Industrial IOT on land and at sea: Mining

Inmarsat Research Programme 2018

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INTRODUCTION

Humans are consuming more. There are more of us than ever, and we have become accustomed to new technologies and the greater access to information they bring to our lives. For businesses in our major industries – agriculture, energy, maritime, mining and transport – this is having a significant impact. Producers need to optimise their extraction processes, manufacturers need to trace goods from initial extraction to their final destination, and suppliers need to provide more information about the goods that they deliver.

Data, generated by smart technologies like the Industrial Internet of Things (IIoT), is enabling these changes, and for businesses engaged in these industries, it has become the key differentiator. Every business needs to collect data effectively in order to create new efficiencies to pass onto customers, before their competitors beat them to it.

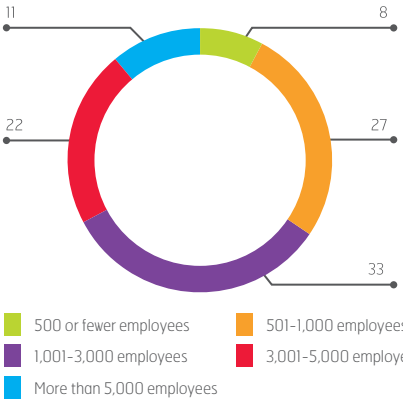
INMARSAT RESEARCH PROGRAMME

The Inmarsat Research Programme is now in its second year. This 2018 research is focused on understanding the ways that the Industrial Internet of Things is affecting the global supply chain and the way in which organisations from the agriculture, energy, maritime, mining and transport sectors operate. In May 2018 Inmarsat commissioned Vanson Bourne, a specialist technology market research company, to interview 750 respondents about their use of, attitude to and predictions for IIoT within their organisation and industry.

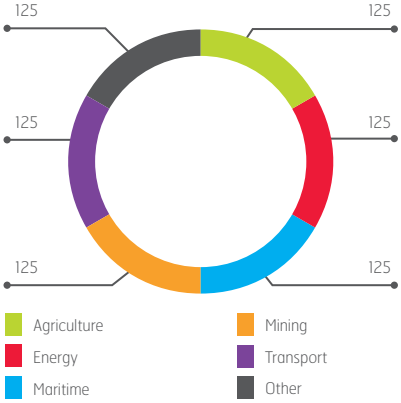
Respondents worked for organisations with at least 500 employees and have either decision-making or influencing responsibilities for IIoT initiatives. However, the profile of maritime respondents is different, in that 46 per cent worked for organisations employing fewer than 500 people.

RESEARCH DEMOGRAPHICS

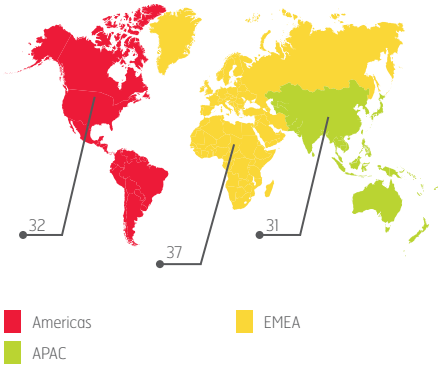
RESPONDENTS BY SIZE OF ORGANISATION (%)



RESPONDENTS BY SECTOR (750)

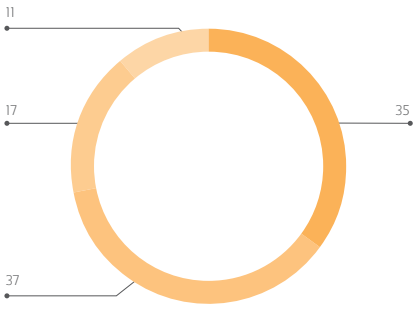


RESPONDENTS BY REGION (%)

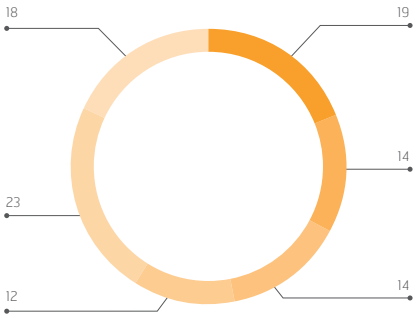


MINING DEMOGRAPHICS

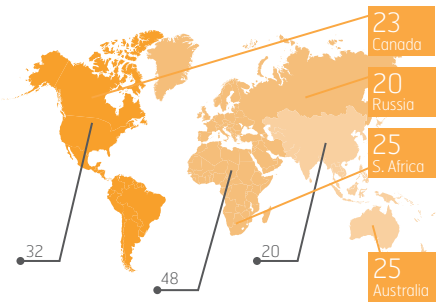
RESPONDENTS BY SIZE OF ORGANISATION (%)



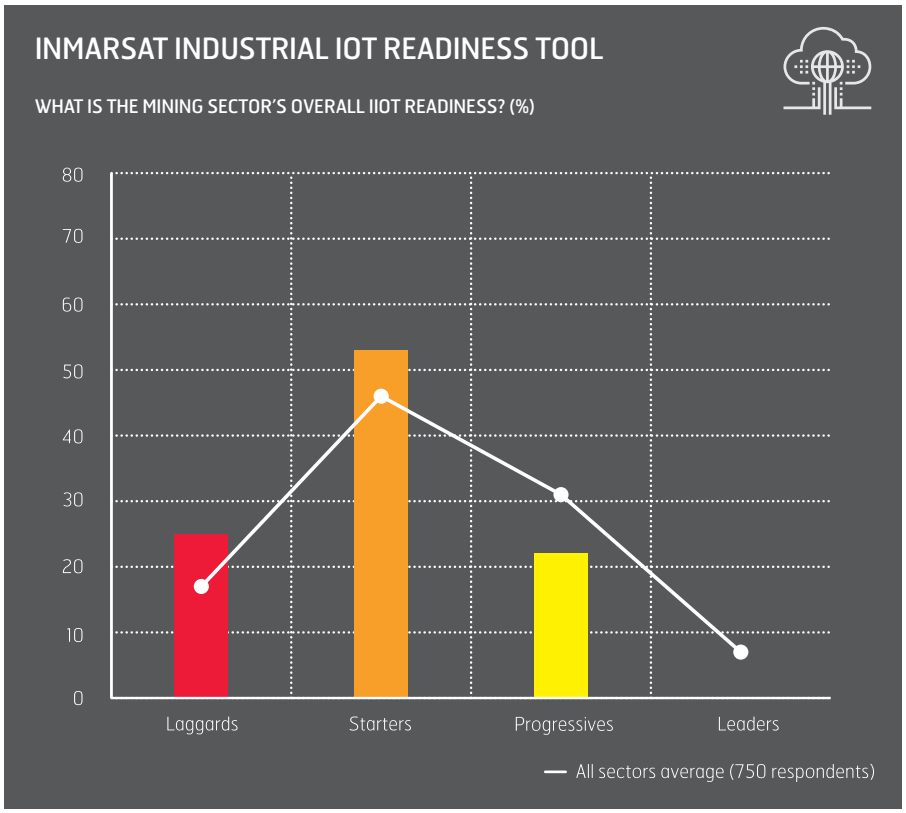
RESPONDENTS BY SUB-SECTOR (125)



RESPONDENTS BY REGION (%)



MINING



The mining data reveals the sector lags behind other industries examined in this report. Our IIoT readiness tool ranks the vast majority of respondents as either laggards or starters, with not a single respondent qualifying or the leader category overall. While this may seem surprising given some of the IIoT projects being developed by some of the major mining companies, our data found skills shortages and approaches to security and connectivity precluded our respondents from classification in this category.

Ultimately, with little value to add to the commodities they seek, success in mining depends upon companies' ability to extract raw materials more efficiently and more cheaply than their competitors can. However, as mineral reserves have depleted, mining companies have been led to evermore remote and difficult-to-access locations to establish their operations and the cost of extraction has increased. It is here that IIoT and other smart technologies can make a tangible difference, automating processes and upping the tempo of operations, making it critical to the future of the industry.

It was notable therefore that the top two drivers for adopting IIoT technologies were improving health and safety across the organisation (68 per cent) and improving the physical security of sites and assets (58 per cent), while the improvement of resource efficiency was third with 48 per cent.

The industry has been relatively slow to adopt of new technologies, preferring to stick to the well-trodden path of tried and tested techniques. And it may well be that wearables and site security are some of the most pressing areas to use IIoT. But, as the pressure on margins continues, and the need to extract raw materials in a way that doesn't cost the earth, harm the environment or endanger personnel, increases, it is becoming abundantly clear that radical new approaches are needed to transform operations.

Encouragingly, there are some very positive signs and most respondents expect to make significant progress over the next few years. Today, just 2 per cent of mining respondents have fully deployed any IIoT-based solutions; a figure that is set to climb to over half within a year.

There is near universal recognition among respondents in the promise that IIoT holds for their organisations, and many view the technology as a way to become more profitable and to operate more sustainably and responsibly.

The level of investment set to be put into IIoT development in the coming years supports the idea that its usage will be accelerated. However, our readiness tool reveals that there are some clear leaders in the packs, with some mining companies' investment in and progress with IIoT remaining negligible, while others surge ahead. Naturally, companies with higher turnovers are investing more, while geographically those from North America – are rapidly steaming ahead. For mining companies in the likes of Australia, South Africa and Russia, that appear to be lagging behind, this should serve as a warning sign. Broken down by type, meanwhile, the data suggests that iron ore mines have taken an early lead on IIoT deployment to accelerate the rate of production, reflecting the increasingly pressurised steel market.

As the data in our research indicates, those organisations that are perfecting their IIoT strategies are already starting to reap the benefits and the mining sector is already showing some real promise. However, it is clear that many have some catching up to do.

INMARSAT INDUSTRIAL IOT READINESS TOOL

Our tool allows us to benchmark sectors, organisations and industries against each other based on their IIoT readiness.

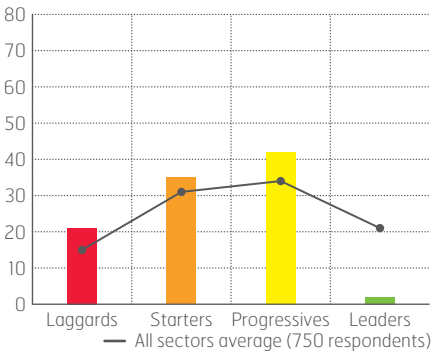
We asked our 750 respondents a series of questions, with points attached to their responses, scoring their IIoT development in six key areas:

- Adoption
- Security
- Connectivity and IIoT technologies
- Skills
- Data
- Investment and ROI

Using the scores, we divided our respondents into categories indicating their IIoT maturity: laggard, starter, progressive and leader.

ADOPTION

HOW MATURE IS THE MINING SECTOR IN RELATION TO IIOT ADOPTION? (%)



The mining industry is in the early stages of IIoT adoption with just 2 per cent of our respondents having fully deployed an IIoT solution. However, a further 29 per cent are trialling IIoT solutions, with the remaining 69 per cent planning to do so within the next two years, testament to the importance placed on the technology amongst R₵D and innovation teams.

While mining organisations lag behind other industries connected in the global production and supply chain, there is evidence they are beginning to seriously consider the benefits that IIoT can bring to the bottom line. 84 per cent agreed that IIoT will revolutionise their organisation, and 79 per cent agreed that the technology is essential for their organisation to gain competitive advantage.

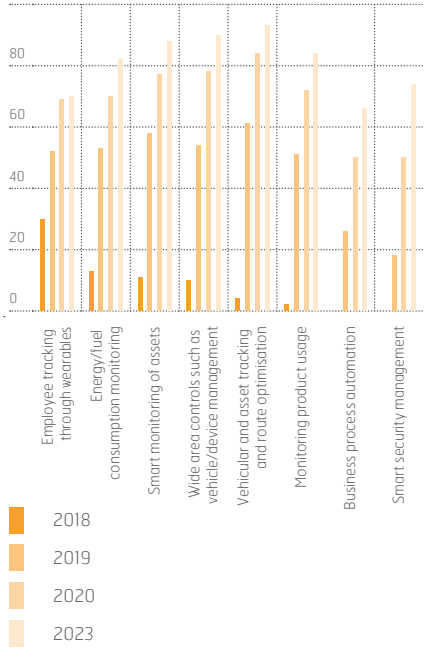
The priority forms of IIoT are focused on asset tracking and smart monitoring, and the greater use of wearables to track employees. The health and safety dangers in the mining sector makes IIoT an obvious choice to help make staff safer, and the complexity of mining operations – vehicles, engineering tools, and other devices needed for an effective site – makes getting detailed data to create efficiencies an early win for many.

It is also clear that 2019 is set to be a year where many trials in vehicular and asset tracking, among other areas, come to fruition.

In terms of the benefits achieved by those who have made or are trialling IIoT deployments, greater automation (41 per cent), improving health and safety (32 per cent) and improved environmental sustainability (28 per cent) rank highest. Overall, mining respondents have achieved less from their IIoT deployments than respondents in other industries, pointing to the challenges they face and the nascent state of IIoT within the industry. However, there are high hopes for IIoT in the future for a number of applications: greater physical security (67 per cent), better decision making (66 per cent) and increased staff productivity (64 per cent) the top three.

The mining industry faces a wide range of challenges as it adjusts to changing market conditions and seeks out new mineral deposits, and while these pose a threat to the sector's future prosperity, those companies that successfully harness digital technologies will be best placed to weather the storm.

IN WHAT AREAS WILL YOUR ORGANISATION ADOPT IIOT-BASED SOLUTIONS? (%)



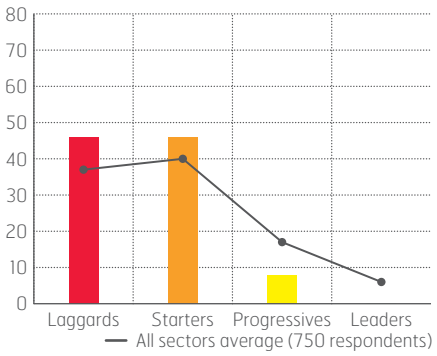
84%

agreed that IIoT will revolutionise their organisation

Mining businesses expect IIoT to deliver improvements in health and safety and environmental sustainability, as well as a raft of other benefits

SKILLS

DOES THE MINING SECTOR HAVE THE SKILLS IT NEEDS FOR IIOT? (%)



Skills shortages in mining have been more pronounced across the board in our 2018 research when compared to the other industries surveyed. Only 9 per cent stated that they have all the skills they need for a successful IIoT strategy, placing the majority of respondents in the IIoT laggard and IIoT starter categories in the maturity index. Unsurprisingly, 59 per cent of mining organisations stated that a lack of skills had caused a barrier to adoption of IIoT technologies.

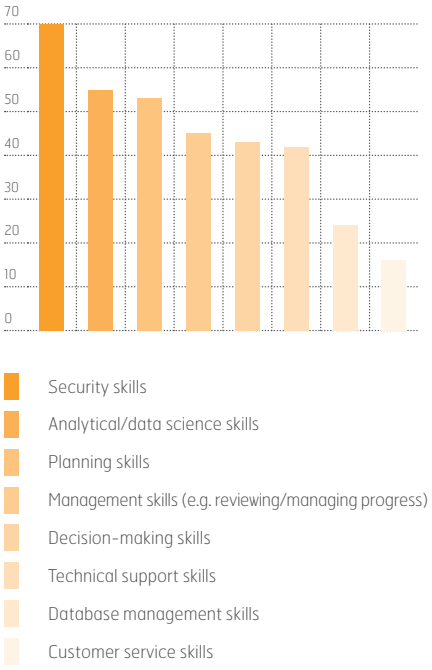
Skills shortages can be seen across all levels of seniority but become more pronounced at implementation levels – 38 per cent reported that they required more skills to devise IIoT strategies, considerably less than the number of respondents who stated that they lacked the skills needed for effective delivery and maintenance (66 per cent). While we can't entirely discount the potential bias of survey respondents (who were senior decision makers and therefore may consider themselves more skilled than they are in reality!) there is a clear pattern where those with both practical, hands-on experience of IIoT and the mining industry are in short supply.

Translating the theory of IIoT-enabled improvements into reality is clearly an area where improvements will need to be made.

The research attempted to understand which skills are most in need. The high level of concern about data security seen elsewhere in our mining data also came through when exploring skills shortages. (Data security was the skill in greatest demand) - 70 per cent said acquiring additional security skills was a top priority. The challenges to effectively interpret and use the data collected also came through with 55 per cent saying that they need more people with an understanding of analytics and data science.

The lack of skills sits at the root of most of the major issues acting as barriers in the mining industry today, and is something that will only gradually improve over the next few years as IIoT matures as a technology with it through upskilling and the introduction of talent from outside the industry. In the intervening time it will be even more important for mining companies to establish partnerships with IIoT service companies.

WHAT ADDITIONAL SPECIFIC SKILLS DO YOU THINK YOUR ORGANISATION NEEDS TO DELIVER IIOT-BASED SOLUTIONS? (%)



55%

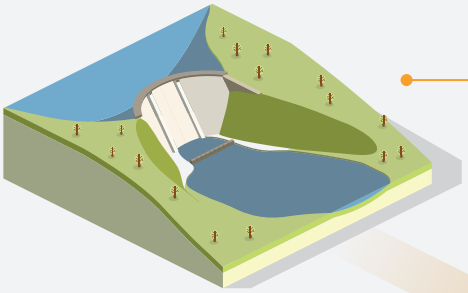
need additional data science and analytical skills

A lack of available skills is proving to be a major inhibitor of IIoT adoption in the mining sector

ZERO HUMAN HARM,

ZERO ENVIRONMENTAL IMPACT

The pressure is on mining businesses to reduce the risk that their activities pose to both their staff and the environment. IIoT-connected sensors will give these businesses the capacity to monitor and act much more quickly upon these risks, helping to reduce harm to the environment and their staff.



MONITORING

Deploying sensors to monitor levels in tailings dams long after mining activity has ceased to ensure that minimum and maximum levels are not breached, preventing environmental disasters.

Reducing environmental impact and improving mining sustainability.

DUST

In hot, dry climates, dirt roads on mining sites have to be frequently sprayed with water to avoid dust clouds building up and endangering staff health and safety. Geo-sensors monitoring which roads have been watered and advise control room staff where to send water trucks.

Safer driving conditions, optimised water usage.

IMPACT

Wearable technology and sensors can detect if workers are struck in an accident with machinery or by falling rock. Staff location monitoring technology can also warn control centres when staff stray into dangerous areas where they are at risk of injury.

Reduce incidence of injury to staff, direct medical attention to the right place.

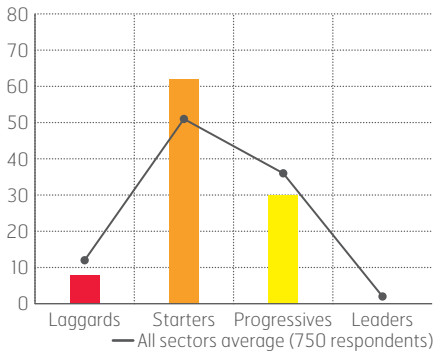
HEALTH

Mining staff working underground risk exposure to dangerous gases. Wearable sensors can detect gases and warn staff to evacuate affected areas.

Improve staff health, safer working environment.

SECURITY

HOW MATURE IS THE MINING SECTOR'S APPROACH TO IIOT SECURITY? (%)



To date the mining sector's attempts to tackle the security of their IIoT initiatives in line with the overall research sample, the majority of mining respondents have a considerable amount of work to do to address the security issue.

38 per cent stated that cyber-security posed a barrier to the development of IIoT in their organisations and, worryingly, 87 per cent and 84 per cent, respectively, agreed that processes to protect against cyber-attacks and data misuse could be improved.

Mining is a major strategically-important industry and a well-executed IIoT-related cyber-attack could have severe implications for not only the company directly involved but also the wider economy. As mining companies come to connect evermore parts of their operations to the internet, through IIoT, they open up new vulnerabilities and the risks of disruption from bad actors multiply.

Mining respondents are keenly aware of these threats, and 64 per cent cite concerns about the risk of external cyber-attacks in relation to their IIoT deployments. By comparison, only around half of respondents from other industries registered the same concerns, indicating the scale of the challenge confronting the mining sector.

Digging deeper, data storage challenges, misuse of data by employees, poor network security and the risk of external cyber-attack all caused a high level of distress amongst survey respondents.

Despite this recognition, the response from the sector to address IIoT-related security challenges has been somewhat muted, and has for the most part revolved around creating internal and external security policies for staff to follow (45 per cent). While this will help to address data misuse by employees, it will do little to protect mining companies from cyber-attacks, which is where much more attention is needed. While 40 per cent have upgraded existing technology, just one in five (22 per cent) respondents report having invested in new security technologies to protect their IIoT deployments, which trails other sectors' responses.

One reason for the relatively low level of activity to address security vulnerabilities in the mining sector may be that mining businesses do not have the right stakeholders involved in their IIoT initiatives. Over half (51 per cent) of respondents report that their organisation's Chief Information Security Officer (CISO) is not involved with their IIoT initiatives but should be, and a further 17 per cent report that they do not need to be involved.

The potential security vulnerabilities of IIoT are well documented, and it should be of some concern that there is not a total consensus that IT security specialists are fundamentally involved in IIoT projects. While this may change as the sector starts to invest in IIoT more heavily, this is an area to watch closely.

38%

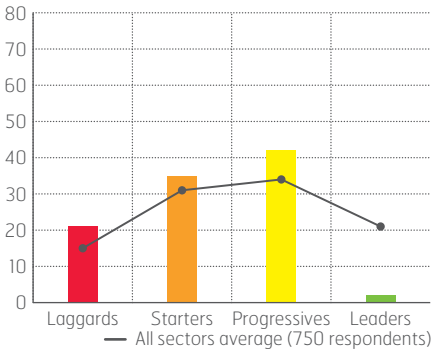
stated that cyber-security concerns were a barrier to the development of IIoT solutions

WHAT ARE THE BIGGEST SECURITY CHALLENGES ASSOCIATED WITH THE USE OF IIOT-BASED SOLUTIONS WITHIN YOUR ORGANISATION? (%)

The response from the sector to address IIoT-related security challenges has been somewhat muted and needs to focus on new technologies that can fend off emerging and evolving cyber threats

DATA USAGE

HOW ADVANCED IS THE MINING SECTOR'S APPROACH TO IIOT DATA? (%)



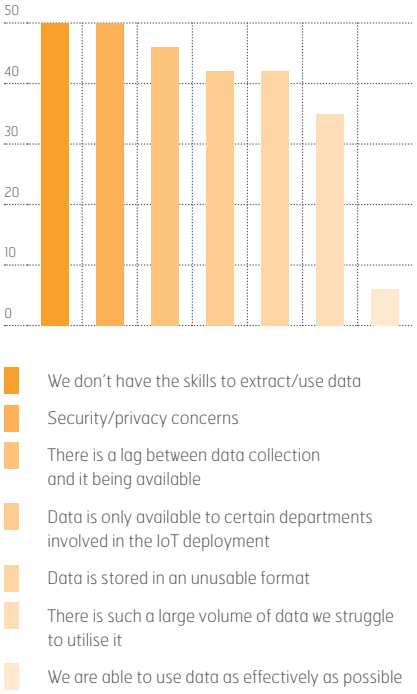
The mining sector has three clear priorities on how it wants to use data collected from IIoT infrastructure – to improve health and safety for employees (68 per cent), build better physical security of mines and the assets used onsite (58 per cent), and increase resource efficiency to reduce costs (48 per cent). However, respondents made it clear that there are some significant challenges in being able to use and share data to improve operations, which place the majority of respondents in the IIoT laggard or IIoT starter categories.

Only 23 per cent stated that data from IIoT was available to anyone (following security clearance) in the organisation to interrogate, and 34 per cent said that data was only for the IT department and senior management. This level of restriction has an impact on the pace of innovation.

As digital transformation has spread through organisations in recent years, innovation also needs to be dispersed if it is to be effective. While the involvement of senior management and IT departments are important, the best ideas for deployment do not come through a top-down hierarchy. More flexible approaches to innovation are needed in the mining sector where those working on the frontline can work hand in glove with specialists developing IIoT solutions. Historically, the mining sector has not been known for this level of flexibility in the way that it manages change. However, growing competitive challenges in the market are now forcing new cultural behaviour to more flexible approaches to innovation.

When asked what is holding back the sharing and use of data half said that they do not have the skills to extract and use data, 42 per cent said data was being stored in unusable formats, and 35 per cent said that there was just so much data that they were overwhelmed by the prospect of understanding and using it. So, as well as needing to be more flexible and open in how data is used and shared, IT leaders need to quickly improve their data analytics functionality to enable better use of the wealth of data that is being created.

WHAT CHALLENGES DOES YOUR ORGANISATION FACE IN USING DATA EFFECTIVELY AS POSSIBLE? (%)



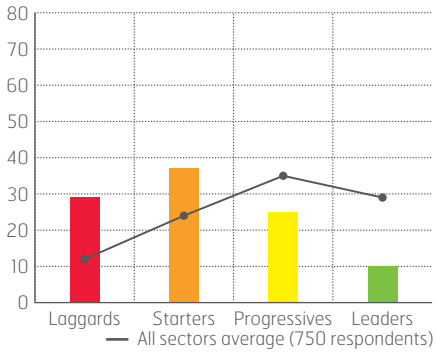
Businesses need to improve their data analytics functionality to enable better use of the wealth of data that is being created by their IIoT initiatives

68%

expect to use IIoT-generated data to improve health and safety

CONNECTIVITY AND IIOT TECHNOLOGIES

HOW WELL IS THE MINING SECTOR ADAPTING TO THE CONNECTIVITY REQUIREMENTS OF IIOT? (%)



The remoteness of many mines, combined with the challenge of multiple sites spread over great distances makes connectivity an especially pressing issue for the mining sector. Factor in a growing move toward automation, smart exploration and sample analysis and the need for reliable connectivity is more important than ever. However, 35 per cent of mining respondents cited connectivity issues as a barrier to IIoT adoption, a higher percentage than any other segment interviewed.

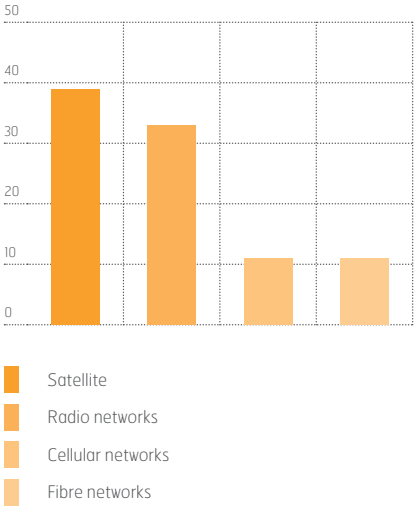
For control centre staff, connectivity issues may reduce visibility of data which will lead to a shut down in production, which could seriously impact upon a mine's profitability. A further 61 per cent agreed that connectivity issues could disrupt IIoT deployments and 66 per cent reported that they struggle with reliable connectivity at least some of the time.

Satellite evidently plays an important role in an industry challenged by connectivity issues in its journey toward digital transformation. 39 per cent viewed it as the most important connectivity method, and those that viewed it this way were more likely to be enjoying the benefits from their IIoT deployments.

Given satellite's potential to deliver connectivity to a remote site and mesh radio networks' ability to facilitate data transfer in areas where line of sight is obscured, such as an underground mine, it is no surprise that radio networks also rank highly in importance.

Increasingly, mining companies are using newer wireless data collection mechanisms: RFID was the most widely-used with 42 per cent using it, followed by LoRaWAN and SigFox with 10 per cent each. SigFox was more commonly used in Australia than LoRaWAN, while this was inverted as a trend amongst Canadian mining businesses. Only in Russia did RFID not rank as the top IIoT protocol, with respondents there instead citing Bluetooth Low Energy top.

WHICH CONNECTIVITY TYPE IS MOST IMPORTANT TO YOUR IIOT DEPLOYMENTS? (%)



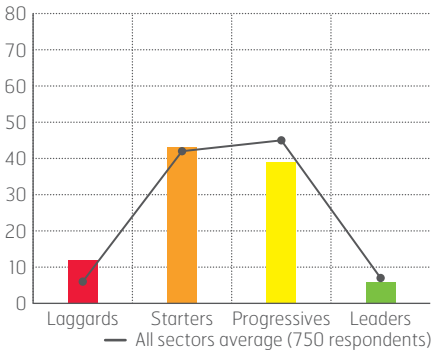
Of all the land-based sectors examined, mining emerged as the most reliant on satellite networks to support its IIoT initiatives

35%

of mining respondents cited connectivity issues as a barrier to IIoT adoption, a higher percentage than any other segment interviewed.

INVESTMENT AND ROI

HOW WILL THE MINING SECTOR INVEST IN IIOT? (%)



Mining businesses expect to invest considerable sums into IIoT over the next three years – with an average investment of approximately $3 million. This equates to just under 8 per cent of mining companies' overall IT budgets and represents around a six-fold increase from the amount spent on IIoT solutions since 2015.

This level of planned spend on IIoT places it as the number one next generation technology that mining companies expect to invest in over the coming period. Respondents expect to spend more on IIoT than they will on cloud computing, robotics and big data analytics (each at 7 per cent) over the next three years, coming as further indication of the sector's faith in IIoT.

However, there is some significant variation within the average spend on IIoT, with around a third of respondents (32 per cent) expecting to invest less than $500,000 over the next three years. Although the size of the operation will naturally dictate how much companies are able to – or need to – spend on the technology, this may indicate that some mining businesses are falling behind in the IIoT innovation stakes.

Plainly, not all mining businesses have the same R&D budgets, and the perceived high cost of IIoT solutions was identified as a barrier to the success of IIoT projects by 37 per cent of respondents.

A lack of turnkey, off-the-shelf solutions is also an issue for half of mining businesses, meaning that IIoT projects must be largely bespoke, driving up the costs of implementation. As the industry matures, and more off-the-shelf IIoT solutions come to market, these barriers should gradually start to subside. Increasingly, with fluctuating commodity markets driving organisational efficiencies, those companies who do not make the necessary investments will suffer.

However, when we consider the potential Return on Investment (RoI) of IIoT solutions in the mining sector, the implications for IIoT laggards become clear.

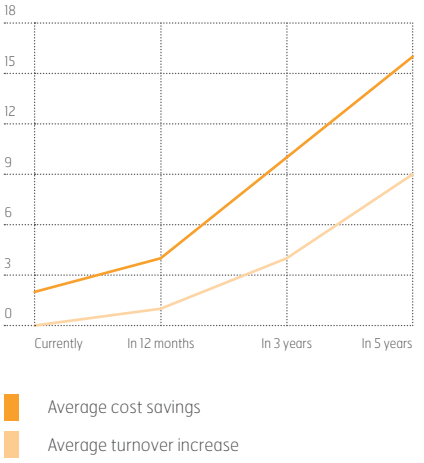
Mining businesses are generally confident in the ability of IIoT solutions to help them both save money and generate new sources of income. While the cost savings and turnover increases are negligible today, mining businesses expect their IIoT solutions to deliver an additional 9 per cent to their top lines and reduce their operating costs by 16 per cent within the next five years.

Respondents expect to realise increased levels of automation, more effective asset utilisation and lower insurance premiums as a result of their IIoT initiatives, all of which will contribute to their bottom lines and help to increase outputs.

Critically, those that are investing higher sums in IIoT are anticipating correspondingly high rewards. Multi-commodities respondents, who expect to invest 6 per cent of their IT budgets in IIoT over the next three years state that this should deliver an extra 6 per cent to their revenues by 2023. Iron ore companies, who will invest 9 per cent over the same time frame, expect to add 9 per cent to their toplines.

Those mining businesses that are slow off the mark, and fail to invest sufficient amounts in IIoT technologies will therefore be placed at a distinct financial disadvantage.

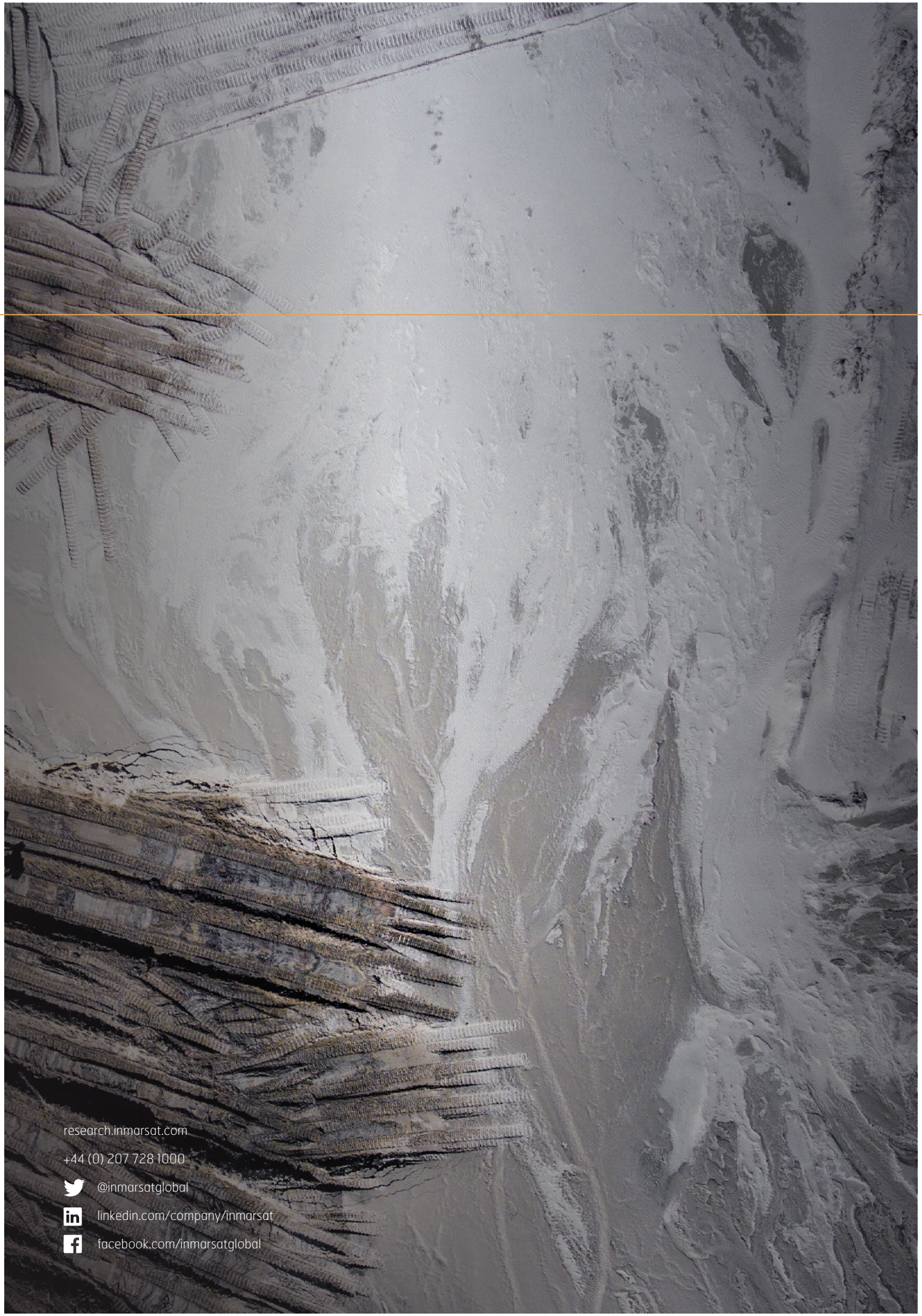
WHAT OPERATIONAL COST SAVINGS AND TURNOVER INCREASES IS YOUR ORGANISATION LIKELY TO ACHIEVE THROUGH ITS USE OF IIOT? (%)



16%

reduction in operating costs predicted through use of IIoT in five years

Those mining businesses that are slow off the mark, and fail to invest sufficient amounts in IIoT technologies, will increasingly find it difficult to compete



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