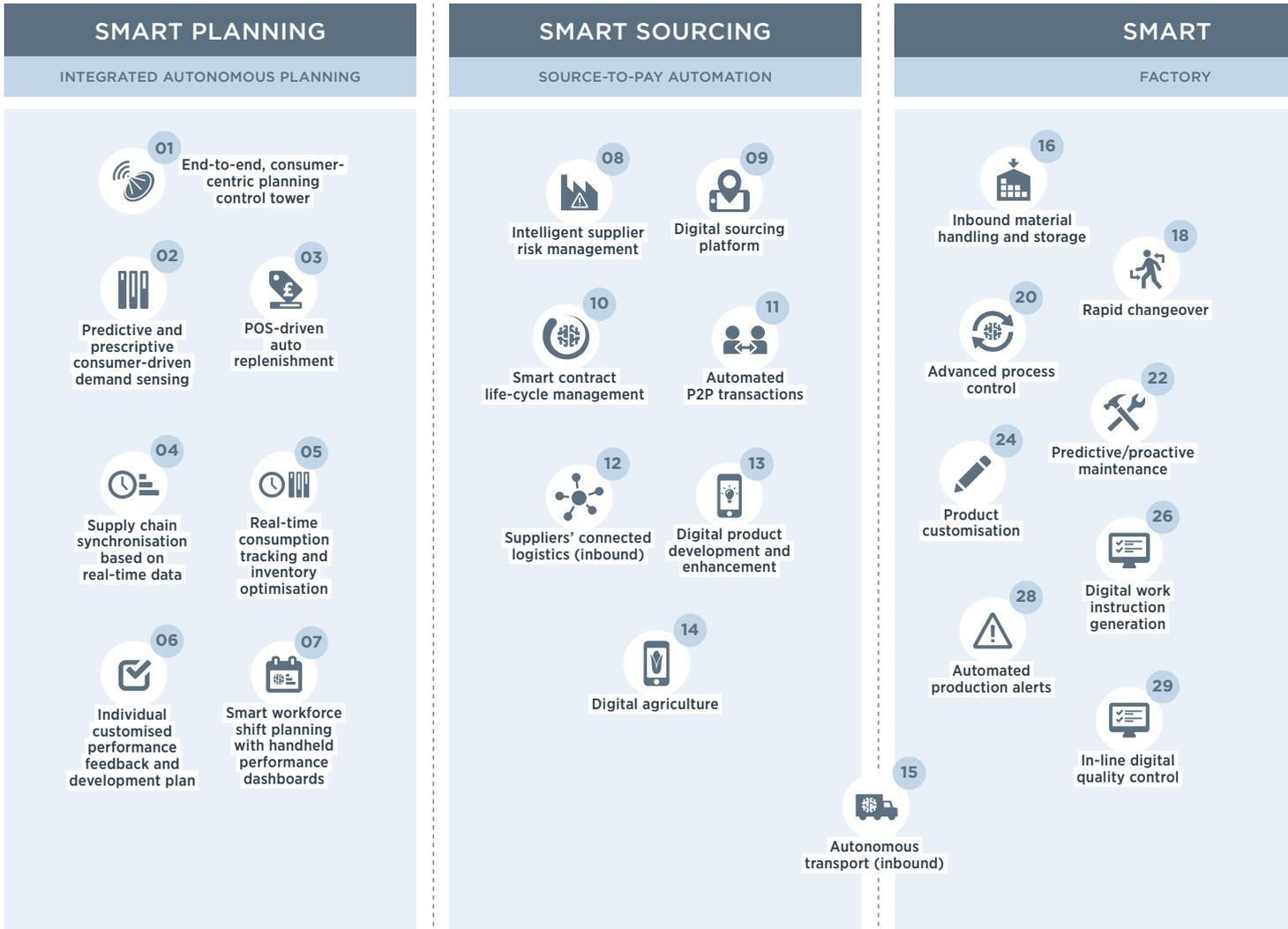
UK supermarket Morrisons is working with technology firm Blue Yonder to predict stock availability using AI. Walmart is testing in-store robots to handle tasks that are repeatable, predictable and manual, like scanning shelves for out-of-stock items, incorrect prices and wrong or missing labels. Target tested a robot called Tally, built by Simbe Robotics, to keep track of product inventory on its shelves in the United States. Home improvement retailer Lowe's introduced the LoweBot to monitor inventory and pricing in stores.



Potential supply chain automation applications

Figure 14 shows examples of some potential supply chain automation applications based on the combination of advanced sensing, AI and Robotics technologies.

This shows the huge potential and broad application areas AI and Robotics already has and will even further exploit in the future.



- 1) Digital centre of excellence equipped with advanced technologies such as RPA/ cognitive agents, digital twin and advanced digital platforms using IoT, big data and cloud technologies for end-to-end supply chain visibility, planning and control.
- 2) Big data-enabled demand sensing covering consumer and market behaviour and AI-enabled predictive analytics to forecast and prioritise production decisions.
- 3) Automated replenishment direct from factory to store linked with point of sale (POS).
- 4) Synchronisation with consumption/ demand, asset utilisation/production and replenishment requirements using AI to optimise materials usage, improve asset and service efficiency configured to a defined product segment.
- 5) Real-time visibility of product status to trigger anticipatory actions using AI providing accurate stock records. A dynamic ability to identify and optimise inventory whether products are in production, in transit, in the DC, in depot, in store backroom or on-shelf.

- 6) Individualised digital performance feedback platform for assigned tasks of a factory worker, which will track and suggest customised development plan.
- 7) A digital platform to prescribe and/or plan workforce shift that can be reviewed and adjusted using handheld device.
- 8) Big data- and AI-enabled intelligent analytics of extended suppliers' risk related to climate, social and political issues.
- 9) A digital sourcing platform that provides real-time transparency of commodity fluctuation, market behaviour, supply base, e-auctions, cost information at material and product level with what-if scenario predictive planning capability for faster, flexible and accurate decision making.
- 10) Contract life-cycle management using AI-enabled digital authoring, workflow, approval with automated prompts for extension or expiration linked with procure-to-pay system.
- 11) Procurement procedures are automated for contracts compliance, buying, purchase orders, receipting, invoicing etc using RPA.

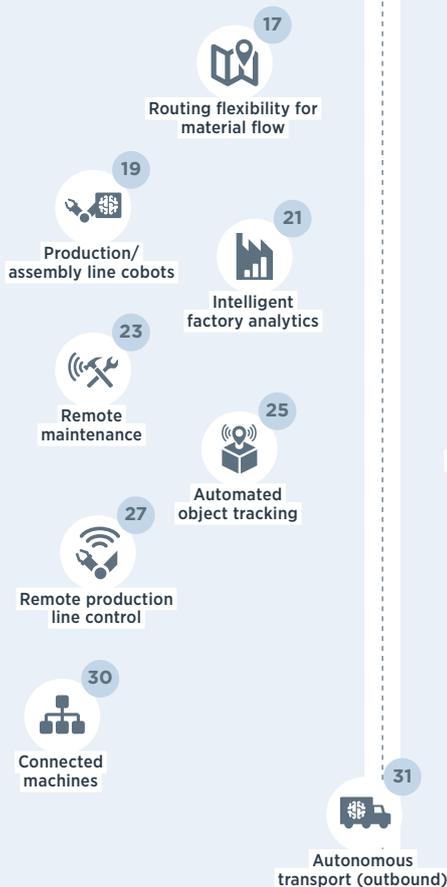
- 12) IoT-enabled intelligent analytics to track and trace products/assets to manage counterfeit, theft, quality and for smart transport planning enabled by AI for real-time routing and fleet management based on live weather, traffic and capacity utilisation.
- 13) Virtual design simulation, rapid data-driven prototyping using 3D printer and fabricated tooling. Using sensors to track how products have been used and understand the life cycle, or where to boost robustness using AI. Could also be used to create new services targeting consumers' use of the products.
- 14) Data-driven agriculture using automated guided vehicles/robots, sensing and AI technologies to predict and identify high-yield areas, periods and crops or animals using real-time insights. An ability to avoid waste, increase productivity and ensure better health for farmers, crops and livestock.
- 15) An ability for inbound logistics to transport materials/products/ machines by autonomous vehicles.

- 16) Using automated guided vehicles, cobots, swarm robots, augmented picking and a smart warehouse execution system integrated with manufacturing and planning system.
- 17) The optimal automated routing for specific work order according to cost, speed or other parameters.
- 18, 19) Manage repetitive and complex tasks using intelligent robots/cobots that adapt automatically to different products for rapid changeovers, loading/unloading, machine tending etc. Works safely with workers to deliver with speed, flexibility and accuracy.
- 20) Real-time adjustment and optimisation of machine process parameters, using machine learning (AI).
- 21) Intelligent integration of machines with planning systems using advanced sensing technology and AI for predictive analytics capability to optimise manufacturing execution.
- 22) AI prompts for maintenance (including spare parts ordering and management), operators are instructed by augmented reality to perform service and repair processes.

Figure 14: Potential supply chain automation applications

MANUFACTURING

AUTOMATION



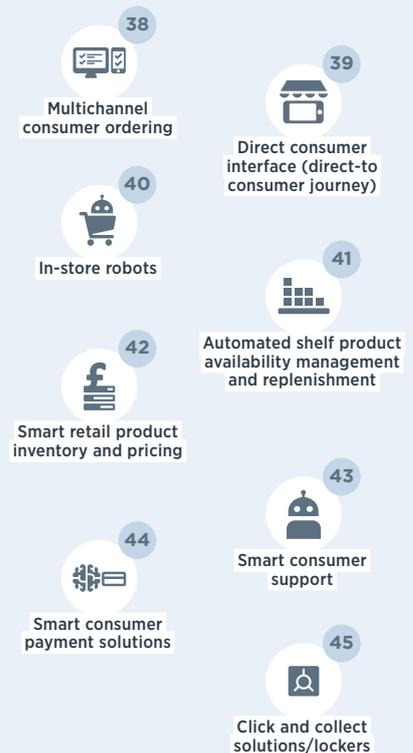
SMART DISTRIBUTION

WAREHOUSE AND TRANSPORT AUTOMATION



SMART CONSUMER SERVICE

ORDER-TO-CASH AUTOMATION



Note: The linear layout of this supply chain picture is a simplified illustration to show where potential automation solutions could be applied. It does not necessarily imply a flow or sequence.

23) Machines are updated and/or fixed remotely by experts or cognitive agents using securely installed software enabled by AI, virtual or augmented reality and/or digital twin.

24) Additive manufacturing (3D printing)/ smart packaging, batch-of-one capability to produce personalised products using automated object tracking and digital work instructions customised to a product.

25) Automated identification using RFID or sensors to enable the automation of mass customised production processes by simplifying the retrieval, tracking and usage of highly specialised components.

26) Individual customised digital work instruction created for operator or a robot with zero effort for lot-size-1 production.

27) Ability to monitor and control line remotely using AI-based digital twin technology to decrease downtimes and optimise utilisation by making the best use of all available information.

28) Alerts generated by sensors on machines are processed and analysed by machine learning, which could be fixed autonomously, as well as subject to the condition.

29) In-line automated 100 per cent inspection of quality using AI deep-learning technology equipped with advanced vision systems, scanning and sensing technologies for defects detection with high precision and speed.

30) Connected machines enabled by voice recognition and/or gesture control, capable of ordering required materials to the line, as per production schedule and inventory level.

31) An ability for outbound logistics to transport materials/products/ machines by autonomous vehicles.

32) Smart glasses, clothing and watches giving and showing what-where-how instructions for better access, handling/picking, safety and visibility.

33) Using automated guided vehicles, intelligent robots, augmented picking and a smart warehouse execution system integrated with manufacturing and planning system.

34) Enhancing human body strength and stability with exoskeletons for higher productivity and better safety.

35) IoT-enabled intelligent analytics to track and trace products/assets to manage counterfeit, theft, quality and for smart transport planning enabled by AI for real-time routing and fleet management based on live weather, traffic and capacity utilisation.

36) 3D printing/smart packaging/ micro or mobile factory (including batch-of-one capability).

37) Drones, robot buggy, crowdsourcing/uberisation/autonomous vans used to deliver parcels with speed and flexibility in hard-to-reach urban or rural areas.

38) Virtual store (e-commerce) subscription-based smart ordering services, direct store ordering.

39) Automated ordering through smart consumer interface, ie appliances or products, eg smart fridge, smart coffee machine, Dash button, Amazon Echo etc.

40) Smart robots for physical retail floor shelving, stock counting and consumer greeting.

41) AI-based automated product availability management and retail shelf replenishment.

42) AI-based advanced analytics solution for dynamic price/promo adjustments, inventory optimisation using real-time information.

43) Consumer or customer service hyperconnected centre of excellence using augmented reality/virtual reality for a pleasant, almost real interactions with consumer/customer. Virtual and/or cognitive agents are there to efficiently answer queries and solve problems with clear rules of escalation.

44) Secured touchless or mobile payments integrated with direct-to-consumer interface and multichannel ordering.

45) Collecting points for flexible delivery and pickup integrated with smart customer service, smart distribution and smart manufacturing.

OCADO

Leading fulfilment automation

Ocado is one of Britain's leading online retailers and has fully automated its fulfilment model. Rather than buy off-the-shelf solutions, Ocado designs its own AI and Robotics automation systems that currently operate with 99 per cent order accuracy.

In 2017, Ocado successfully tested the first driverless grocery delivery in the UK. The company uses high-speed bots that self-diagnose for maintenance and communicate with each other 10 times a second within a 50-metre radius.

Recently, Ocado created a robot called OSPick to pick a range of groceries without damaging them, and now it's working with academia to develop a humanoid robot to assist its warehouse maintenance technicians.

Source: www.ocadogroup.com

MAGNA STEYR

Smart factory

Magna is one of the world's leading automotive suppliers. To keep ahead of the competition, it constantly develops new AI and Robotics automation for its factories.

The company already uses around 180 robots, which are 98 per cent automated, to create the shells of cars.²⁵ And mixed-reality glasses partially automate quality inspection, removing the need for manual measurements and checks.²⁶

The 'factory of the future' is already well advanced.

²⁵ www.plm.automation.siemens.com/global/en/our-story/customers/magna-steyr/15125/

²⁶ www.cambridgenetwork.co.uk/news/magna-supports-new-g-class/

4 HOW WILL IT IMPACT THE WORKFORCE?

Section highlights:

- The workforce will need to adjust to the unprecedented challenges and opportunities of the AI and Robotics revolution.
- Economies of scale and technology enhancements will make AI and Robotics automation more attractive than human labour.
- New skills are needed. Companies need to attract the right talent and change the image of working in supply chain.
- Disruption created by digitalisation will, however, be offset by the new career opportunities for a skilled workforce.
- Companies who embrace AI and Robotics will most likely see a positive impact on their organisation.
- All workforce levels up to C-suite will be impacted by AI and Robotics automation and need to rethink their roles.

An inevitable evolution that the workforce needs to adjust to

Although the linear model of many supply chains has remained largely unchanged until comparatively recently, supply chains have been evolving due to continuous technology disruptions and changing business needs. Both employers and employees have had to adapt to new ways of working. However, the rate of adaption remains low while the skills gap remains high. In the 1970s, consumer packaged goods manufacturers and retailers came up with regional distribution centres to expand their businesses and operate more efficiently.²⁷ This journey progressed

and underwent a series of changes. And in the few years, automation has dominated supply chain development to the extent that priority is now given to the seamless functioning of mobile robots and automated material-handling systems. This time AI and Robotics automation will revolutionise the way we organise, work and respond to business needs. Therefore, the workforce needs to adjust to the unprecedented challenges and opportunities that AI and Robotics automation will bring.

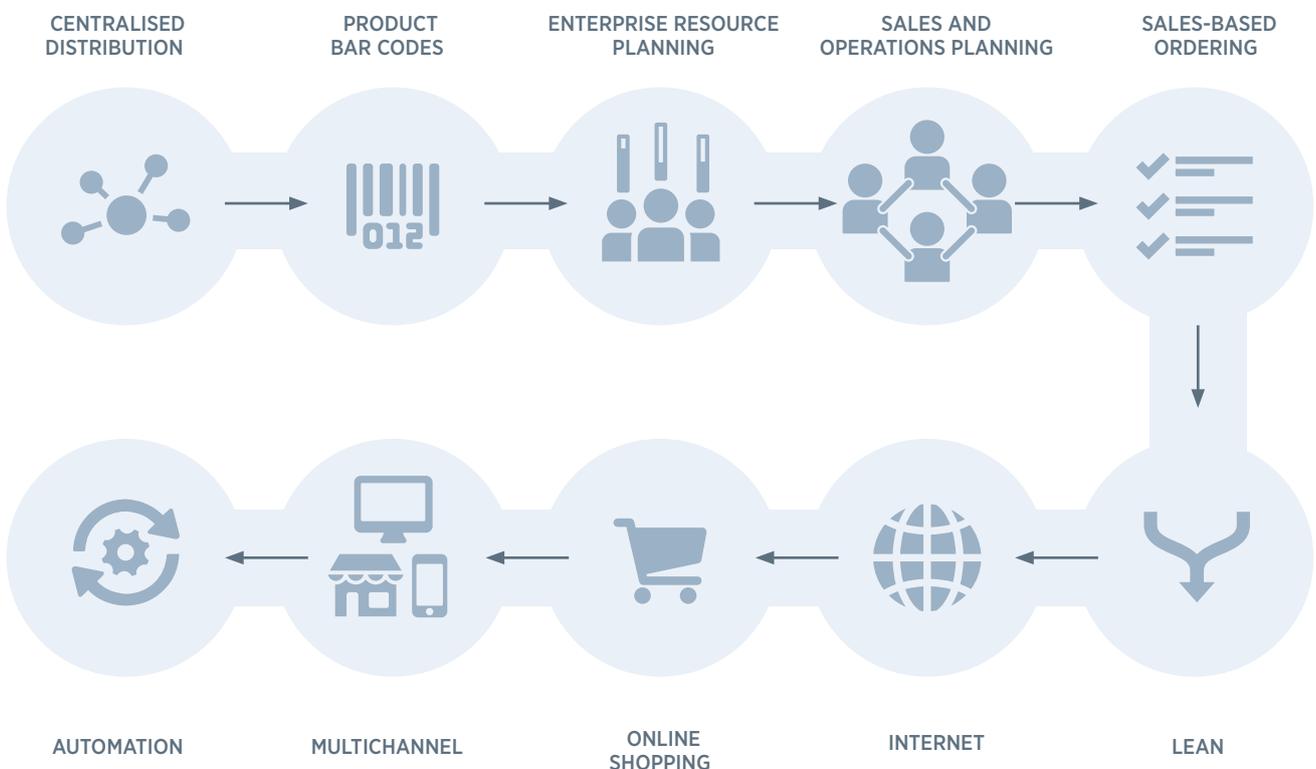


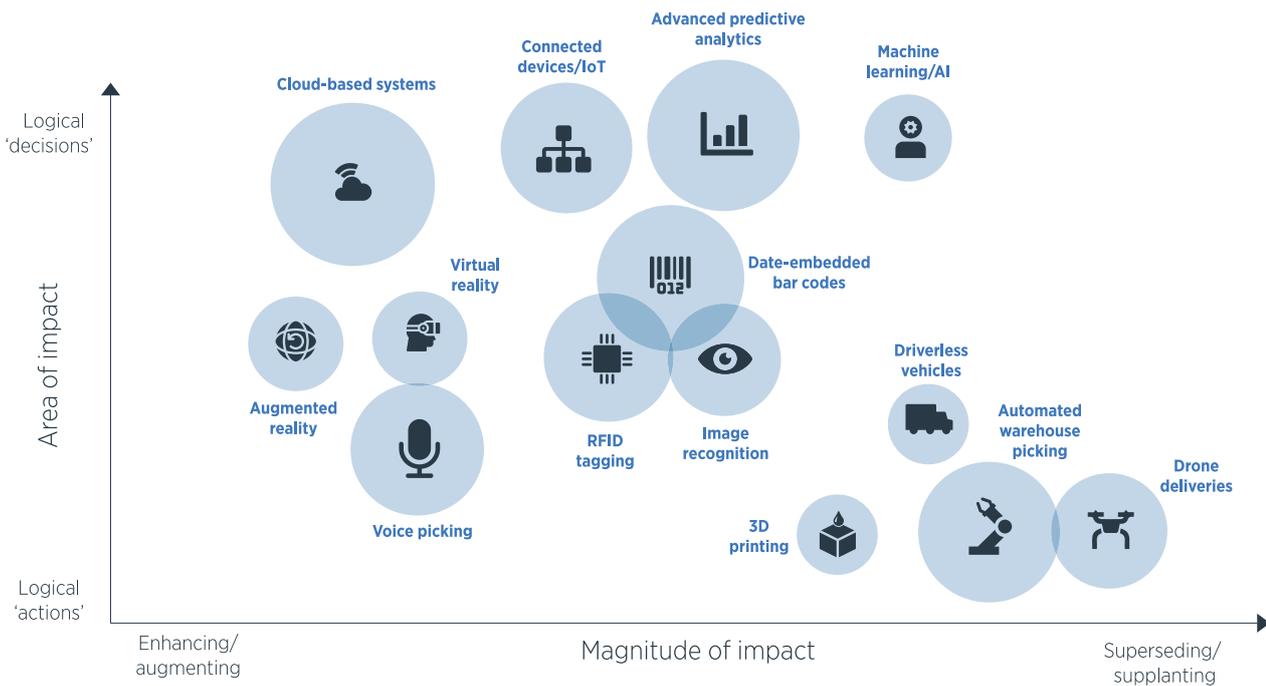
Figure 15: Evolving enablers of supply chain competitive advantage

Source: IGD Supply Chain Analysis

AI and Robotics automation will enhance decision-making and replace manual labour

IGD, in its 2017 technology survey,²⁸ put existing and emerging technologies with the potential to impact supply chains into categories. It said technology can help with either logistics (eg physical movement of goods) or logic (eg analysis and decision making), and can either enhance what we do (eg act as a tool) or supersede what we do (eg act as the workman).

The survey shows AI and Robotics will most likely supersede logistical work with technologies such as driverless vehicles, automated warehouse picking and 3D printing. Logical work will be enhanced by technologies such as cloud-based systems, connected devices and advanced predictive analytics. Meanwhile, decision making will have a much broader data pool, with more granular information, to draw from.



Bubble size represents the proportion of businesses actively investigating these technologies.

Figure 16: Potential technologies impact on supply chain operations

Source: IGD

Predicted rate and degree of job automation

Several studies have focused on the impact of AI and Robotics on human labour. In 2013, Carl Frey and Michael Osborne of Oxford University reviewed 702 jobs in the United States.²⁹ They found 47 per cent faced a high risk of automation, and another 19 per cent faced a medium risk. The OECD disputed these figures in a 2018 study,³⁰ however, finding only 10-12 per cent of jobs would be automated. Yet both studies found that entry-level jobs are most likely to be automated, potentially making it difficult for young people to start a career in future.

The studies also agreed that physical and logistical jobs are most likely to be automated, which leaves the question of whether logical jobs can ever be fully automated. The most obvious challenges to automating those roles are that they involve perception and manipulation (eg dexterity), creative intelligence (eg originality) and social intelligence (eg empathy and persuasion).

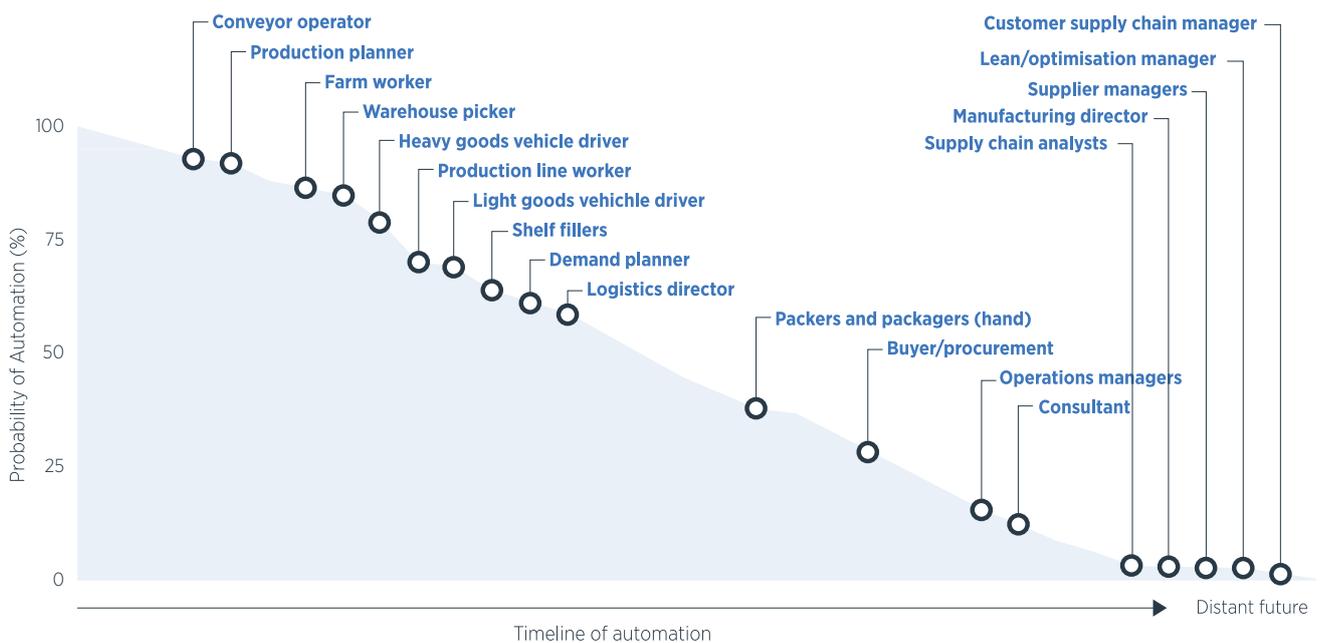


Figure 17: The future of employment

Source: The Future of Employment | Oxford University³¹ | IGD report³²

29 The Future of Employment: How Susceptible Are Jobs to Computerisation?, by Carl Frey and Michael Osborne | Oxford University | September 2013

30 Automation, skills use and training | OECD | March 2018

31 The Future of Employment: How Susceptible Are Jobs to Computerisation?, by Carl Frey and Michael Osborne | Oxford University | September 2013

32 Supply chain technology | IGD Supply Chain Analysis | 2017

Will AI outperform humans at all tasks?

In a 2017 survey,³³ the University of Oxford and Yale University surveyed 352 AI researchers to create a timeline of the impact AI will have on human tasks.

According to the survey, mechanical tasks will be completely automated within 10 years. Robots may also be able to perform basic creative tasks, such as writing high school level essays. And in just 50 years, robots could take on complex creative tasks like writing a book and conducting mathematical research.

Ultimately, the researchers estimated AI could automate all human tasks by 2061 and all human jobs by 2136.

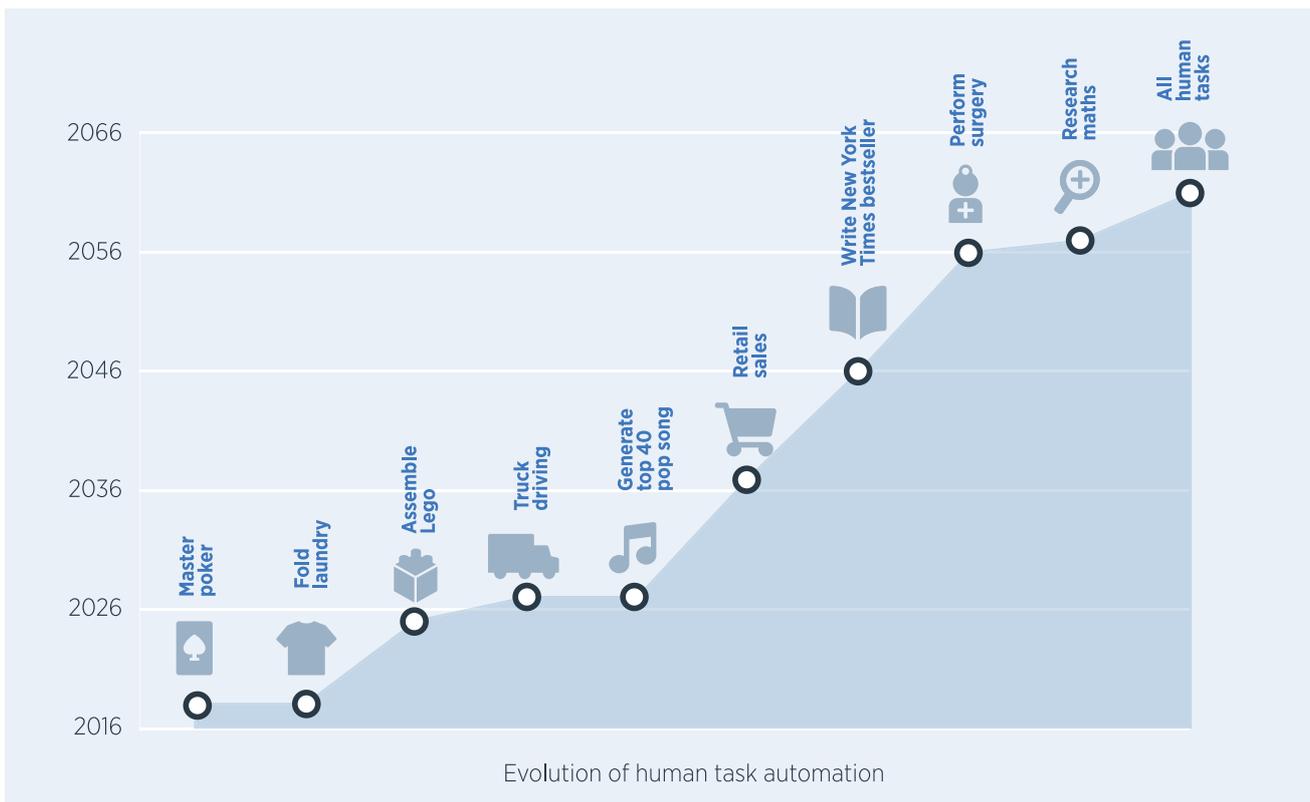


Figure 18: When robots could take over human tasks³⁴

Source: Business Insider UK

³³ When Will AI Exceed Human Performance? Evidence from AI Experts, by Katja Grace et al | Oxford University and Yale University | May 2017

³⁴ Here's when robots will start beating humans at every task | Business Insider UK | June 2017

Organisations need to refocus skills to adapt to the future

If companies don't invest in developing their people's skills, there's a risk the value delivered will fall short of the opportunity and AI and Robotics will be seen as underperforming. Even worse, companies will likely blame the technology for failure rather than the underlying skills gap.

With a skills gap already prevalent in many supply chains, there's a risk it will widen with the impact of AI and Robotics automation. That makes it crucial to understand why it exists:

Scarcity of experienced supply chain professionals

Supply chain professionals are expected to run complex and continuously evolving systems. That means they need a broad set of technical skills, a wide range of knowledge and must readily adapt to industry changes and new technologies, such as predictive analytics, the IoT and blockchain. This is becoming increasingly rare as more than 25 per cent of supply chain professionals are reaching retirement age.

Insufficient focus on soft skills development

Emphasis is often put on learning technical skills, but soft skills, like communication, leadership and teamwork, are equally important. Supply chain professionals lacking soft skills are likely to struggle when managing critical assignments. For example, transforming a strategy into reality requires effective communication across the entire organisation. Additionally, without soft skills it's impossible to build relationships, which hinders vertical and horizontal collaboration.

Millennials' perception of supply chain

Millennials often believe supply chain jobs are neither attractive nor for the tech savvy because roles lack visibility. Business studies, for example, devote less than 2 per cent of syllabuses to supply chains. This exacerbates ignorance about the job process, high-tech work environment and career possibilities.

There are benefits

AI and Robotics automation needs a highly skilled workforce, creating new opportunities for job aspirants. That means there are some big benefits for organisations and their workforce.

Quality of work

- Employees won't have to do repetitive, mundane or dangerous work
- People can channel their efforts into creative and innovative activities
- Organisations will offer mass retraining in automation skills needed for smart factories.

Workplace efficiency

- Machines perform the exact same motion repeatedly without variation or error
- Machines always deliver accuracy, consistency and performance.

Employee safety

- Robots and automated systems don't cause accidents, improving employee safety
- Collaborative robots with enhanced safety features don't require fences in the workspace
- Collaborative robots work with humans, resulting in employee fulfilment, improved focus on work and minimal safety concerns.

Reshoring

- AI and Robotics automation keeps manufacturing in advanced nations where it would otherwise be outsourced.

Roles at all levels need rethinking

AI and Robotics automation will impact jobs beyond the factory floor. It will require management to reinvent many roles up to the C-suite to bring a purpose-led, top-down vision and new network support. Operating models will become more connected, while new agile systems will gain insights from better use of data. New threats and risks will also arise, compelling companies to spend resources on cyber security and risk management.

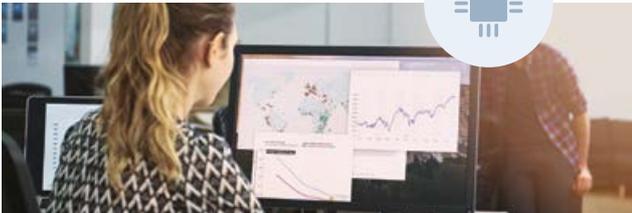
To evolve management roles, companies will need to build a culture of innovation and ensure employees are aligned to it.



Chief Executive Officer/Chief Innovation Officer

Develop a coherent programme, drive growth and innovation

- Drive agility and innovation
- Build the operating model for a digital ecosystem
- Develop smart products and connected business
- Identify physical-cyber threats and opportunities



Chief Technology Officer/Chief Information Officer/Chief Digital Officer

Implement the latest technology

- Build sensors, big data analytics and automation infrastructure
- Ensure data completeness and accuracy
- Streamline and enable digital systems
- Balance digital innovation with IT maintenance
- Integrate front-office apps with back-end systems
- Make AI and Robotics applications transferable across business



Chief Executive Officer/Chief Technology Officer/Chief Information Officer

Minimise risk and enhance security

- Predict and manage physical and cyber risks
- Keep pace with evolving cyber threats
- Understand and mitigate risks of new technologies
- Establish a cyber-security programme and capability



Chief Marketing Officer/Chief Sales Officer

Enhance the consumer experience

- Deepen customer/consumer relationships and insights
- Build direct-to-consumer digital platforms
- Get close to supply chain and technology partners
- Collaborate with retailers and integrate consumption data



Chief Supply Chain Officer/Chief Operating Officer/Chief Procurement Officer

Modernise supply chains and operations

- Establish a digital supply network to respond quickly to market changes
- Create an autonomous supply chain
- Leverage collaboration across all levels and partners
- Develop supply chain automation talent
- Enhance visibility of supply risks and cost leakages



Chief Financial Officer

Modernise finance, tax and legal

- Automate processes and control
- Digitise invoices and documents
- Maximise tax savings from digital initiatives
- Address legal and regulatory requirements



Chief HR Officer

Find and keep the right people

- Create a diverse culture of innovation
- Support the redesign of the organisation to fit the digital age
- Train people to meet digital business needs
- Build a collaborative digital work environment
- Integrate digital technologies to empower people



RODON GROUP

You don't have to be big to automate

Rodon is an American injection moulding factory that uses Baxter robots, from Rethink Robotics, to pack parts as they come off the production line. With dust and debris accompanying the monotonous work, it's often hard to find people to fill the roles.

By using Baxter robots, Rodon can offer parts more cheaply to the American market than Chinese factories thanks to its domestic supply chain. It also ensures everything is made in line with US laws and regulations.

The Rodon factory is now fully automated and can run 24 hours, 7 days a week for most of the year.

Source: Robotics and the "New" Supply Chain:
2015-2020 | Robotics Business Review | September 2014

5 HOW TO TAKE IT FORWARD

Section highlights:

- When companies endeavour to embrace the world of AI and Robotics automation, all options need to be on the table to align and reinvent the supply chain automation journey.
- It's not an overnight exercise: consider all options and find the solution that is right for you.
- We recommend all companies take into consideration the following five objectives on their road to implement AI and Robotics automation:
 - tailor your strategy
 - align coherently
 - adapt your organisation
 - implement in an agile way
 - protect yourself.

Adopting AI and Robotics automation isn't an overnight exercise

In the midst of the fourth industrial revolution, organisations trying to keep up with the trend often end up with an inconsistent proliferation of digital initiatives across geographies, functions and business units. Without a coherent global automation strategy and implementation programme, execution can be onerous and result in delays, cost leakages and offer poor return on investment.

When organisations embark on a supply chain automation journey, catchphrases such as Industry 4.0, digital supply chain and 'factory of the future' are often used to express different aspects of the same vision. This can lead to conflicting initiatives, even though they share the same goals. In such situations, it's difficult to achieve tangible outcomes as priorities shift in response to trends. A certain amount of digital adrenaline is vital to achieving progress, but can be harmful if the speed, quality and coherence of initiatives are not managed with care across the organisation, particularly when dealing with rapidly evolving technologies.

That is the reason why an enterprise-wide, coherent AI and Robotics automation strategy is important to delivering concrete achievements that can scale up relatively quickly. The strategy will impact companies across most functions and business areas, but different parts will approach AI and Robotics automation with different needs and different levels of understanding. To be successful, programmes must carefully scope the business and supply chain ecosystem and consider the human element of such a change.

In future, some jobs will be fully automated, while others will transform, and new ones will be created. The human element of such a change should not be underestimated, and a robust AI-human talent strategy should be developed as part of any AI and Robotics automation programme. This will develop the capabilities, manage the cultural change and ensure sustainable outcomes.

We have identified five key objectives for organisations setting out on a transformational AI and Robotics automation journey.

TAILOR YOUR STRATEGY

- Generate ideas that will let you progress quickly while building a foundation for good long-term results
- Ensure your strategy can adapt to the learnings you'll make along the way rather than seek perfection immediately
- Engage with potential partners and vendors at the start to understand possibilities and limitations
- Assess the opportunities, define high-level use cases and get stakeholders' buy-in

The route to your AI and Robotics automation strategy should continuously be reviewed and checked using a rigid strategy framework. Use the same four questions you would for any strategy:

- What are you trying to achieve with AI and Robotics automation?
- Why do you need it, and why now?
- How will you design and implement it in your market and corporate environment, and how fast can you move?
- Where should you start and with whom should you work?

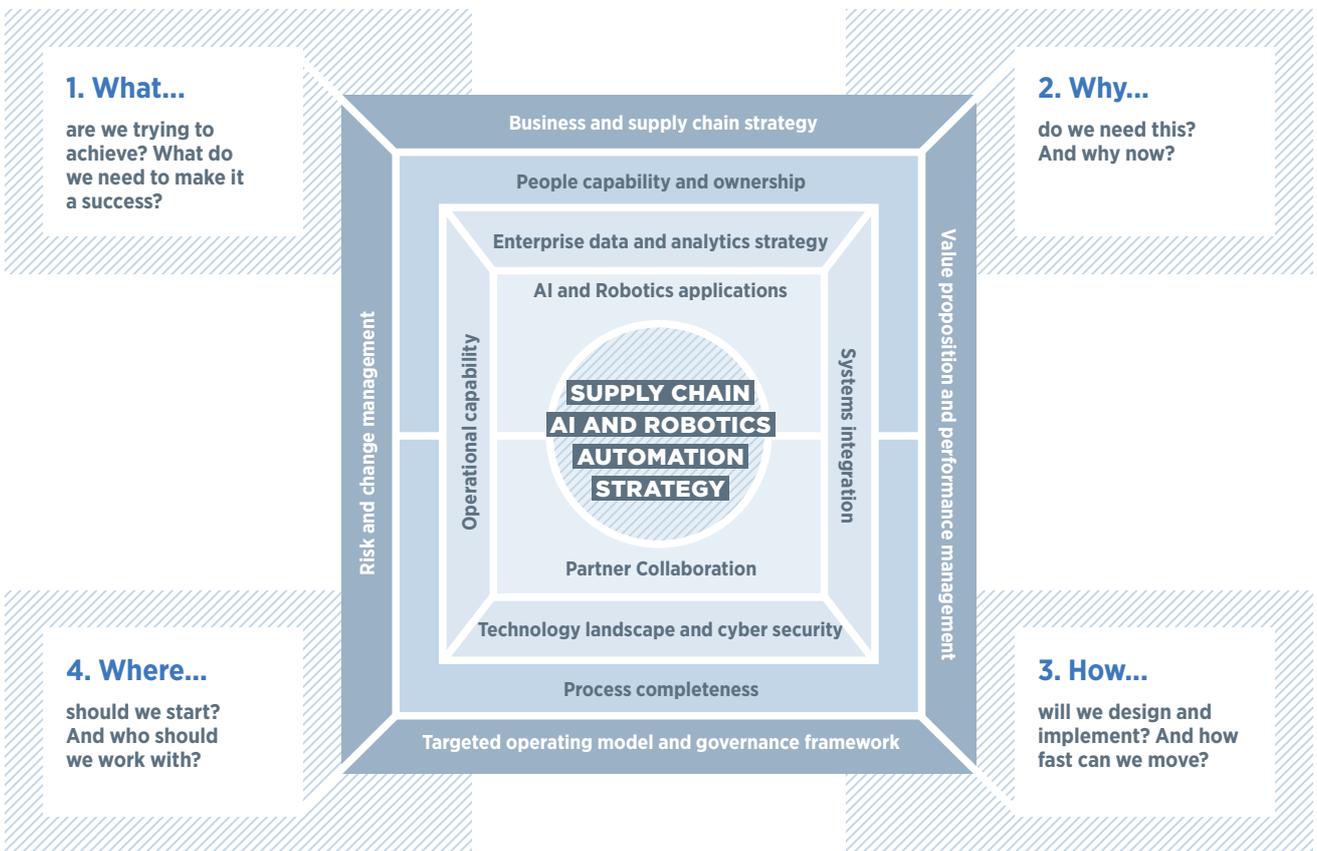


Figure 19: Supply chain AI and Robotics automation strategic framework

Source: PA Consulting Group

You need to develop your AI and Robotics automation strategy with the ‘think big, start small, scale fast’ philosophy.

Think big about where you want to be. Don’t get stuck with old systems just because they’re already there, for example.

Plan on taking small steps towards that big picture. Show automation working in one part of your supply chain first to develop your internal skill sets and build positive momentum.

Finally, scale your solution across the organisation. You’ve shown it already works, so getting buy-in shouldn’t be a problem.

ALIGN COHERENTLY

- Align your AI and Robotics automation strategy to the business ecosystem
- Clearly define its scope
- Identify process and integration gaps across the supply chain
- Select and map applications in detail
- Decide what technology to use and how to engage potential partners and vendors
- Develop a roadmap with a focus on an iterative experimentation culture

Your AI and Robotics automation strategy is highly dependent on your supply chain digitalisation scope and business ecosystem. It needs to take into consideration the current and desired state of the business entity, the overall supply chain, the individual plants, all the way down to the specific production equipment.

Successful examples show that an ongoing, iterative alignment with the overall business ecosystem is crucial to avoid isolated, stand-alone solutions during the implementation of your AI and Robotics automation strategy.

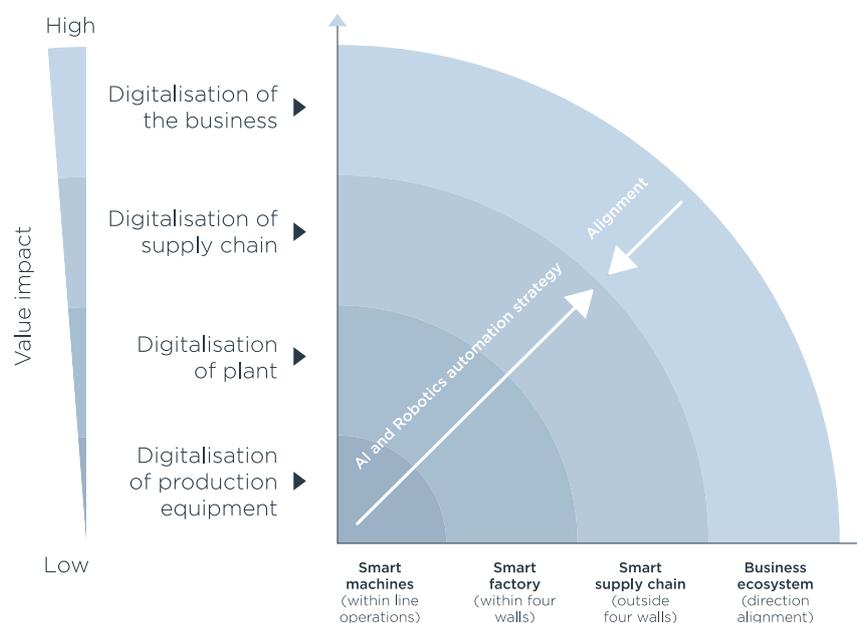


Figure 20: The value impact of AI and Robotics automation

Source: PA Consulting Group

Based on our experience, we believe there are a few critical factors that should help you to succeed:

A well-balanced top-down strategy and bottom-up commitment should be embedded through a test-and-evolve culture.

Automation of processes and activities must be clearly defined, allocated and prioritised (eg automating a transactional process could be a quicker win than automating a physical process).

Automation needs to address the touchpoints for horizontal (across value chain) and vertical (technology levels) integration.

Information technology, such as enterprise resource planning, must be integrated with operational technology, such as manufacturing execution system process control.

Create a digital roadmap to address the evolution of the technology stack and show the direction of travel from a technical standpoint.

ADAPT YOUR ORGANISATION

- Learn how machines and humans can complement each other to build a better whole
- Understand the impact on people
- Develop an AI-human talent strategy
- Test your culture with a pilot project and share the learnings

AI and Robotics automation is challenging the status quo, will affect jobs and will offer plenty of opportunities. Capturing those opportunities will make companies survive and thrive. And to do that, you'll need an HR strategy that finds the right talents and future needs.

Some jobs will become fully automated, others will transform and still others will be created. The AI-human talent spectrum will be a broad band, from 100 per cent human work to 100 per cent AI work. To manage the impact on people and organisations, you'll need an AI-human talent strategy:

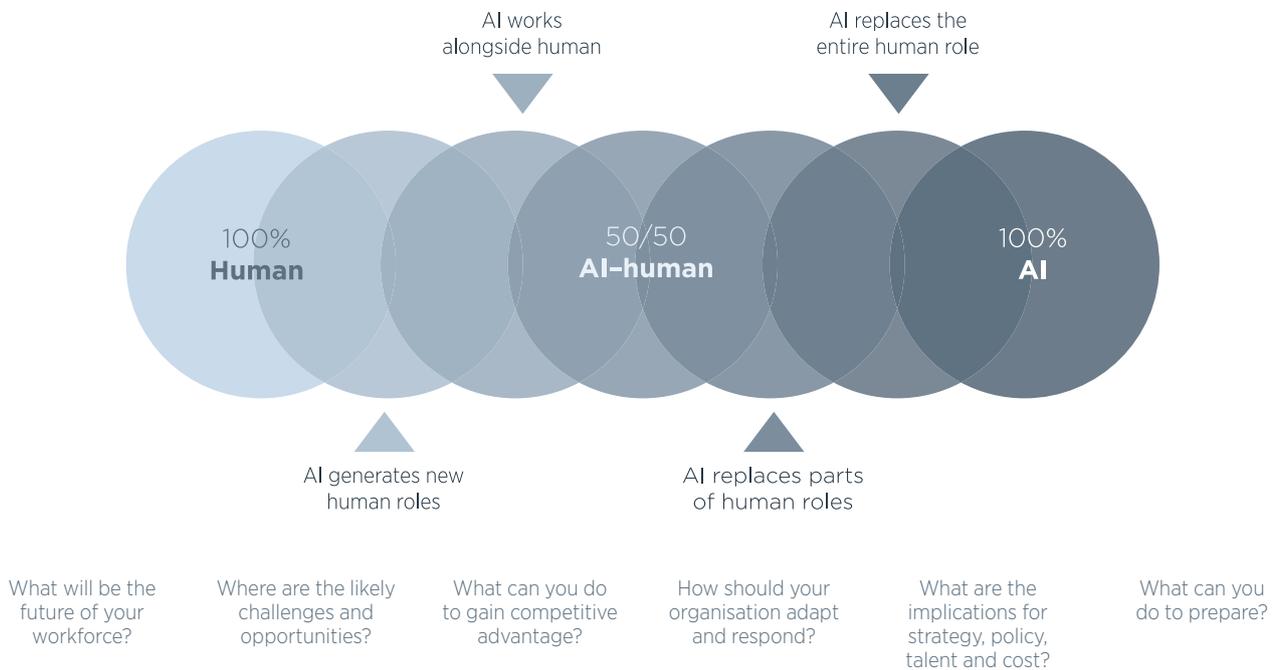


Figure 21: AI-human talent spectrum

Source: PA Consulting Group

- 1. Look for commercial, agile and transferable skills**

Recruit those with a commercial appreciation of the wider business and core technical skills that are transferable across functions. This will help future-proof your skills pool.
- 2. Understand the talent gap and outsource to maximise value**

It's normal for people to change employers every three to five years, posing a risk to investing time and money in training and development. You should, therefore, look out for talent outsourcing opportunities.
- 3. Collaborate to create a talent pool**

The skills gap can't be addressed by employers alone. A collaborative effort involving government, education and industry is needed to fill the long-term supply chain talent gap.
- 4. Innovate talent**

Hire entry-level graduates and give them experience in all supply chain functions and geographies. This will help create an internal talent pool that constantly creates value.

IMPLEMENT IN AN AGILE WAY

- Design and integrate processes and understand their impact on business
- Expand your data and analytics teams
- Form relationships with new vendors and business partners
- Develop selected applications and test them
- Leverage tested applications and deploy an iterative implementation process
- Learn, share and improve the experience to scale up

Successful implementation of an automation programme is based on targeted point solutions, established process and technology capabilities, and a clear business case. The change also needs to be managed in an agile way, involving experts in supply chain automation and business design, in order to develop a culture of using automation.

Learn from successful companies. There's value in having the outside-in view, and you can leverage third parties who have already challenged the inside-out norms. It's all about knowing your strengths, weaknesses, business priorities and the risks you're willing to take.

Continuous customer or stakeholder involvement is integral to the Agile approach. Direct feedback from customers or representatives in each sprint ensures that what is delivered meets expectations, and any mismatch in expectations is quickly addressed before money is wasted.

Risk can be reduced rapidly by focusing on regions, processes or products that represent the highest exposure to the business. Incremental delivery allows organisations to demonstrate real, tangible progress to regulators.

Agile is focused on delivering at an early stage, obtaining user feedback and making improvements quickly and routinely.

Enterprise automation can't be achieved by buying an off-the-shelf solution, it needs design thinking tailored to business needs. Typically, companies need to work with those who have both technical and organisational agile implementation experience to work as integrators agnostic of specific off-the-shelf technology or solution. In collaboration with integrators, companies must work with hardware and software vendors to build a data foundation and implement a fit-for-purpose and scalable capability.

PROTECT YOURSELF

- Minimise cyber risks, bolster your cyber security
- Establish trusted information security, interoperability and universal cloud interfaces

And finally, you must not underestimate the cyber risk.

More automation increases risk in two ways:

- Firstly, through overdependence on machines without people able to take over when needed.
- Secondly, through increased exposure to malicious attacks such as hacking.

Only 16 per cent of businesses cite data security issues in their top three barriers to digital technologies. But the risk is real.³⁵ If security isn't prioritised by businesses, it may undermine trust and slow take-up of, and benefits from, AI and Robotics automation.

You need to increase the overall trust in the systems your organisation operates, the information they hold and the people who have access to it. Cyber-security gaps must be investigated to drive out vulnerabilities and improve the resilience of your information technology infrastructure.

The main objective is to build 'digital trust'. This can be achieved in three steps:

- Understand digital risks. Identify the assets, systems and processes that are critical to business operations and understand the impact of their loss/disruption to the business.
- Protect critical assets. Define, design and deliver controls and improvements to protect the business, by ensuring that risks are addressed by all staff and business operations continuously.
- Respond to incidents. Enable the business to detect, investigate and respond appropriately to incidents to minimise disruption and ensure a swift return to business-as-usual operations.



RENTOKIL

Launching an award-winning IoT cloud platform to handle 24 million messages a day

Rentokil, a world leader in pest control, had spotted the potential of the IoT to improve services. The company wanted to roll out connected traps (fitted with a sensor that sends a message whenever a trap needs clearing) to 15,000 customer sites within less than a year.

Working with Google and using Agile techniques, PA's digital experts took just 12 weeks to develop and launch a new cloud platform to support the roll-out. The platform offers Rentokil infinite scalability for the future and, with this, the opportunity to explore new ways of using data to transform its business.

Source: PA Consulting Group



If you'd like to know more about our research or our work in AI and Robotics automation, please get in touch with:



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ABOUT PA



An innovation and transformation consultancy, we believe in the power of ingenuity to build a positive human future in a technology driven world.

As strategies, technologies and innovation collide, we turn complexity into opportunity.

Our diverse teams of experts combine innovative thinking and breakthrough technologies to progress further, faster. Our clients adapt and transform, and together we achieve enduring results.

We are over 2,600 specialists in consumer, defence and security, energy and utilities, financial services, government, healthcare, life sciences, manufacturing, and transport, travel and logistics. And we operate globally from offices across the Americas, Europe, the Nordics and the Gulf.

PA. Bringing Ingenuity to Life.

ABOUT THE CONSUMER GOODS FORUM



The Consumer Goods Forum is a global, parity-based industry network that is driven by its members to encourage the global adoption of practices and standards that serves the consumer goods industry worldwide.

It brings together the CEOs and senior management of some 400 retailers, manufacturers, service providers and other stakeholders across 70 countries, and it reflects the diversity of the industry in geography, size, product category and format. Its member companies have combined sales of €3.5 trillion and directly employ nearly 10 million people, with a further 90 million related jobs estimated along the value chain. It is governed by its board of directors, which comprises more than 50 manufacturer and retailer CEOs.

For more information, please visit www.theconsumergoodsforum.com

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