

Inmarsat
Research
Programme



The Future of **IoT** in Enterprise – 2017

 inmarsat



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About Inmarsat

Inmarsat plc is the leading provider of global mobile satellite communications services.

Since 1979, Inmarsat has been providing reliable voice and high-speed data communications to governments, enterprises and other organisations, with a range of services that can be used on land, at sea or in the air. Inmarsat has more than 60 locations around the world, with a presence in the major ports and centres of commerce on every continent. Inmarsat is listed on the London Stock Exchange (ISAT.L).

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About Inmarsat Enterprise

Inmarsat Enterprise is enabling the connected world. Focusing on the provision of satellite connectivity and IoT solutions for land-based businesses, Inmarsat Enterprise operates globally across a diverse set of sectors including agritech, aid and NGO, energy, media, mining and transport.

Methodology

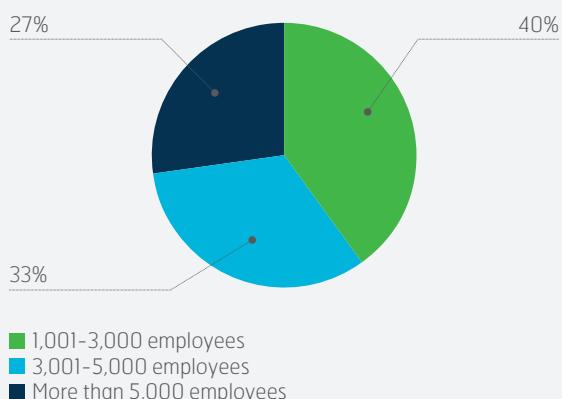
In May 2017, Vanson Bourne, a specialist technology market research company, interviewed 500 respondents about their use of, attitude to, and predictions for IoT within their organisations.

These respondents were qualified by their involvement in their organisations' IoT-based solutions, and by the size and type of organisations they work for:

All the respondents work at organisations that employ at least 1,001 employees.

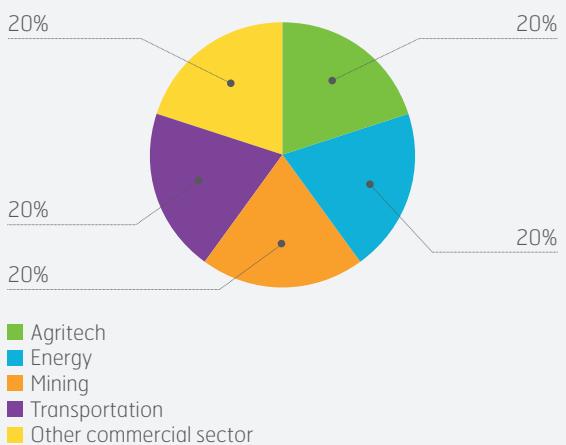
All respondents have either decision-making, influencing, or executional responsibilities for IoT initiatives in their organisations. They represent a broad range of functions within their organisations, including business strategy, engineering, information technology, and operations.

Respondents by size of organisation



Respondents were divided evenly between four target industries – agritech, energy, mining, and transport – and a fifth category that included a collection of industries. This 'other' category was included so that we could draw conclusions about IoT within the broader business community, and compare those to our target industries.

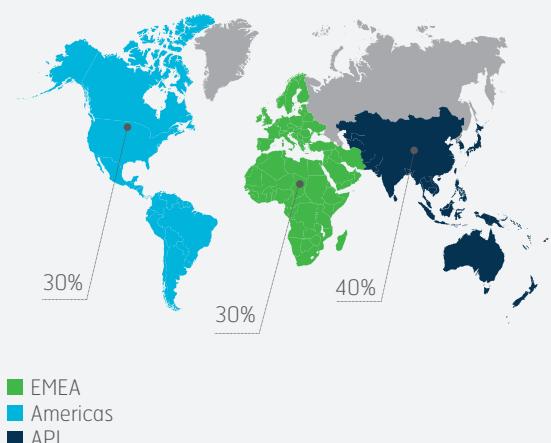
Respondents by sector



The geographical mix of respondents, which were sourced from throughout EMEA, the Americas and Asia-Pacific, also provided us with a global and representative picture of the market.

With a broad array of organisations canvassed – some firmly rooted in previous industrial revolutions and some very much responding to recent technological developments – the findings offer a barometer on the ways that these sectors are changing, thanks in no small part to IoT.

Respondents by region



Executive summary

We are trained from an early age to view history in easy to understand blocks of change. Antiquity, medieval, the renaissance, industrial revolution, and the modern era all have their clearly defined periods. However, it is far harder to picture a new age when you are living through it. Yet the new digital age we are entering is turning everything we do and think on its head at a breath-taking pace. It really will be a new age – a Fourth Industrial Revolution – where life for all of us will be nothing like what has gone before. Advances in miniaturisation, wireless connectivity, and increased data storage capacity mean that we can transform everyday objects into a network of information that allows us to understand our world more than ever. The Internet of Things (IoT) has become the vanguard ushering in this new age. It is the eyes and ears of the world around us and is enabling radical change in our homes and work.

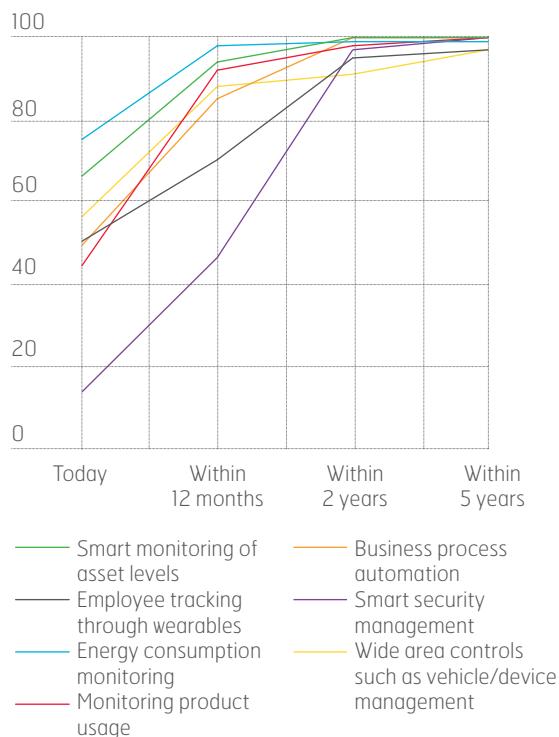
The Inmarsat Research Programme is dedicated to understanding the IoT phenomenon in some of our most important industries – agritech, energy production, transportation, and mining. These sectors are the foundation to security and stability in the world. By 2050, world population will hit 10 billion people, which will demand entirely new thought processes if we are to live sustainably and peacefully on this planet. We will need new production methods if we are going to feed everyone. Mass urbanisation will challenge how we connect our cities and enable transportation across the world. The demand for energy will only increase, putting huge strain on the need to improve sustainability and energy efficiency. And without the raw materials from mining, our ability to build the infrastructure needed for a growing society will be severely restricted.

Our research confirmed that IoT is currently the most prominent technology in the digital transformation that is washing through businesses the world over. 82 per cent of respondents told us they will have adopted some form of IoT within the next two years. It has taken a lead over other forms of innovation – but importantly this is because without the sensors and the information they provide, many other innovations stall. Machine learning, robotics, automation, 3D printing, artificial intelligence and augmented reality in many circumstances can only bring significant value when they are guided by the most accurate data possible. IoT is the foundation for all these technologies so it is little wonder that we have picked up in our research that it is being deployed at the rate that it is.

However, this is not to say that there are not significant challenges for organisations. A more connected world brings with it a host of issues that many feel ill-equipped to currently handle.

Data has become vital and a decisive factor in the profitability and success of nearly every organisation, making data theft ever more attractive for criminals. Three quarters of respondents in our survey agreed that they needed to improve their processes to protect against malicious attacks; and just over half reported the need to reduce the risks of accidental misuse by employees. Time is not on their side, and the speed of IoT development makes it critical that the sectors surveyed overhaul their approach to security to smooth the transition to becoming digital-first businesses.

Anticipated future deployment of IoT amongst organisations that have already deployed IoT (by application) (%)



21%

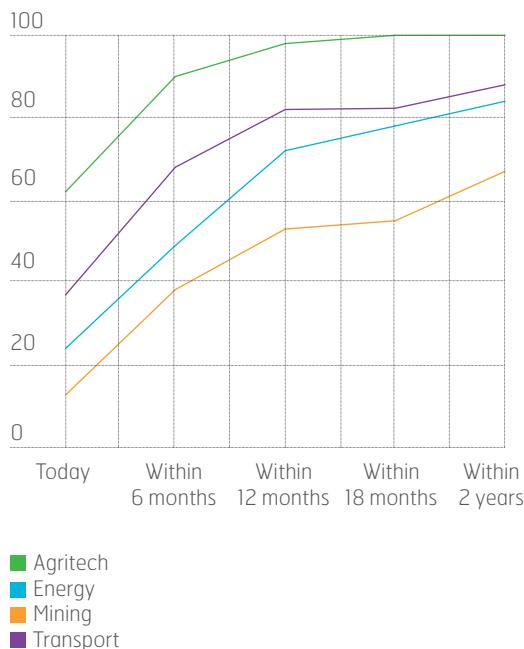
of respondent organisations
have fully deployed
IoT-based solutions

33%

of respondent organisations
have already at least partially
deployed IoT-based solutions

The collection of data is one thing. However, without the connectivity to transfer that data to the right place for analysis it is useless. A common challenge for the sectors that we surveyed is the remoteness of their operations. Whether it is an opencast mine, an oil rig, or farm, each of them faces a challenge in getting the level of connectivity that they require. Even in city areas, transport networks struggle with the reliability of connectivity to maximise the use of IoT based solutions.

Anticipated future IoT deployment levels (by sector) (%)



The third big challenge is a global skills shortage. The development and deployment of IoT is a new phenomenon spreading over every industry in every part of the world. Yet, the IT skills needed to innovate and manage the technology are in short supply. Shortages in the fields of data security, analytical data science and technical support are acute.

Does your organisation have the skills to make the most from IoT at a delivery level?



- We have all the skills we need
- We would benefit from additional skills at this level
- We are lacking the skills we need at this level

The result of these challenges is that organisations are working more collaboratively than ever, using partners in multiple ways to plug the gaps to deliver IoT successfully. IoT acts as the eyes and ears of organisations and its value comes from applying the data it produces to drive innovation that improves effectiveness. Developing new technology is complex and draws on many different types of skills and experiences. Reliable network infrastructure providers that can operate anywhere in the world need to work closely with end-user businesses to make sure they understand their operational needs.

Is your organisation using/planning to use external partners in the development and deployment of its IoT-based solutions?



- All managed in-house
- Use an external provider to assist with some of this
- Use an external provider to assist with as much of this as possible
- It has not yet been decided

Innovative companies with sector-specific knowledge need to draw in a network of specialist organisations and work with their customers to ignite innovative new ways of doing things better. And everyone in this network needs to work in a continuous cycle, edging upwards to new heights of efficiency. The Fourth Industrial Revolution is upon us!

82%

of respondent organisations will have deployed an IoT-based solution within two years

Agritech





The future of the agritech sector

By 2050, the agricultural sector will need to be capable of feeding a global population of 9.7 billion people (a third bigger than the current population) in a way that maintains sustainable productivity in the face of environmental challenges, changing consumer demands, and an ever-increasing array of regulations and standards.¹

Technological advances offer a way to drastically improve efficiency and this potential is not being ignored by the burgeoning agritech sector. The sector's enthusiastic embrace of IoT technology augurs how smart sensors in a network can transform agricultural operations, making precision farming the norm. Once farms have this kind of network in place, they will have the volumes of quality data they require to drive AI and machine learning technologies that could yield huge increases in productivity, reduce water, food wastage and generally find new ways of farming sustainably.

¹ Source: United Nations Department of Economic and Social Affairs, <https://esa.un.org/unpd/wpp/Download/Standard/Population/>

Growing sustainability standards are sowing the seeds of innovation

Consumers are increasingly keen to understand the provenance of their food and are developing a taste for organic and free range options. Along with government environmental regulations and pressure exerted by shareholders, environmental and social sustainability has been pushed to the top of the agricultural agenda. The net result is a framework of complex standards and regulations, many of which present logistical and operational challenges for the industry. As food production becomes increasingly globalised national standards are being transferred abroad as a pre-condition of agricultural businesses exporting into their markets.

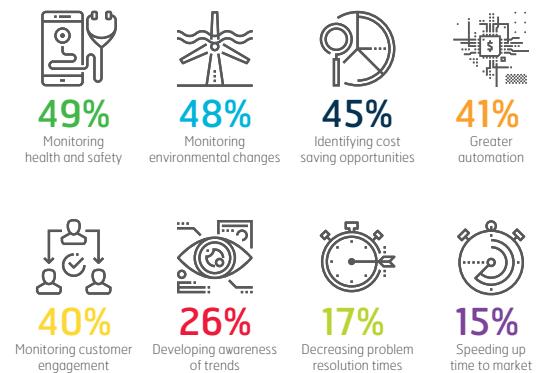
Perhaps unsurprisingly, this need for sustainability has been one of the core drivers of IoT in the agricultural sector; technology that makes it possible to gain a clear picture of the journey that food takes from 'seed to bin' and from 'farm to fork'.

Deploying IoT sensors at different points in the supply chain can go some way to helping agritech businesses meet their sustainability requirements, from the use of precision irrigation and fumigation systems to limit environmental impact to devices that enable the intelligent monitoring of food safety and staff hygiene.

An example of the ways that IoT is being used to help developing markets adapt to more stringent regulations comes from Indonesia. Its fishing fleet – one of the largest in the world – has to meet traceability standards in order to export into the US and the EU.² A key part of this is the installation of IoT sensors into the fishing fleet to track fishing activity and prove that fish are not being caught in overfished regions. Additionally, the monitoring makes the lives of fishermen safer, as they are tracked, combatting piracy and making them easier to insure.

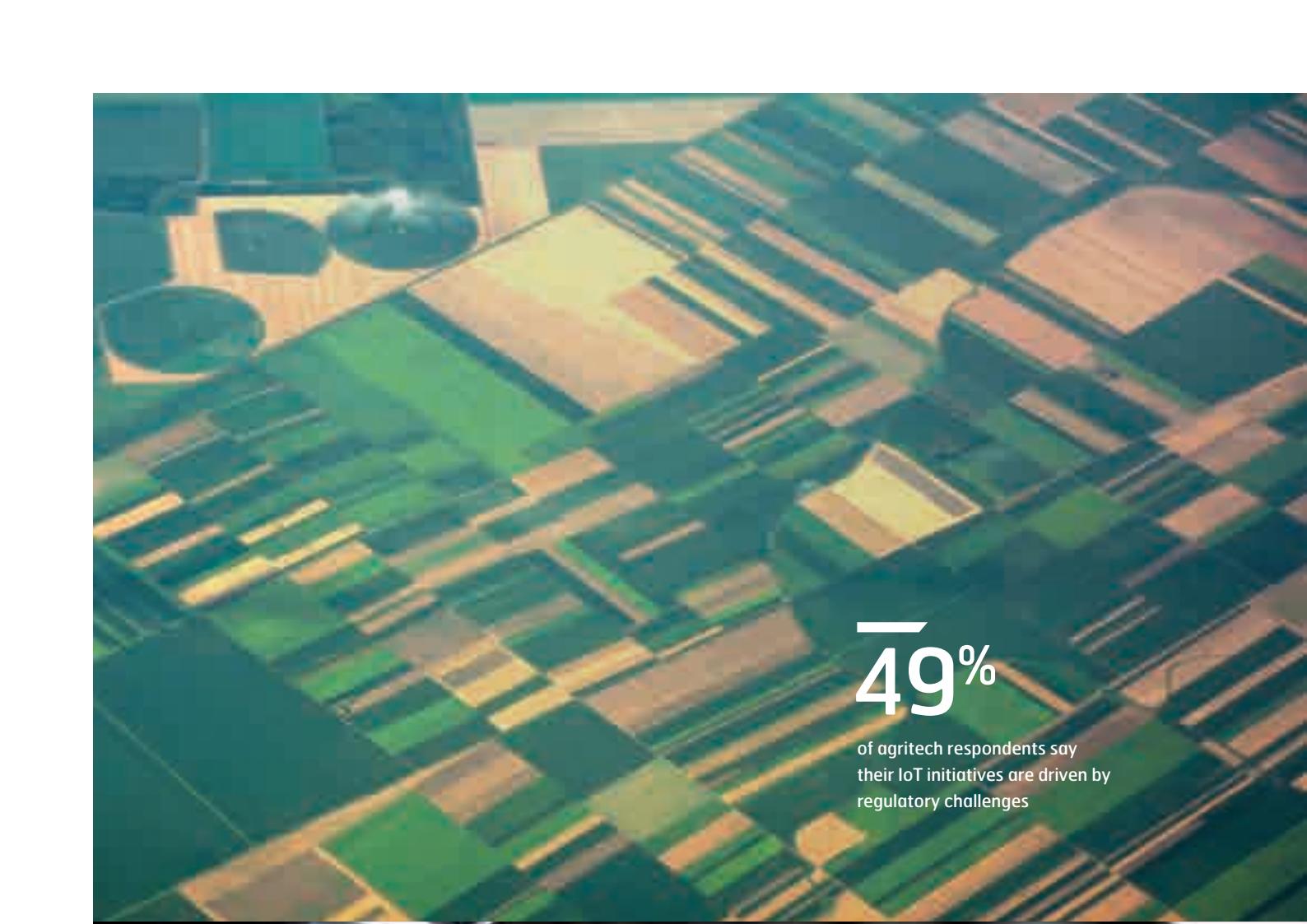
IoT, combined with other elements of digital transformation, is essential to minimise the burden and costs of new regulations. IoT can boost the globalisation of food production, enable access to new markets and create greater prosperity in the developing world. No wonder it is such a focus for agritech businesses today.

What are your organisation's priority areas for the deployment of its IoT based solutions?



IoT is making it possible to gain a clear picture of the journey that food takes from 'farm to fork'.

²Source: United States Department of Agriculture, Foreign Agricultural Service, <https://www.fas.usda.gov/data/indonesia-indonesia-revises-seafood-import-rules>



49%

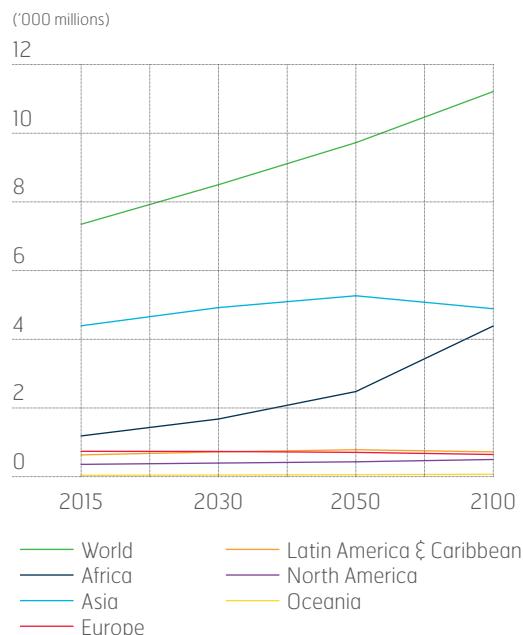
of agritech respondents say
their IoT initiatives are driven by
regulatory challenges



We must achieve far more, with far less, to avoid food poverty

By 2050, the world's population will be a third larger than it is today, meaning global food production must be boosted by 70 per cent in order to feed these extra mouths.³ This will put immense pressures on the planet and the industry must drastically reduce the ratio of land and resources needed to produce the food that we need if it is to meet this challenge. Waste is also a pressing issue, and it's critical that we can take action to reduce the amount of food lost and wasted along the supply chain, amounting to around 1.3 billion tonnes a year. In short, food producers and processors need to get smarter, leaner and faster.

Global population projections



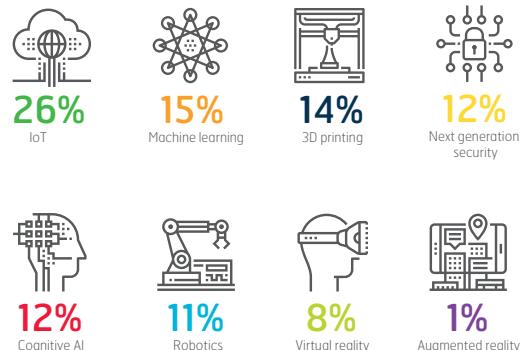
Source: United Nations, 2015

New technology, and particularly IoT, is a significant part of the answer to this challenge, and it is by and large delivering on that front. 52 per cent of agritech respondents have improved the sustainability of their operations with IoT while 45 per cent have improved staff productivity and 36 per cent have driven down costs, enabling greater efficiency.

Blue River Technology's IoT-based LettuceBot, a high precision lettuce thinning robot which has been shown to boost farm yields by 10 per cent, is a compelling example of the innovation IoT can enable, though the applications go further still.

For example, predictive analytics of IoT data can bring significant benefits for agricultural production. Being able to predict how the microenvironment will change depending on varying weather conditions enables farmers to take precautionary measures to protect their crops as needed, maximising potential yield. Predictive analytics can also be used to estimate crop yields based on the information being collated from the fields. This ensures that farmers and their customers can tailor their supply chains accurately to crop yields later in the year, reducing unnecessary logistics and labour costs.

Which digital transformation areas are being prioritised by your organisation?



Agriculture is both an ancient profession, slow to change with the majority of production based at the SME level, and one at the cutting edge of innovation, forced to tackle significant global issues. Perfecting the technology to efficiently feed the world as it undergoes a dramatic set of changes will be challenging, but with the right focus, investment and innovation it is achievable.

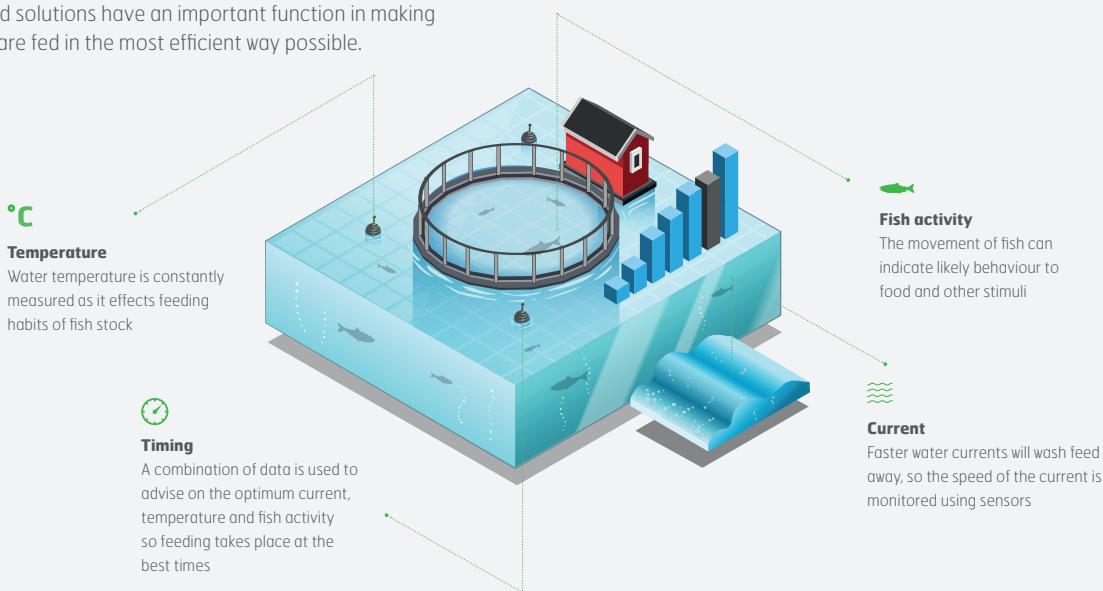
³Source: United Nations Department of Economic and Social Affairs, <https://esa.un.org/unpd/wpp/Download/Standard/Population/>

Doing more with less

Population growth and changing eating habits are leading to a rapid increase in the demand for food. To meet the challenge, farmers will need to produce far more, with less waste, and far fewer resources.

Fish farming

Food is one of the largest ongoing costs for fish farmers and minimising waste can add significantly to the bottom line. IoT-based solutions have an important function in making sure fish are fed in the most efficient way possible.

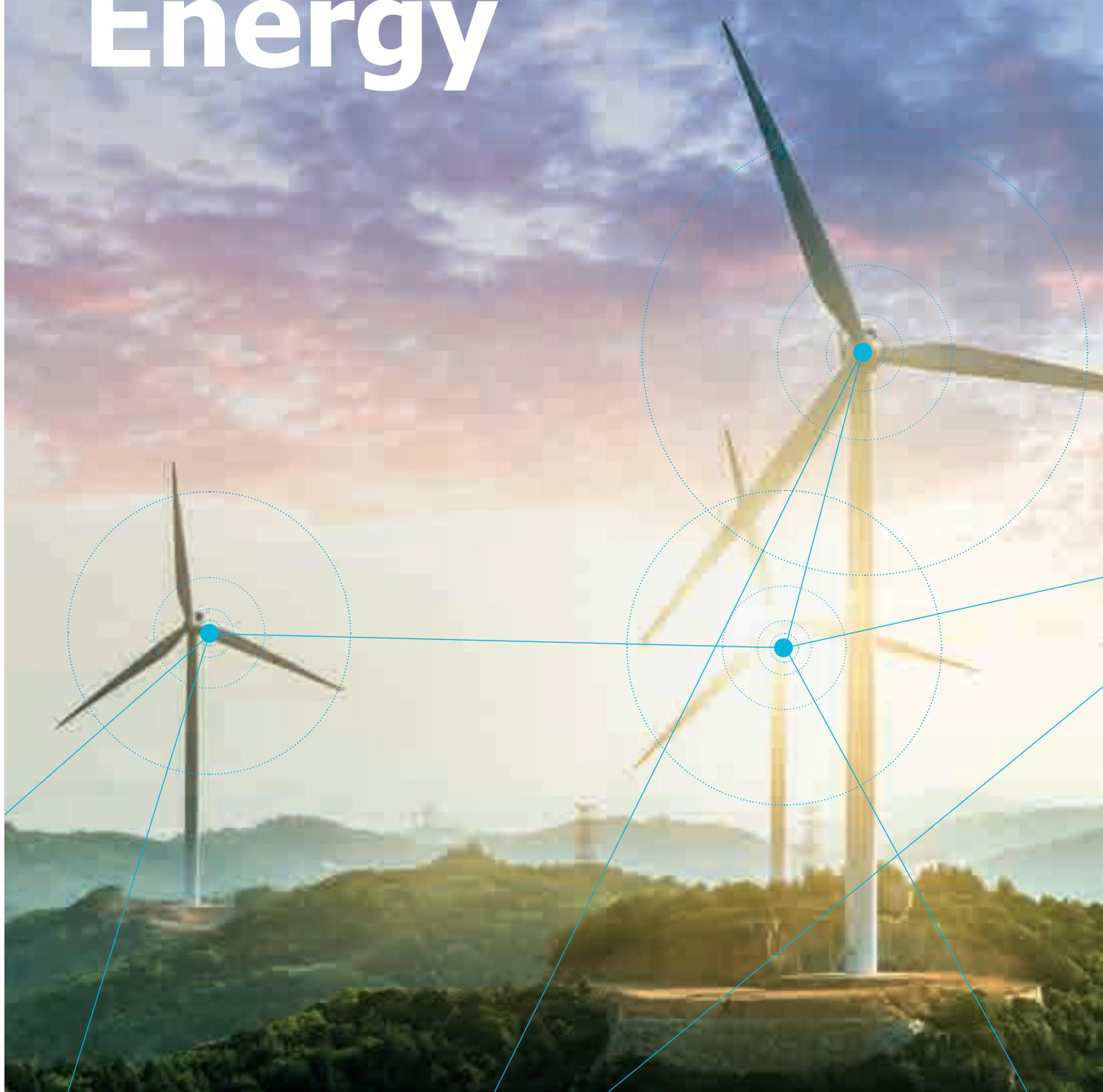


Almond farming

Every almond takes a gallon of water to produce. Precision farming can reduce water consumption by 20 per cent.



Energy



The background of the page features a photograph of a wind farm at sunset or sunrise. The sky is filled with warm, orange and yellow clouds. In the foreground, several wind turbines stand on a grassy hillside. Overlaid on the image is a network diagram consisting of blue lines and circles. Three specific wind turbines are highlighted with solid blue circles and connected by lines to a central point, suggesting a communication or data exchange between them.

The future of the energy sector

With renewable sources gaining momentum and fossil fuel reserves under scrutiny, the energy sector's future will be determined by how effectively it embraces new technological advances.

Our research shows that it is keen to advance towards IoT solutions, and this is unsurprising when you consider that smart sensors combined with robotics are making it possible for energy companies to extract fossil fuels from locations that until only recently were deemed too inhospitable. Meanwhile, renewables have already benefited greatly from embracing technology, with falling panel production costs and enhanced energy generating capacity driving increases in ROI. IoT offers the foundation for a smarter grid for renewables that adapts to changing weather conditions and maximises output. Security and connectivity, however, are key challenges for this strategically important sector, and technological advances will only further expose its vulnerabilities. As energy organisations look to replace ageing infrastructure for regulatory purposes, there is an opportunity to introduce new technological elements to optimise performance.

Connectivity set to make or break IoT in the energy sector

IoT adoption is fast advancing amongst those energy companies who are looking to further reduce costs and improve productivity and safety. This adoption of IoT technology can largely be attributed to the benefits of remote monitoring of equipment and production sites. By combining different components in energy systems with sophisticated sensors, companies can collect important data remotely and therefore gain essential insights into the overall health of their operations and areas that can be optimised.

Which of the below statements best describes your organisation's current status when it comes to deploying IoT-based solutions?



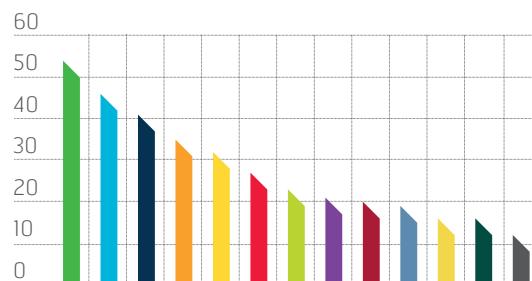
- We have fully deployed IoT-based solutions
- We have partially deployed IoT-based solutions
- We plan to deploy IoT-based solutions within 6 months
- We plan to deploy IoT-based solutions within 12 months
- We plan to deploy IoT-based solutions within 18 months
- We plan to deploy IoT-based solutions within 2 years
- We are in the process of developing IoT-based solutions

Examples of this in action include the continuous monitoring of operations and production sites, such as oil rigs, solar panels and wind turbines, to ensure these systems work at the maximum possible efficiency, as well as the ability to gain real-time insights to ensure equipment is reacting appropriately to environmental conditions. Given their typically-remote operations, the ability to do this from a central control point and without manual intervention promises to be a benefit for the industry.

Connectivity, however, could leave a significant portion of the energy market unable to capitalise on this technology's transformational capabilities. As indicated by our research, this danger has not escaped the notice of energy organisations. Over half state that connectivity is a challenge that they face, and, more worryingly still, 24 per cent believe that connectivity issues could derail their IoT deployments before they have even begun.

For IoT deployments to succeed, connectivity must be constant enough to collect and transmit data between multiple devices, as without consistent data insights companies are unable to suitably monitor their assets. Effective connectivity is also necessary to ensure the safety of personnel in more remote locations or where safety or environmental hazards might be an issue, by ensuring availability during difficult times or emergencies. This is where satellite connectivity comes into its own, providing not only connectivity for remote locations but also providing a highly reliable and resilient service on a global scale.

What challenges is your organisation facing in deploying your IoT-based solutions? (%)



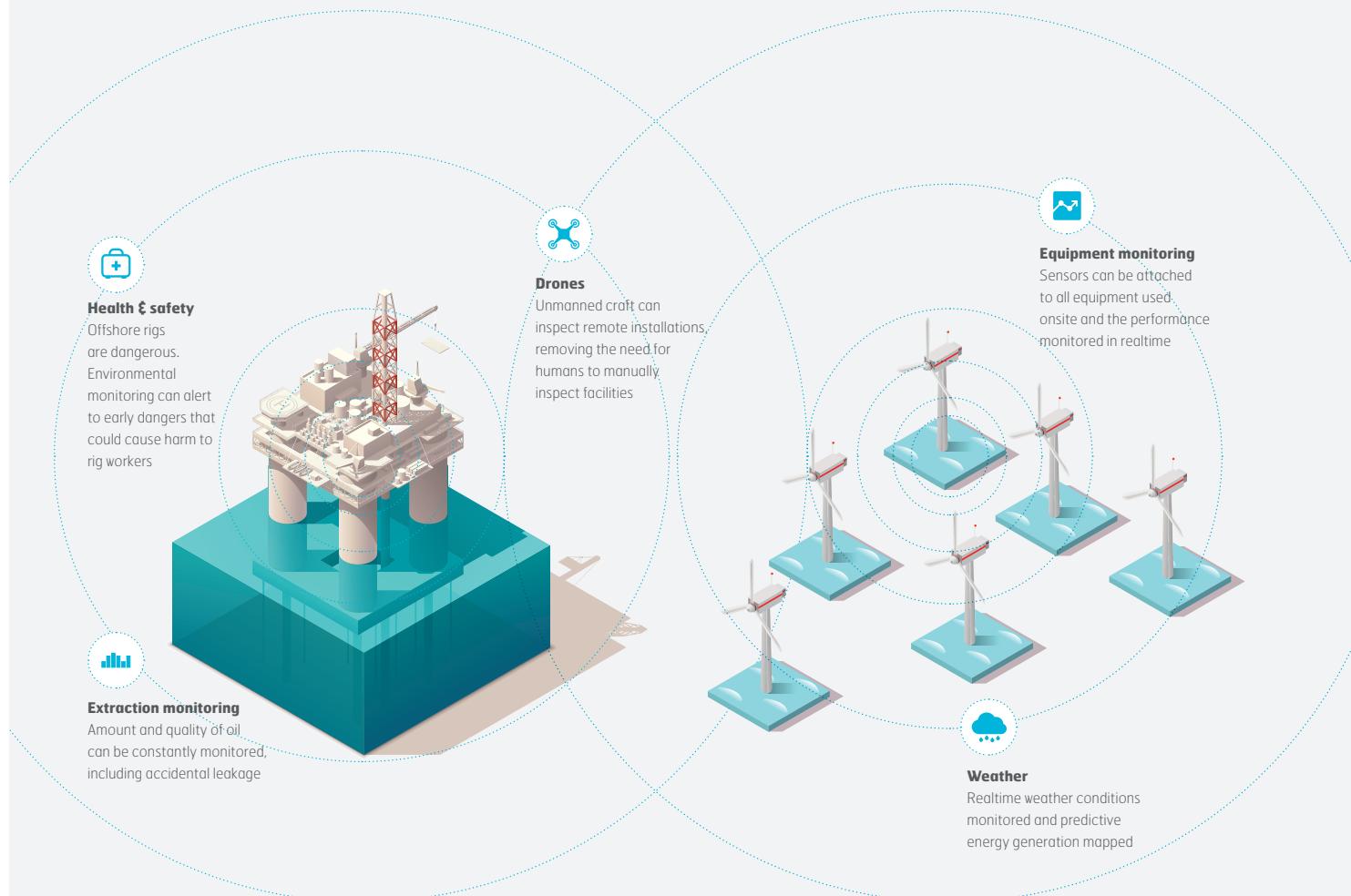
- Connectivity issues
- Integrating IoT technology with existing platforms
- Existing infrastructure complexity
- A lack of in-house skills
- A lack of vision into the potential for IoT
- Security implications
- IoT not being prioritised by the board
- Costs higher than expected
- Business culture cannot evolve
- Cannot scale past prototypes/trials
- Employee resistance
- Concerns over regulations
- Data-driven culture prevents wider uses being considered

24%

believe that connectivity issues threaten to derail their deployments before they have even begun

Bringing remote operations together

The ability to monitor remote operations like oil rigs and wind farms is creating a range of efficiencies and system improvements. But the successful adoption of digital technologies depends on strong connectivity for data transfer.



CONTROL CENTRE

Environment data

Information can be collated from across organisations' remote site, and measures put in place to minimise the environmental impact of extraction

Predictive maintenance

Equipment failure can be accurately predicted and efficient logistics established for swift replacement

Data analytics

Data can be drawn together from across an organisation's operations and algorithms established to find new ways to improve performance

Augmented reality

Data analysts can explore data more effectively using augmented reality tools that improve human-to-technology interaction

Machine learning and artificial intelligence

Humans can be removed from some decision making and control centre activities altogether when tools can learn autonomously to respond to data as it is analysed

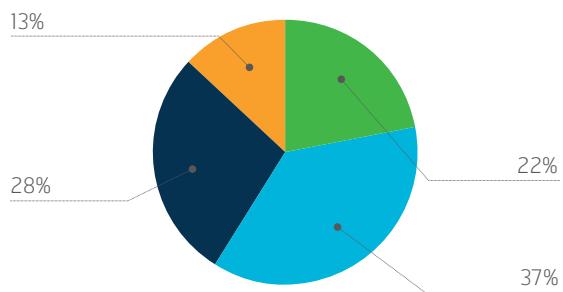
Powering up for IoT security

Growth in renewables, accelerating levels of urbanisation and the availability of new digital technologies are driving unprecedented change in the global energy sector. Energy companies increasingly seek to adopt digital tools such as IoT to contend with some of the large-scale operational, maintenance and distribution challenges they face. This is, however, bringing new difficulties to the fore – amongst them, security is perhaps one of the most hazardous.

Today's cyber threats are persistent, well organised and constantly evolving. The energy sector is a prime target for bad actors, as it underpins every country's society and economy. A breach or service disruption could have potentially disastrous consequences, which might involve large-scale data theft or even targeted attacks on infrastructure, potentially leaving entire regions without power.

Security must therefore be at the top of the agenda for those looking to take advantage of IoT. The expansion of internet connectivity is eroding the traditional enterprise perimeter, as more data flows outside of an organisation's immediate defensive layer, presenting hackers with a larger surface area to compromise. It is therefore concerning that so many energy companies feel that they need to rethink their approach to data security to deploy the IoT safely.

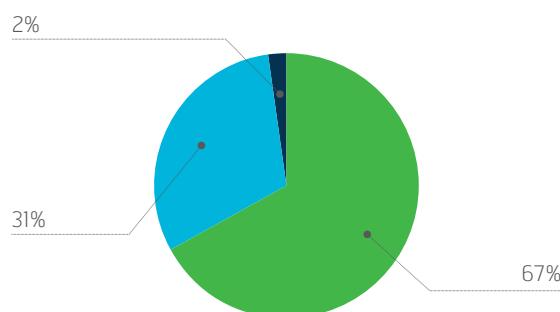
How well do you think IoT is understood at the board level of your organisation?



- It is not understood at all
- It is only partially understood
- It is mostly understood
- It is fully understood

While many energy companies are well aware of the security challenges that accompany IoT deployments, success will be largely dependent on board level support and understanding. Without a solid appreciation of IoT and its security necessities at a leadership level, it's almost impossible to enforce the appropriate security measures across the business – and this is something that is currently lacking in too many organisations.

Which statement best describes your view of data security and IoT?



- We will need to rethink our approach to data security and make heavy investments to meet IoT security requirements
- The use of IoT will mean that we need to evolve our data security measures but this will be straightforward and not involve significant resource investments
- It creates no new challenges for us and our existing approaches to data security are adequate to meet IoT security requirements

As is the case with any technology, nothing is ever static, and energy companies will therefore need to continuously learn and evolve through a recurrent cycle of improvement to ensure security risks are constantly reduced. Organisations must remain alert and diligent; this might involve monitoring networks more closely and ensuring the right questions are asked to ensure IoT connections are secure: how much data is being gathered? Who has access to this information? Where is it being stored?



Mining





The future of the mining sector

The mining sector faces a number of serious challenges that are likely to intensify, including the commodity downswing and the increasing scarcity of high-quality ore deposits. Traditionally a “fastest follower” in innovation, the sector will increasingly look to the digital revolution to increase its productivity, with technologies such as IoT providing the building blocks for a smarter mine.

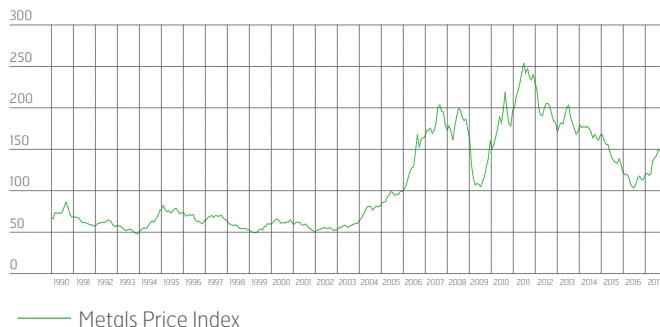
By deploying connected smart sensors in a network, IoT makes it possible to automatically pick up data from previously elusive locations and for this data to be communicated rapidly to other devices. This will sow the seeds for a network of automated devices that adjusts to environmental conditions in real-time, and will enable mines to take more workers out of dangerous locations and replace them with robotics. However, historically sluggish mining companies will need to develop new skill sets if they are to embrace digital technology’s promise.

Digging deeper: going beyond the commodity cycle through innovation

As the supplier of the raw materials that make up the modern world, from iPhones to eyeglasses, the mining industry is exposed to global economic forces that determine demand for its goods. Mining organisations have therefore historically been conditioned by the global commodity cycles, characterised by boom periods followed by downswing phases, and back again.

The predictability of this cycle means that mining organisations often maximise pure volume during the favourable conditions of boom phases, while turning to sharp cost-cutting measures during downswings. This cyclical pattern is problematic because it is short-term – every move which deviates from the norm must have an immediate and calculable pay-off in profitability.

International Monetary Fund, Metals Price Index, 1990-2017



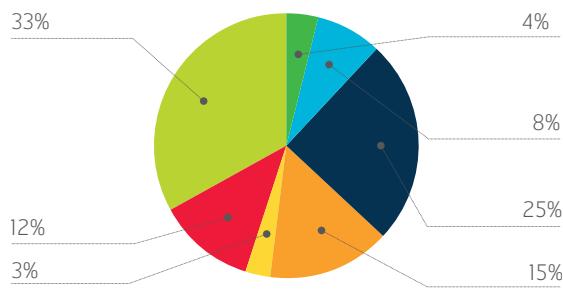
With the depletion of high grade, easily accessible ore bodies in stable jurisdictions putting structural pressure on mining organisations, it's becoming increasingly important for them to find ways to improve productivity in a way that transcends the ebbs and flows of the global commodity market – and technological innovation offers a way forward.

While mining is lagging behind other sectors in its adoption of new technology, it can afford to be bolder – the World Economic Forum has calculated that the economic impact from digital transformation for the mining sector could be between \$428 billion to \$784 billion for the period 2016-2025.⁴ There has been, however, been some significant progress in mining businesses taking a digital-first approach.

For example, the Rio Tinto Mine of the Future has seen the deployment of the largest fleet of automated haulage trucks in the world and the development of an automated long distance railway system.⁵ The automated trucks have already saved approximately 40,000 litres of fuel every year, and reduced haul and load operating costs by approximately 13 per cent. IoT-based solutions can also have an impact in the development of automated exploration drones, enabling a more accurate assessment of territory before drilling begins.

Despite these examples, it is impossible to not see in our latest research that the mining sector is in the very early stages of IoT development. With persistently low productivity taking its toll, however, the industry needs to adjust its approach if it is to find its way out of the doldrums.

Which of the below statements best describes your organisation's current status?



- We have fully deployed IoT-based solutions
- We have partially deployed IoT-based solutions
- We plan to deploy IoT-based solutions within 6 months
- We plan to deploy IoT-based solutions within 12 months
- We plan to deploy IoT-based solutions within 18 months
- We plan to deploy IoT-based solutions within 2 years
- We are in the process of developing IoT-based solutions

⁴ Source: World Economic Forum,
<http://reports.weforum.org/digital-transformation/wp-content/blogs.dir/94/mp/files/pages/files/wef-dti-mining-and-metals-white-paper.pdf>

⁵ Source: World Economic Forum,
<http://reports.weforum.org/digital-transformation/wp-content/blogs.dir/94/mp/files/pages/files/wef-dti-mining-and-metals-white-paper.pdf>



12%

of mining respondents have
fully or partially deployed
IoT-based solutions



Data — the new gold for the mining sector

In an information-rich world, data has become a source of competitive advantage for businesses, and mining is no exception. The value of being digital-first is significant – with 2025 EBITDA projections for the most innovative mining companies being 70–200 per cent higher than digital laggards. Despite this, mining organisations put less than 1 per cent of their data to effective use.⁶

Mining organisations need to look at data as they might do a precious metal, and establish the infrastructure and expertise to extract, share, and analyse this new gold. On top of this, they also need to build data security throughout their operations to protect this highly valuable asset.

Miners already produce large amounts of data from sensors embedded across operations – either directly such as through surveys, or indirectly as a by-product from their general operations. Machine learning and improved statistical techniques mean previously unseen patterns from this data can be made visible and used to improve productivity in, for example, the flow of mined materials from initial extraction to processing and final transportation. Data from the entire process journey can be collated and analysed for pinch-points where inefficiencies often occur, enabling the production of a highly specific plan for each mining operation to improve performance.

To what extent does your organisation have the skills to make the most from IoT at the following levels?

Strategic level



Management level



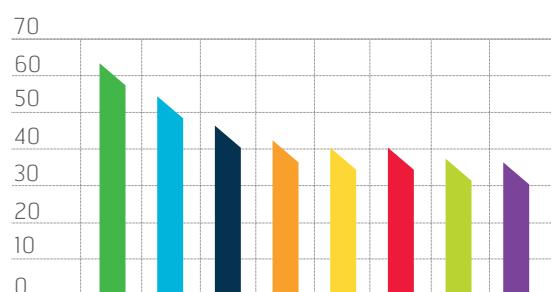
Delivery level



- We have all the skills we need
- We would benefit from additional skills at this level to augment those we have
- We are lacking the skills we need at this level

However, mining faces additional challenges in attaining the relevant skills to make the most of its data – its workforce is ageing and while older workers possess more deep industry knowledge, they are also less comfortable with digital tools. With millennials often not looking favourably at the mining industry and shunning more mechanical-physical careers, it is not surprising that the mining industry has a skills shortage when it comes to IoT. It is highly probable that this shortage is contributing to the delayed development of digital-first operations when compared to other sectors in this research project.

What additional specific skills do you think your organisation needs to deliver IoT? (%)

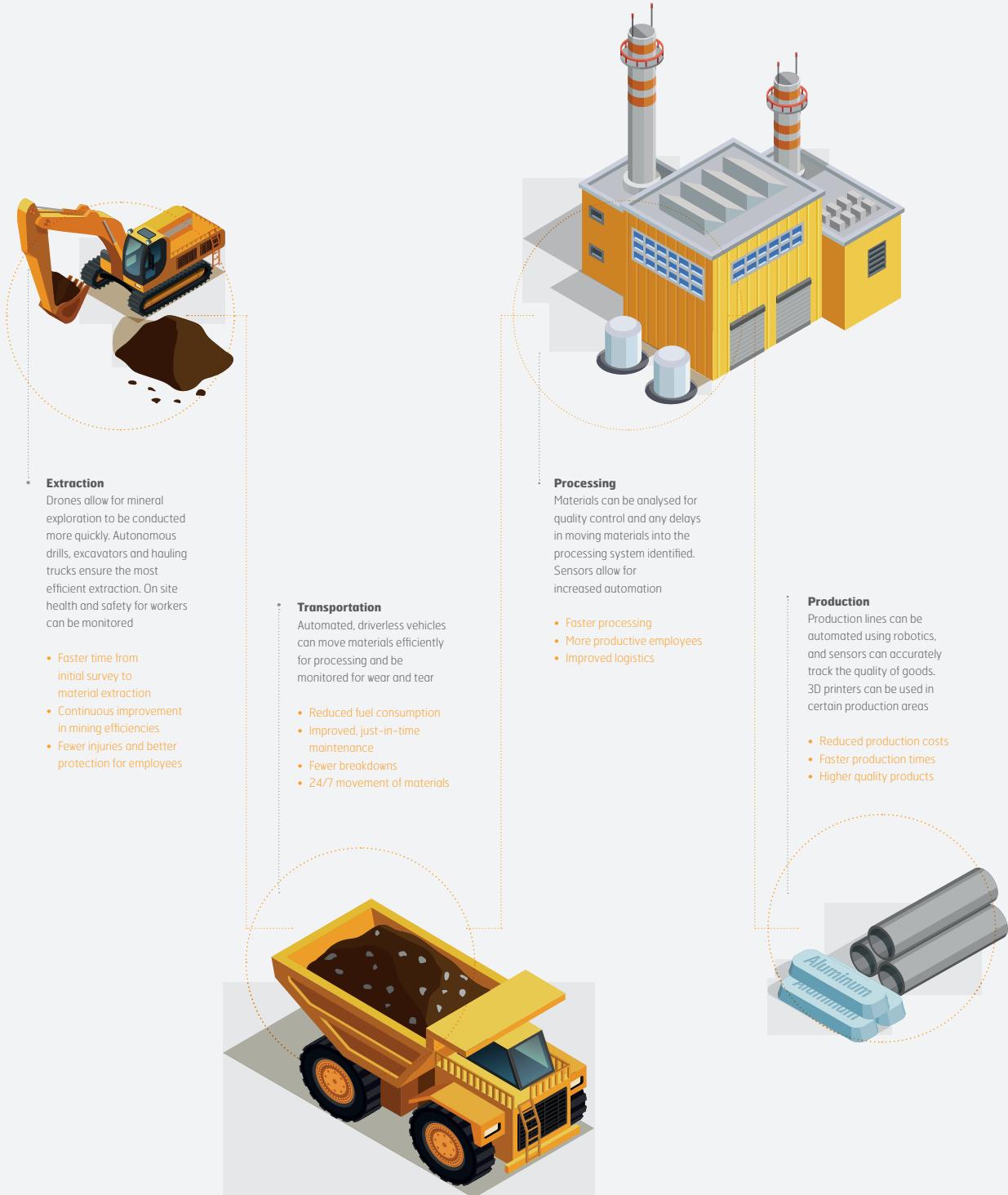


- Security skills
- Decision-making skills
- Management skills
- Technical support skills
- Analytical/data science skills
- Customer service skills
- Planning skills
- Database management skills

The mining industry has not yet put in place the secure and stable infrastructure or recruited the skills required to take advantage of the new gold, data. Without this, it will continue to lag behind other industries already embracing the exploitation of data for productivity and profit.

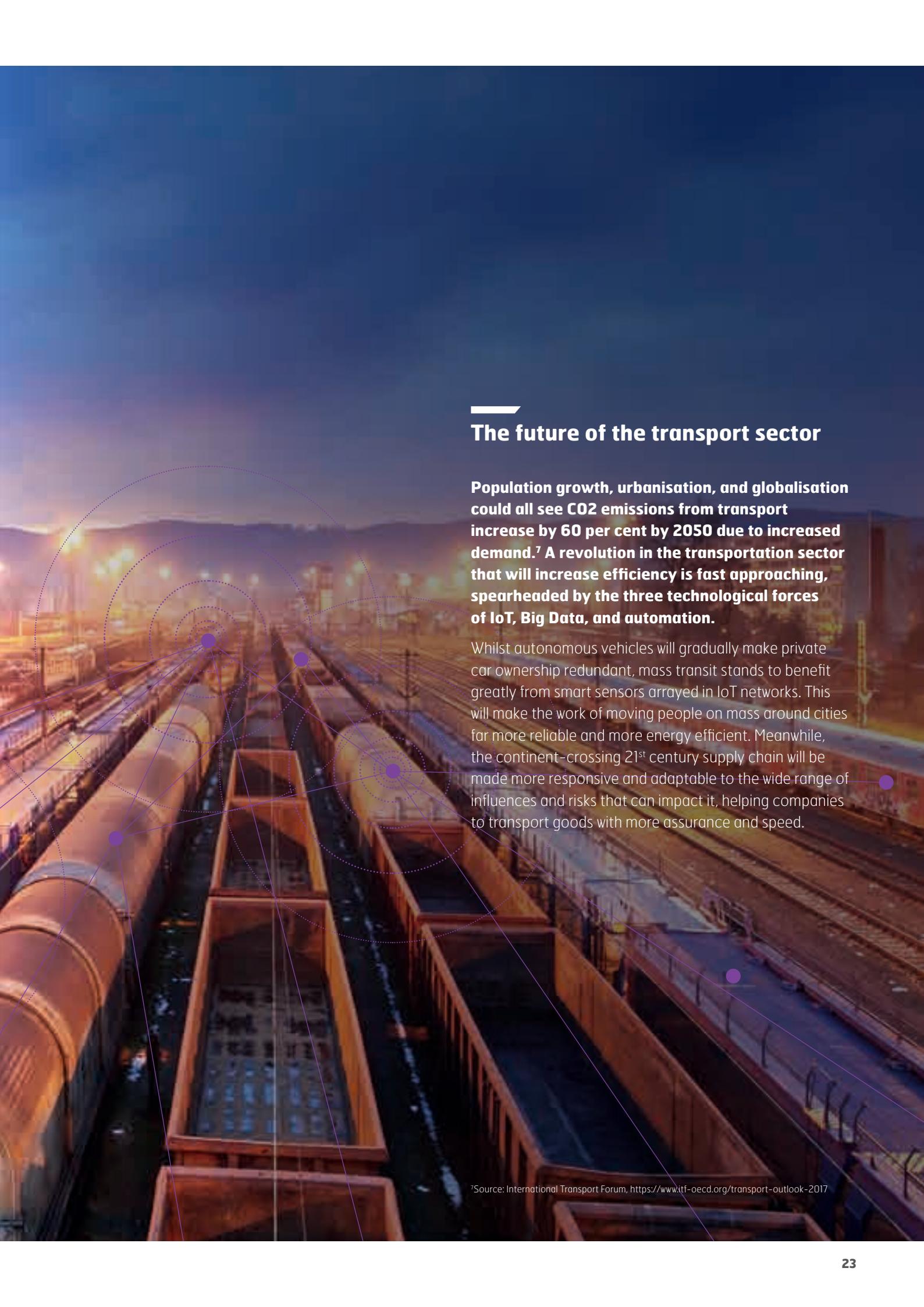
Data is the new gold

Mining businesses need to value data like a precious metal, and have the expertise to extract, share, and analyse what has become their most valuable commodity.



Transport





The future of the transport sector

Population growth, urbanisation, and globalisation could all see CO₂ emissions from transport increase by 60 per cent by 2050 due to increased demand.⁷ A revolution in the transportation sector that will increase efficiency is fast approaching, spearheaded by the three technological forces of IoT, Big Data, and automation.

Whilst autonomous vehicles will gradually make private car ownership redundant, mass transit stands to benefit greatly from smart sensors arrayed in IoT networks. This will make the work of moving people on mass around cities far more reliable and more energy efficient. Meanwhile, the continent-crossing 21st century supply chain will be made more responsive and adaptable to the wide range of influences and risks that can impact it, helping companies to transport goods with more assurance and speed.

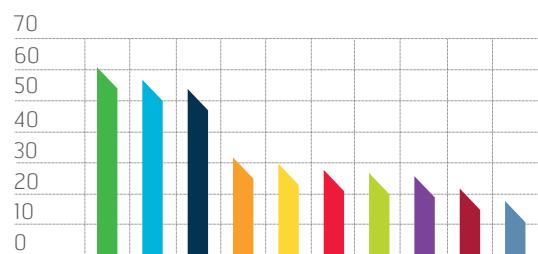
⁷Source: International Transport Forum, <https://www.itf-oecd.org/transport-outlook-2017>

Collaboration key to driving IoT success

In recent years, globalisation and population growth have greatly elevated the demand for mobility in the movement of passengers and goods, with the result being more vehicles filling our roads and skies, leading to more complexity and more pollution. Radical new approaches are needed if the transport industry is to successfully accommodate these changes and limit its impact on the environment, and digital technology such as IoT offers this potential.

Connected road signs and traffic lights, for example, can help to better manage the flow of traffic in our cities and motorways by flexing speed restrictions in line with localised requirements; remote diagnostics and predictive maintenance on vehicles can keep downtime to a minimum; and things like pothole monitoring can make driving safer and generally a more enjoyable experience.

What benefits would your organisation expect to see following the successful deployment IoT-based solutions? (%)



- Better health and safety across the organisation
- Greater workforce productivity
- Improved service delivery capabilities
- Business efficiencies – time and cost savings
- Increased amount of data/insights collected
- Creation of new product/services
- Increased demand for existing products
- Wider access to data/insights
- Better knowledge to improve strategy and objectives
- Greater business innovation

However, while respondents recognise the promise of IoT and are turning to the technology in pursuit of a broad range of benefits, deployments to date have not always been as smooth or straightforward as they might have been and many of these hoped-for benefits are yet to be realised.

IoT deployments will typically depend on the experience, technical capabilities and support of a whole ecosystem of partners.

How would you score your organisation's achievement of expected benefits of IoT so far and for the future?



- We have already achieved this
- We have not achieved this but still expect to in the future
- We have not achieved this and now do not expect to in the future

The data suggests that a greater reliance on partners may help speed up the return on investment for IoT-based initiatives, as, at present, there is a greater-than-average tendency in the transport sector to go it alone. Even where partners are used, they are much more likely to be brought in to help with the initial development and deployment of IoT solutions than with their on-going management.

To what extent is your organisation using/planning to use external partners in the development and deployment of its IoT-based solutions?

Development



Deployment



On-going management



- All managed in-house
- Use an external provider to assist with some of this
- Use an external provider to assist with as much of this as possible
- It has not yet been decided

For one company to master the whole IoT value chain is a tall order - deployments will typically depend on the experience, technical capabilities and support from a whole ecosystem of partners to be successful. Moreover, deriving wider value from IoT initiatives rests on an organisation's ability to scale, which is determined by their access to the correct staff. However, as competition in the labour market for individuals with sought-after IoT, data security, and data analytics skills hots up, this will prove increasingly difficult. With economies of scale on their side, specialist partners can help businesses overcome these bottlenecks and make their IoT deployments successful.

26%

of transport respondents say they are not looking for help with their IoT deployments from outsourced partners



Digital exhaust: the untapped potential of data

The McKinsey Global Institute estimates that IoT technologies could generate up to \$11 trillion a year in economic value by 2025,⁸ but unlocking this value will be contingent on businesses' ability to leverage the data that connected things will generate. The transport sector in particular stands to be one of the primary beneficiaries from the windfall of data coming its way from the Internet of Things.

81%

of transportation sector respondents believe IoT will revolutionise their industry

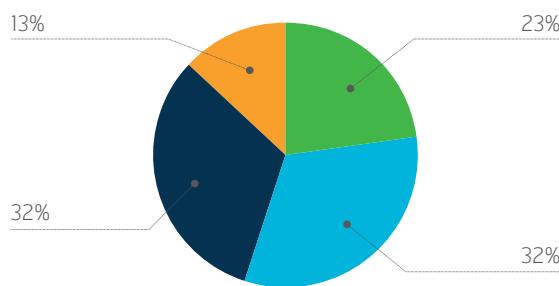
Digital exhaust – the data generated by people's online actions – is an ever-growing source of intelligence for transport companies, with the rollout of Wi-Fi on planes, trains and other public places continuing. While many companies have been adept at leveraging this data to dynamically manage routing, sensor-derived data – generated by sensors placed on cargo, vehicles, employees and places – has the potential to fuel a revolution in the sector.

To extract maximum value from the data generated by connected things, organisations need to develop a collaborative internal approach. Despite this, in over half of cases access to that data is restricted to departments directly related to the IoT deployment, suggesting that respondents may be limiting the scope of their transformations.

Talent is also an issue, with four in ten respondents stating that they required additional analytical/data science skills to successfully deliver IoT. Transport Systems Catapult estimates that as many as 3,000 data specialists will be needed in the UK alone to support the transport industry's drive to exploit data, indicating that this is clearly an area in need of attention.⁹

Reliable connectivity is similarly vital, as data-driven decision making relies upon organisations' ability to collect and analyse all data sets at their disposal to decide on the best course of action. When tracking moving assets, such as vehicles, location accuracy can be particularly important. Car insurance companies, for example, can determine their premiums based on drivers' habits – including how they drive in different traffic intensities – but would struggle to do so accurately without full and real-time access to this data. Doubts exist, however, about how possible it is to achieve full connectivity with almost three in ten (28 per cent) stating that connectivity issues could derail their IoT deployments. The transport sector has much to gain from IoT's data potential, but there yet lie some bumps in the road ahead.

To what extent does/will your organisation share the data created through IoT deployments?



- It is only available to the IT and senior management
- It is only available to certain departments involved in the IoT deployment
- It is available to anyone in the organisation but access must be granted
- It is available to anyone in the organisation to access and use

⁸Source: McKinsey and Company,

<http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world>

⁹Source: Transport Systems Catapult,

<https://ts.catapult.org.uk/news-events-gallery/news/report-warns-of-uk-skills-shortage-in-im-sector/>

Road management with connected cars

The mass urbanisation of world population is increasing the density of traffic on our roads and increasing pollution. Improving the quality of data and making sure it can be used by the right people can make it easier for people to move around in a more sustainable way.



Inmarsat: enabling the connected world



Case study:

Remote oil and gas sites come into view with IoT innovation

IoT enables a new way of monitoring and managing operations and assets in out-of-the-way locations through remote sensing technologies.

The challenge

Oil and gas production sites often operate in adverse environments and demanding conditions. A solar-powered, long-range network of sensors can continuously monitor operational parameters in a remote, upstream production site and transmit data to a control room where a SCADA system adjusts set-points and provides control settings. If there is a failure in power generation of the solar panels or transmission equipment at the site, the entire production process can grind to a halt with a significant cost implication.

The solution

An Inmarsat IoT sensor network is installed at the well-site to monitor performance of solar panels, health of point-to-point radio links, router up-time and micro-level environmental conditions. This data is transmitted to the central control room where it is analysed and acted upon to improve efficiency, safety and site management practices. Adverse events trigger alarms and mobilise the appropriate level of response, reducing the need for manual checks of equipment and for staff to visit distant production sites, generating significant operational savings in addition to the low cost of network installation and operation.

Case study:

Following the herd with an IoT livestock tracking system

A reliable, long range solution for tracking livestock and monitoring their location, health and safety.

The challenge

Livestock spend long periods of time grazing on the open range. During this time, they may be out of sight of the livestock owner and, while unsupervised, an animal will wander away from the property or a calf may be separated from its mother when the herd migrates to a new location. In both instances, it is easy for the lost animal to wander outside of the safe perimeter where they risk being injured or stolen.

The solution

The Inmarsat IoT livestock solution is installed at the ranch and tracking devices are placed on each of the animals. An application enables the rancher to monitor the location and activity level of each animal in the herd, and sends out an alert to the ranch manager and ranch-hands when an animal is at risk of being lost, is behaving erratically or is nearing the perimeter of the ranch. The livestock owner may then take the appropriate actions to retrieve the animal before an adverse event takes place.



Case study:

IoT plays critical role in precision farming deployment

The Inmarsat IoT water management solution optimises water use for agriculture.

The challenge

Due to increasingly frequent and widespread water shortages, large agricultural operators must manage their water resources and irrigation systems smartly. Walnut orchards in California, where rainfall is limited and water shortages are common, often suffer inadequate irrigation resulting in reduced nut size, sunburn and increased susceptibility to insects and disease. Additionally, competition for water from other industrial sectors and increasing water costs means walnut growers must optimise water usage and irrigation schedules.

The solution

With Inmarsat's IoT solutions, farmers can monitor water levels in reservoirs, soil conditions across the property, and move water to where it is needed most to compensate for variations across the property in groundwater deposits, soil porosity and water infiltration rates. The resulting irrigation schedules ensure consistent soil-water content for all trees and reduced water-stress problems.

How it works

Inmarsat's IoT solutions operate on LoRaWAN Low Power Wide Area Networks (LPWAN) that are optimised for battery life, range, indoor-outdoor coverage, bi-directionality and cost. They utilise a variety of field-based sensors, designed to send small amounts of data over long distances. Each of the sensors send their short packets of data to a LoRa gateway. The gateway forwards the data to a cloud-based network server via backhaul (satellite, Ethernet, cellular, Wi-Fi). Inmarsat satellite technologies are used to backhaul data and, as a single operator, Inmarsat removes the burden of dealing with multiple carriers across geographically dispersed regions and countries.

The network server manages the data intelligence and network complexity, filtering redundant data, performing security checks and adaptive data rate management. If a sensor is mobile, no handover is required from gateway to gateway, a critical feature to enable asset tracking applications. The integrated platform provides an end-to-end solution that delivers insights and supports decision making, creating value for the end-customer.

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