



# The Internet of Things Actualisation Quotient: An Asia-Pacific Perspective

A white paper by Frost & Sullivan,  
commissioned by Singtel

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# Executive summary

Decision makers must come to terms that the Internet of Things (IoT) is no longer a futuristic concept. Many enterprises are already progressing beyond the conceptualisation stage and embarking on their IoT deployment. However, it is important to understand that as with all new digital initiatives, IoT implementation is a journey.

While there are immediate benefits when new IoT initiatives are implemented correctly, it is also important to understand that enterprises can achieve greater business gains as they move towards the mature stages of the IoT roadmap. Enterprises have different IoT maturity levels, and how well they progress along the IoT journey depends on the strategies they adopt. The more digitally mature an enterprise is, the greater the impact of IoT and digital transformation.

While decision makers should take a broad perspective on how IoT can change their business activities, many of them still have misconceptions about IoT and are adopting a rather narrow view of IoT. The Frost & Sullivan 2018 IoT Actualisation Quotient (AQ) aims to address some of these common misconceptions.

## Myth 1: IoT is just hype

While the hype around IoT captured the attention of enterprises a few years ago, the interest in the benefits of IoT has resulted in actual deployment to improve in business outcomes today. Based on our study, **43% of Singapore enterprises surveyed have carried out IoT proofs of concept or have existing IoT implementations in place.**

## Myth 2: IoT doesn't have tangible business outcomes

As IoT moves out of the nascent stage, the increasing maturity of the technology is making it more economical to deploy, resulting in measurable benefits to justify an organisation's investment. Our study shows that **enterprises surveyed have experienced improvement in overall business metrics of 12.1% after implementing IoT initiatives.**

## Myth 3: IoT has limited use cases

Taking a broader view of IoT has led enterprises to see the value of IoT in unexpected ways. As an enabler of new business models, IoT has opened up new use cases that deliver value-added services. Our study shows that, on average, **enterprises surveyed have implemented four to five IoT use cases either as trials or commercial systems.**

## Myth 4: IoT is about connecting devices

IoT is more than just connecting devices. It is about creating new innovative services and applications, while also securing them against cyber threats. **Enterprises highlighted that applications and cybersecurity were two essential elements in which they lacked expertise.**



# 1. What does IoT mean to you?

## Introducing the IoT Actualisation Quotient (IoT AQ)

A successful IoT implementation encompasses multiple facets. It requires a journey-based approach, and is dependent on both external and internal organisational factors to unlock its true value over time. As such, it is imperative for enterprises to assess their current level of IoT maturity and identify the key components that will enable them to achieve their IoT goals.

The IoT AQ is a framework that can serve as an industry standard for mapping an enterprise's IoT journey and the business value it creates. This is a two-step process, where the first step involves understanding how the enterprise fares in each of the IoT AQ components, while the second involves understanding the corresponding business value the enterprise can then deliver. Frost and Sullivan conducted surveys in Australia, Hong Kong, and Singapore across the energy, transportation, logistics, building, and retail sectors. Based on the results, an IoT AQ framework was developed to map enterprises' IoT maturity across four stages.

This whitepaper provides insights into where most enterprises are in their IoT journey by leveraging the IoT AQ framework and the associated business benefits they reap at each stage of this journey. The whitepaper and the IoT AQ will also guide enterprises in planning their IoT roadmap.



### Step 1: Mapping out IoT AQ components

The six key components of the IoT AQ are:

**Component 1 – Action:** This refers to the enterprise's current stage of their IoT journey and reflects how realistic the IoT aspirations are.

**Component 2 – People:** This examines the stakeholders involved in IoT planning within an organisation and the level of involvement from the management team.

**Component 3 – Data Strategy:** This is the first of three technical measures: How do organisations use IoT data? Is data used for reporting or driving business strategy?

**Component 4 – Artificial Intelligence (AI) Strategy:** This is the second of three technical measures: How does the organisation see the role of AI in terms of IoT? Are there specific views or approaches to AI that affects the IoT use cases within the organisation?

**Component 5 – Cybersecurity Strategy:** This is the last of three technical measures: Does the organisation prioritise the changing of security processes for IoT?

**Component 6 – Commitment:** In the process of IoT actualisation, what is the budgetary allocation level for IoT investments to make this a realistic goal?

## Step 2: Using the IoT AQ to gauge an enterprise's IoT maturity

The IoT AQ quantifies an enterprise's IoT maturity by capturing various facets of its IoT strategy including management involvement, technology strategy, IoT investments, and actions taken. Based on the IoT AQ, enterprises are mapped into one of the four stages of maturity.

### Stage 1 – Connected Enterprise



These enterprises are just beginning their journey and focused on getting systems connected to gain organisation visibility. This is often an initial use case and the stepping stone to getting internal purse strings loosened for actual, tangible IoT investment. This involves investing in platforms and devices to provide always-on connectivity to mission-critical applications, both between employees and applications, and between widespread applications themselves.

#### Key Focus

- Availability
- Connectivity
- Insights
- Optimisation

### Stage 2 – Data-First Enterprise



These enterprises take a data-centric approach towards driving business decisions and improving business outcomes. A common data-driven use case is that of IoT devices capable of communicating with consumers while sending data to manufacturers. This data opens up new business opportunities based on use patterns, and unlocks new initiatives for pricing models based on a pay-per-use scenario.

#### Key Focus

- Data-driven services
- Data-centric approach towards optimisation

### Stage 3 – Secure Enterprise



These enterprises work with their partners and put in proper security measures for systems and processes to ensure safe and reliable digital services. For instance, enterprises would need to update their security processes so that IoT devices are segmented into their own networks and have network access restricted.

#### Key Focus

- Ecosystem of partners
- Securing partners
- Cyber resilient organisation

### Stage 4 – Cognitive Enterprise



These enterprises explore new business models and digital services by leveraging AI to unlock even more value from IoT. After setting the foundations and implementing internal IT, security, data, and compliance structures, enterprises can monetise the next stage of building profit models and revenue strategies using IoT.

#### Key Focus

- New business models
- Cognitive services

## 2. Why does IoT matter?

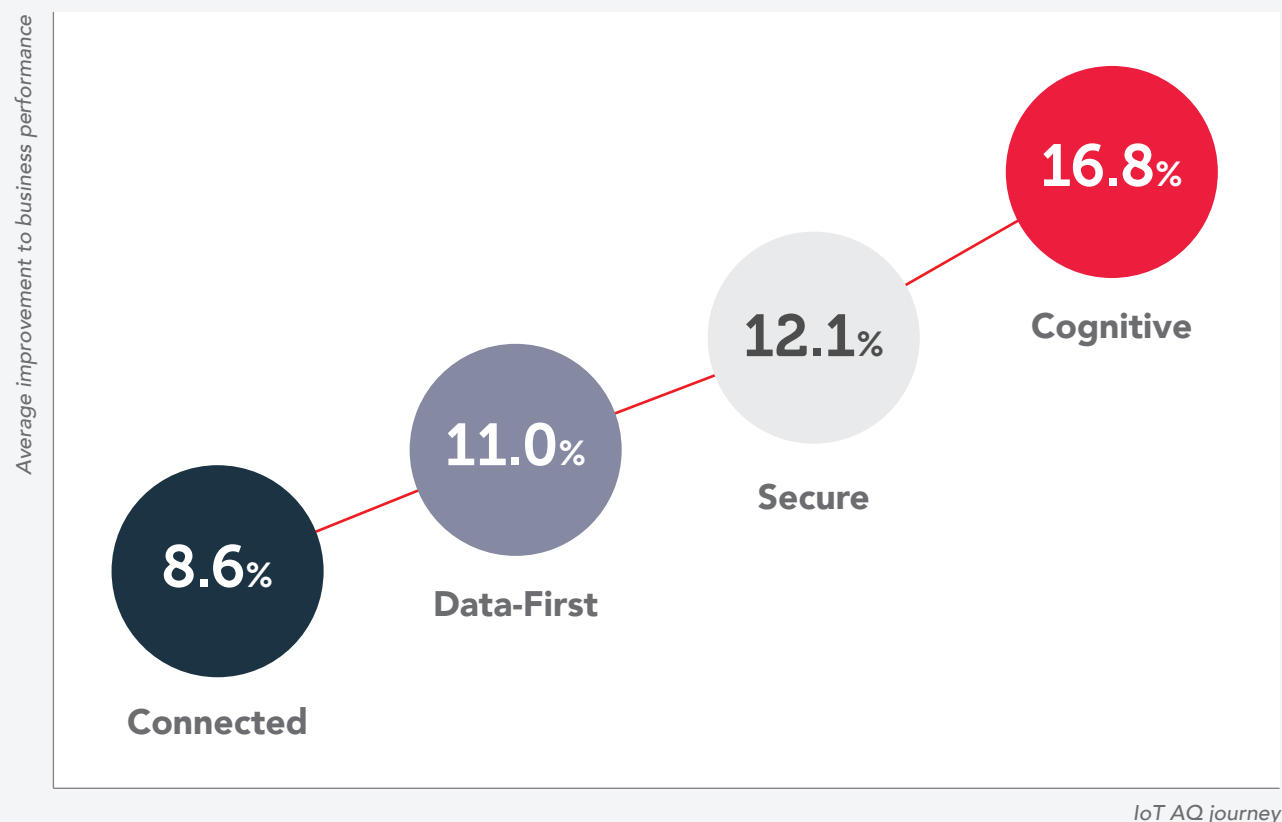
Not just a buzzword: Tangible, profit-driven IoT

### Key Takeaway #1

### The higher the IoT AQ stage, the higher the business outcome

This study showed that enterprises in the higher stages of the IoT AQ scale had a direct relationship with business outcomes, and saw more substantial profits.

#### Overall IoT impact on business, Australia, Hong Kong, and Singapore, 2018



#### Stage 4 or Cognitive Enterprises scored a 16.8% on IoT impact

based on IoT AQ's eight key business outcome measures: profit margin, revenue, operational efficiency, employee productivity, resource utilisation, employee satisfaction, customer base, and brand reputation.

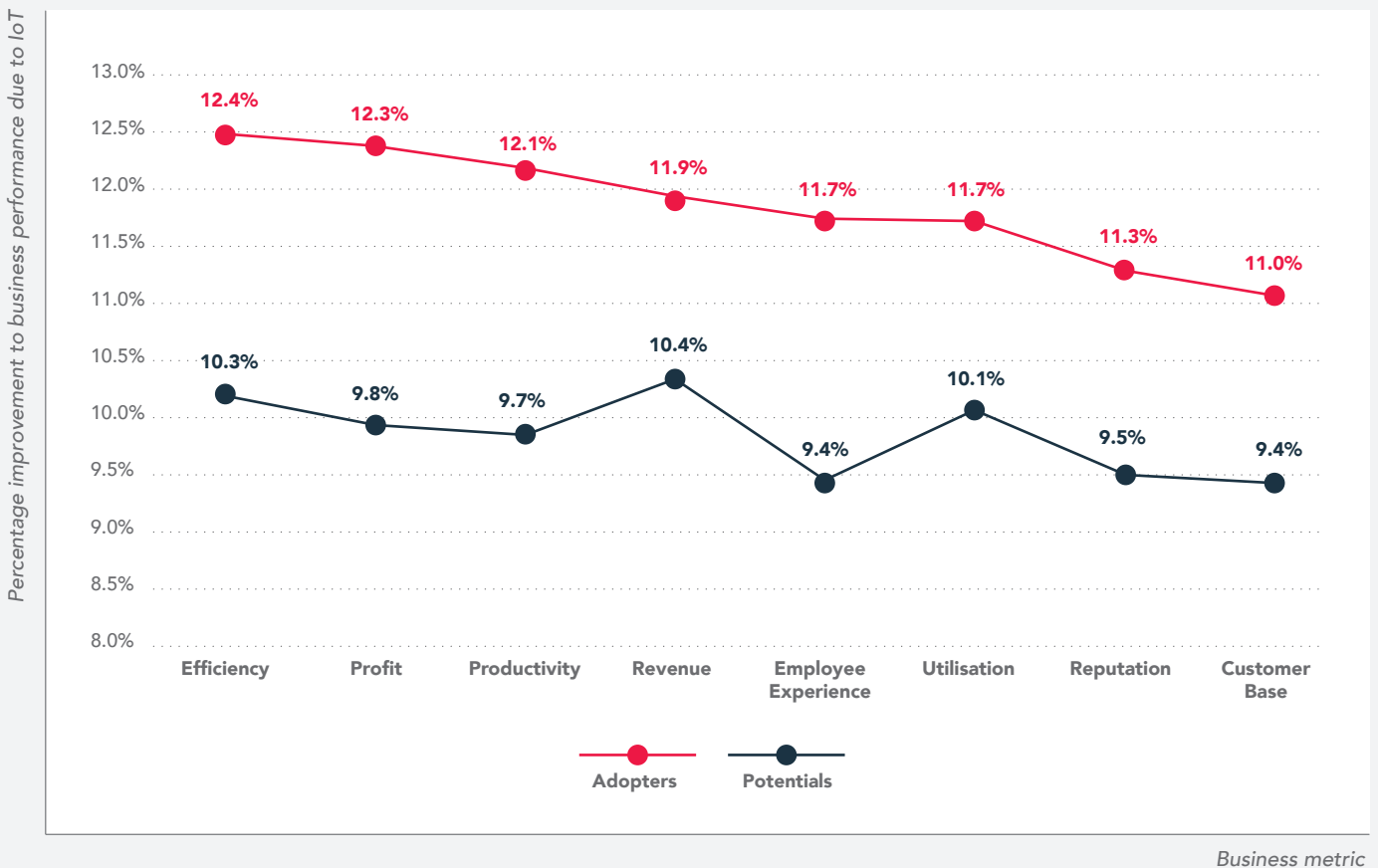
Across all business outcomes covered in the study, Cognitive Enterprises realised more gains, especially in critical financial metrics like profit margins (18.9% business impact) and revenue (18.6% business impact).

## Key takeaway #2

### Adopters realised higher actual gains than initially anticipated

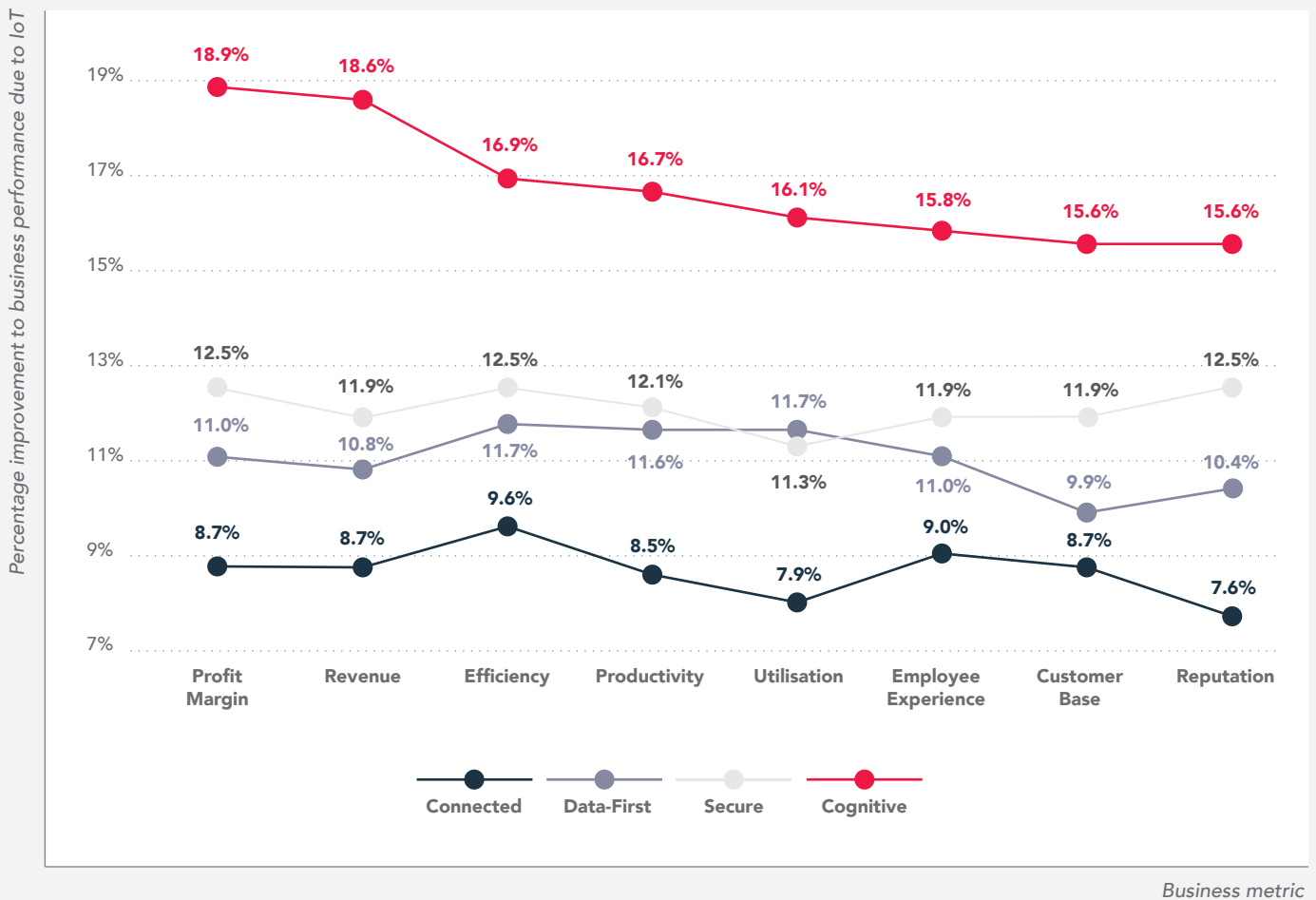
A comparison of respondents who have adopted IoT and those who have not found that IoT adopters, in general, realised much higher business outcomes across all business metrics than originally expected, underscoring the value and potential that IoT could potentially bring to enterprises. In many cases, with the introduction of the “new shiny toy,” there is usually some unrealistic assumption of the value that the new technology can bring, especially among those who have not implemented it. However, findings of the survey show that in the case of IoT, the returns on IoT investment far exceeded expectations.

#### Mapping business outcomes across the IoT actualisation journey, Australia, Hong Kong, and Singapore, 2018 (adopters vs potentials)



Realised IoT business outcomes were higher than anticipated outcomes. The 112 respondents who have implemented IoT reported higher impact to business outcomes across all key metrics compared to the 188 respondents who have not implemented IoT.

## Mapping business outcomes across the IoT actualisation journey, Australia, Hong Kong, and Singapore, 2018 (adopters)



Business metric

The 112 respondents who have implemented IoT (adopters) were classified according to their IoT AQ score. Respondents who are more advanced in the IoT journey have indicated that they have realised higher business outcomes as a result of IoT. For example, respondents classified as Cognitive Enterprises have realised higher business outcomes across all key business metrics.

### Key takeaway #3

## Energy, logistics, building, and transportation are the top 4 verticals with the highest gains

#### High gain verticals

Respondents from logistics, retail, building, energy, and transportation industries have reported positive impact of between 8% and 16% on all their business metrics.

For the retail sector, IoT is playing a crucial role in bringing customers back to the physical store and understanding their buying behaviour. This has resulted in gains of 15.8% in profit margin and 15.4% in employee productivity for those who adopted IoT.

Resource utilisation is one of the most critical metrics for the logistics industry. IoT provides fleet operators with track and trace capabilities to optimise the utilisation of their vehicles. The study has shown that the logistics industry achieved the highest gain of 14.8% in resource utilisation across the five industries surveyed.



# 3. Where are you on your IoT journey?

## IoT AQ as a journey: But why care about the journey at all?

For any organisation, the true impact of IoT and the value that it brings is very hard to estimate right from the beginning. The business case for investing in IoT differs between organisations. As they progress along their IoT journey and reap incremental benefits, there is a temptation to stop investing or move to something new. Up to a certain point, estimating subsequent gains can be increasingly difficult to gauge.

As decision makers ask themselves how much further they need to invest in their IoT initiatives, it is important to realise that the greatest gains on business outcomes happen when enterprises effectively integrate IoT into their overall business strategy to bring about new business models and services beyond their existing products.

With our survey findings showing that Cognitive Enterprises reap significantly higher gains than those who are not so far along on their IoT journey, it is important that enterprises check off all components of IoT actualisation, instead of only exploring standalone solutions.

### Checklist of IoT AQ Components:



The IoT AQ framework effectively captures an enterprise's IoT maturity and provides a view of the anticipated business outcomes associated with this maturity. A holistic approach towards IoT involves:

- getting **management buy-in** and financial **commitment**
- putting the right strategies in place for **data, artificial intelligence, and security**
- enabling enterprises to move towards the eventual goal of becoming a **Cognitive Enterprise**

The results of the IoT AQ framework provide a clear yardstick to help enterprises plan their IoT journey in order to truly deliver holistic business outcomes.

# 4. How can IoT be best utilised?

The answer lies in use cases.

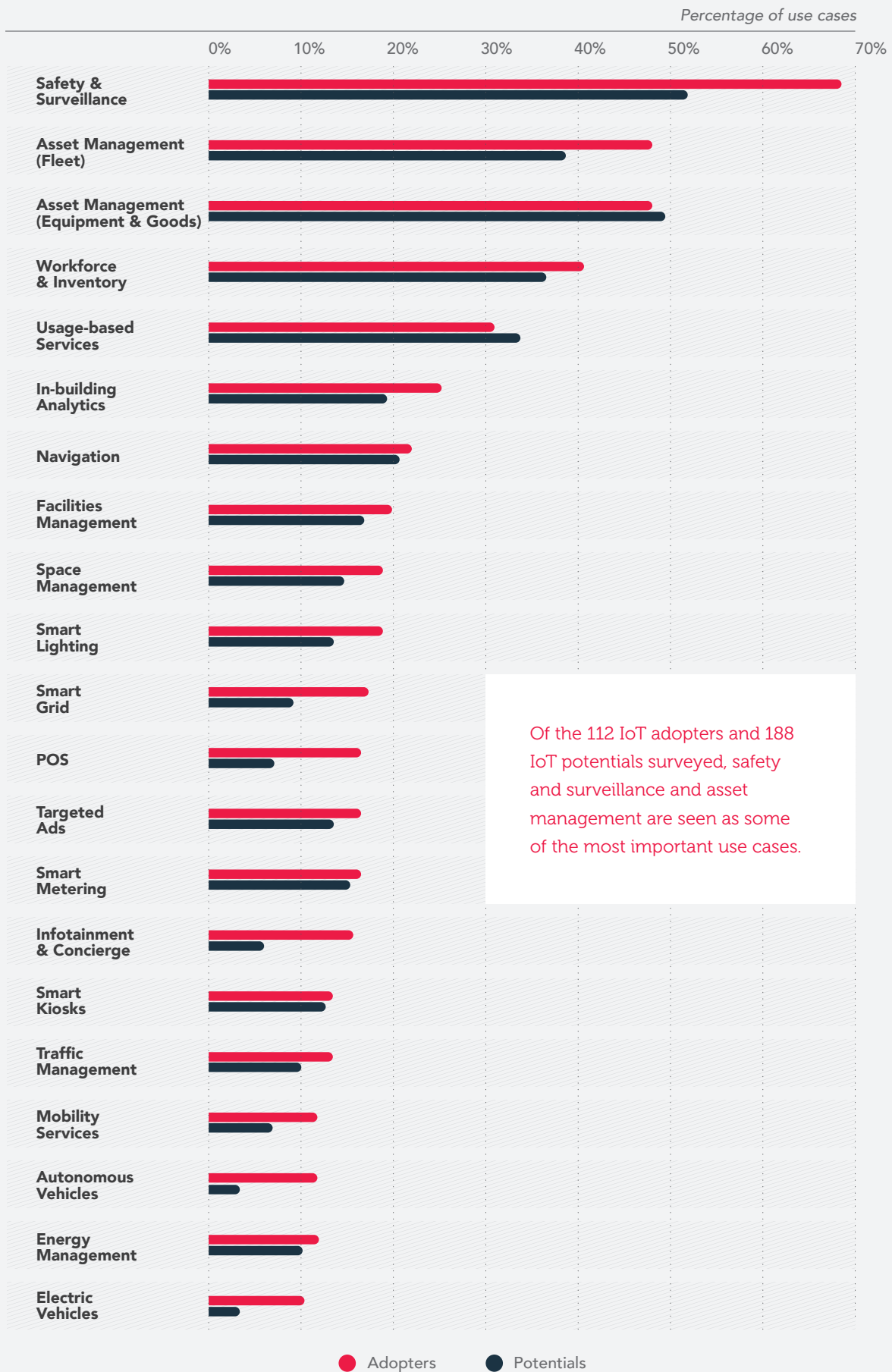


## Majority of IoT use cases are about connecting goods, things, people, and spaces

IoT brings about a number of new use cases, and enterprises across different industries have adapted its implementation to meet their business needs. However, the use cases usually revolve around connecting goods, things (machinery and vehicles), spaces, and people for the purpose of monitoring and managing them. This resonates with our findings where the top five use cases that respondents have implemented or are thinking of implementing IoT, are in the areas of asset and workforce management. The incorporation of these new sources of data into their existing business processes enables enterprises to enhance efficiency and resource utilisation and understand what is happening within their organisations.

IoT implementation for surveillance and safety, in particular, is receiving lots of attention across the different industries as enterprises look to protect their assets, infrastructure, and employees. This is, in large part, due to the advances in video analytics technologies and their ability of video to provide contextual information. Enriched data from the different sensors and video sources enable enterprises to understand the interactions between people, goods, things, and spaces leading to new digital services and business outcomes.

## Types of use cases being adopted or investigated, Australia, Hong Kong, and Singapore, 2018





## IoT is enabling new usage-based business models

Coming on the heels of surveillance and asset management use cases is the implementation of IoT for usage-based services. The ability to measure and quantify people, spaces, things, and goods have enabled enterprises to investigate new business models. This has led to the proliferation of usage-based business models. Pay-as-you-drive and bike-sharing business models are enabled by IoT, where operators are now charging by the usage of vehicles, rather than by the duration of the rental.

Similarly, car insurance companies are also exploring the use of IoT data to price their premiums based on how you drive rather than traditional demographics-based premiums. The growing popularity of the usage-based business model is reflected in the survey findings, with many of the enterprises surveyed indicating that they have either deployed or are thinking of deploying IoT for usage-based services.

## Customer experience: A key use case for retail and logistics

Business processes and customer experience go hand-in-hand for verticals such as retail and logistics, where enhanced customer and process journeys have a direct impact to the bottom line.

For such industries, business outcomes include strengthening existing business processes, enhancing customer experience, augmenting employee experience (leading to higher productivity), and improving financial outcomes. In the case of logistics, many respondents have highlighted several IoT use cases where they hope to achieve or have achieved positive impact on employee experience (and its associated employee productivity) and business processes (improving operational efficiency and resource utilisation).

For example, the retail sector is focusing on enhancing customer experience using in-store analytics, seamless check-out and payment processes, and interactive advertising and display. IoT makes these components more seamless and end-to-end in terms of the overall customer journey. This is critical for the retail sector as e-commerce threatens to displace brick-and-mortar outlets. The ability to bring customers back to the store by providing better in-store experience and seamless online and offline experience is driving IoT adoption in retail.

# Adopted IoT use cases in retail and logistics, Australia, Hong Kong, and Singapore, 2018

Retail



Logistics



The different use cases adopted or identified as relevant by respondents in the logistics and retail industries. There is a strong focus on improving customer experience in retail and strengthening business processes in logistics (73 respondents in retail and 69 respondents in logistics).



# IoT Use Case

## Driving customers back into the stores with a better experience

### CHALLENGE

The brick-and-mortar retail sector is an intensely competitive one. The popularity of online shopping has been threatening the survival of physical stores. Due to the "Amazon effect", shoppers now demand better customer experience and seek the same digital experiences even when in a physical environment.

### SOLUTION

While the outlook for the brick-and-mortar retail sector may seem a little uncertain, IoT may be the key to bringing consumers back into the physical store. This takes the form of interactive digital signage displays which allow customers to browse, compare, and investigate products beyond just touch and feel. Similarly, in-store analytics, driven by WiFi sensors or video sensors enable retailers to better understand the demographic and visitation trends in their physical stores. This allows them to influence not only stock selection and merchandising display, but also the sensorial experiences within the store using interactive digital signage displays. Smarter point of sale technology also enables customers to transact more efficiently while allowing retailers to create proximity-based personalised offers.

## Bringing radical changes to the operating model of fleet operators

### CHALLENGE

Operators of large vehicle fleets face a number of issues. Apart from coping with growing customer demand and complex business models, fleet operators also have to manage the risks of pilferage, dangerous driving behaviour, and unexpected vehicle breakdowns. At the same time, the increasing need for fleet operators to fulfil omnichannel deliveries is both a growth opportunity and challenge that call for new capabilities to keep their customers happy and loyal.

### SOLUTION

IoT offers fleet operators with the means to change their operating models radically. Telematics installed in vehicles enhances business outcomes with predictive maintenance, driver behaviour, vehicle utilisation, route optimisation, and asset utilisation. The insights captured from the vehicles are valuable in supporting the delivery of services and business model. This includes the ability to offer utility-based insurance, driver training, and scheduled maintenance, all of which enhances key business outcomes of fleet operators. In the long run, by leveraging these new sources of data, fleet operators will be able to continuously improve their operations and adapt strategies to drive positive business outcomes.

## Changing the way people interact using intelligence workspace

### CHALLENGE

Across the world in all major cities, the cost of renting commercial office space is on the rise. This has put increasing pressure on enterprises to utilise their space better, and plan their workplace to make it more intelligent. To keep up with the changing needs of the workspace, offices have evolved extensively to become more intelligent by leveraging emerging technologies to create an environment that enhances productivity, efficiency, and collaboration.

### SOLUTION

IoT solutions around the intelligent workspace are changing the way people work. The use of beacons, wearables, sensors, biometrics, and mobile apps enhances energy savings and enables enterprises to provide an efficient, safe, and conducive environment for people to work and collaborate. The collection of movement, people, and environmental data provides insights for even better future office planning, such as improved ergonomics and efficient utilisation of meeting spaces.

# How do you do it?

## Network, Security, and Applications

### 1. Setting the foundation: The network

In IoT, connectivity is always on. Network must come first. In this way, the network is fast becoming a telemetry and data platform, from which enterprises can use insights from data to gain better business outcomes. Not only does it provide the channel for people and things to exchange data, it opens up opportunities for enterprises to better monetise from the platform and turn data into business outcomes. This is also aligned to the growing shift among enterprises from product-based to service oriented and usage-based business models. The importance of connectivity is reinforced in the results of the study. The value that connectivity brings is recognised by both the adopters and the potentials. The matrix diagram illustrates this by capturing respondents' perception of the importance of the IoT technology stack and their confidence in delivering on this stack. Adopters and potentials not only rated it to be highly important, there is also a strong level of confidence associated with it.

**Perceived importance of IoT layers vs Perceived confidence (Mean) – Adopters, Australia, Hong Kong, and Singapore, 2018**



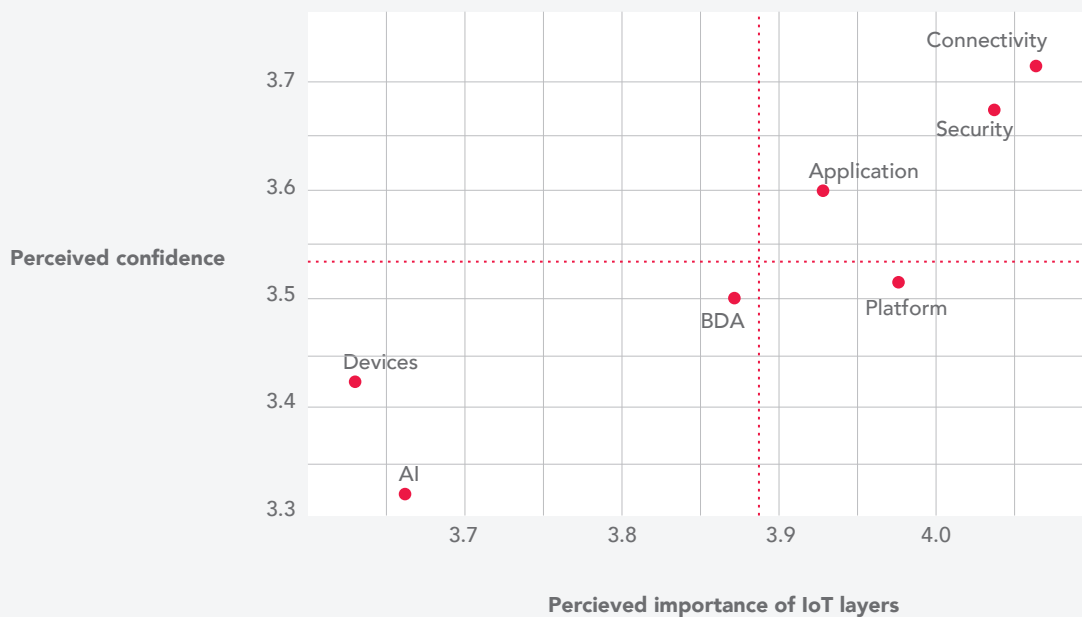
At the connectivity level, it is also important to leverage AI to improve network services, thus enhancing the quality of digital services. While it is usually viewed as a utility, the possibilities that connectivity and networking unlock will change the digital business landscape. As IoT services evolve to take on more mission-critical and time-sensitive applications, more will be demanded from the network. Mining contextual information and network telemetry will enable applications developers to optimise device and application performance, and network consumption to improve the lifespan of batteries. This will increasingly become more important in enhancing the quality of services, customer experience, and other business outcomes.

## 2. Protecting the house: IoT security

Enterprises are starting to become very concerned about the potential cyber risks associated with connecting their systems and processes onto the network. The fact that one of the largest Distributed Denial-of-Service (DDoS) attacks was contributed in large part by IoT devices has raised the alarm for them. Cybersecurity incidences that result in the loss of data, privacy, money and customer confidence are a top-of-mind concern for CEOs.

While decision makers have realised the need to provide secure services, they might not have fully appreciated the difficulty of securing these services, resulting in overconfidence in their ability to tackle threats. This is reflected in the findings of the survey where security is perceived to be highly important for both enterprises who have adopted IoT and those that have not. But there is a visible difference between their levels of confidence. Respondents that have yet to adopt IoT perceive themselves to be well prepared for cybersecurity threats, while those who have adopted IoT have realised that they might not be as prepared as they thought. The matrix diagram illustrates this and highlights that respondents who have not implemented IoT underappreciate the difficulty of securing their digital assets.

**Perceived importance of IoT layers vs Perceived confidence (Mean) – Potentials, Australia, Hong Kong, and Singapore, 2018**



## 3. Building the roof: The application ecosystem

The growth spurt in IoT is expected to come from the adoption of applications, but the take-up rate has generally been slower than anticipated. A reason why IoT applications remain nascent today is due to the lack of application solutions that cater to specific industries. Enterprises are accepting that IoT spans several domains, and no single solutions provider can deliver everything under a single roof. Even the largest IT vendors may struggle to achieve that. To accelerate go-to-market it is essential to leverage your partner ecosystem to gain access to a wider body of domain expertise and broaden the pool of applications for customers. This notion resonates with our findings where respondents who have adopted IoT and those who have not perceive applications to be important. However, there is a difference between their perceived levels of confidence in delivering on the application layer. Respondents who have yet to adopt IoT do not fully appreciate the challenges behind creating and deploying applications. This might hinder the success of IoT initiatives by enterprises that have yet to begin the IoT journey.

# In conclusion

The journey to introduce IoT is a long one, but it has shown to bear fruits. Many enterprises in Australia, Hong Kong, and Singapore have already embarked on this journey and realised significant gains in their business performance. In fact, the end-user study conducted found that enterprises at different stages of their IoT actualisation journey have realised increasing business benefits as they transition from a Connected Enterprise to a Cognitive Enterprise. Sometimes the hardest part of the journey is to begin, but it is just as important to continue with the journey and realise the increasing business benefits associated with this journey. As enterprises adopt IoT, it is important to understand that IoT should be outcome focused, and a data-driven approach is key to ensuring successful IoT outcomes. To reap the VALUE associated with IoT, enterprises should bear in mind the following principles when executing their IoT strategy.

## **V**alidate your business outcome first before considering anything else

- IoT should focus on business outcomes. Focus on the big ideas and business outcomes before deciding on the technology.
- Obtain not only management sponsorship but also engage multiple lines of business stakeholders when defining the intended business outcomes.
- Take a structured approach towards defining the problem and discovering the solution. For example, leveraging best practices such as design thinking and sprint methodology.
- Look for solutions that allow you to quickly and cheaply investigate to establish business value and understand the return on investment.

## **A**rtificial intelligence is key to optimising a data-first approach for your business

- IoT is a data-driven initiative and the IoT platform chosen should be data-centric.
- The platform should provide the necessary tools not only to manage the devices but also allow innovation on top of it to create data-centric products and services.
- Data platform should provide seamless data integration to provide access to the right information, data analytics for reporting and visualisation, and advanced methods such as machine learning to optimise services and automate them into existing business processes.

## **L**everage your technology partners and their ecosystem to accelerate go-to-market

- You should be focused on running a business and not grappling with technology and IT issues. It is important to choose a technology partner that has a full stack optimised for the intended connectivity type. A full IoT stack, including devices, connectivity, and cloud platform should reduce complexity and simplify application development and delivery.
- IoT is to a large extent an ecosystem play, and access to the large body of application developers is key. Evaluate your partners based on their ecosystem of capabilities and the ability to co-create with them.
- IoT implementation can be rather complex and spans multiple technologies, domains, and in many cases, multiple industries. It is important to partner with companies with the necessary domain and system integration capabilities.

## **U**nderscore all digital services with security considerations

- IoT is expected to increase cyber risk exposure, and as enterprises' business become geared towards providing digital services, it is imperative that security is taken care of .
- You are as strong as your weakest link. Ensure that your end-to-end services are secure by selecting solutions that are cyber secure across devices, connectivity, platform, and applications.
- This encompasses not only cyberattack concerns but also any factor affecting the reliability of your service such as quality of service.

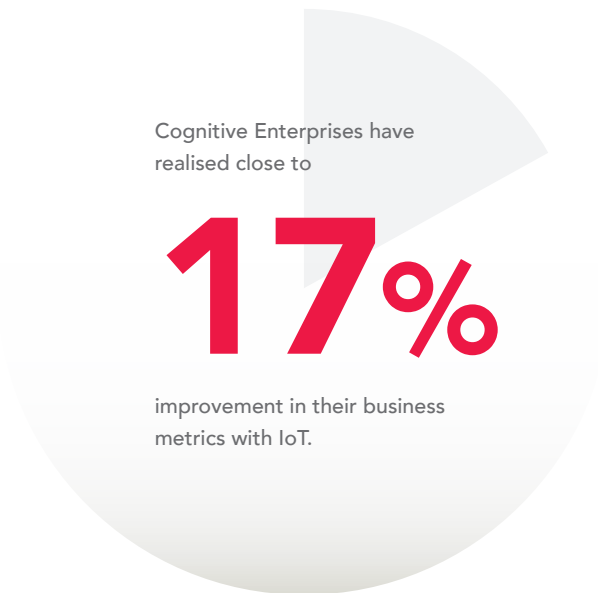
## **E**xecute and scale your IoT business

- Ensure that the solutions and platforms chosen will be able to scale. This includes the ability to scale across geographical regions, enabling IoT services to be offered overseas.
- Little costs add up quickly. As many IoT services rely on scale, it is important that the IoT solution chosen is cost effective. This includes leveraging the economics of cloud and ensuring data connectivity costs are flexible and low.
- Lastly, do not stop innovating after the proof of concept, where a continuous refinement of IoT applications and services should be expected.



## Network, security, and applications

are important ingredients in successful IoT implementations.





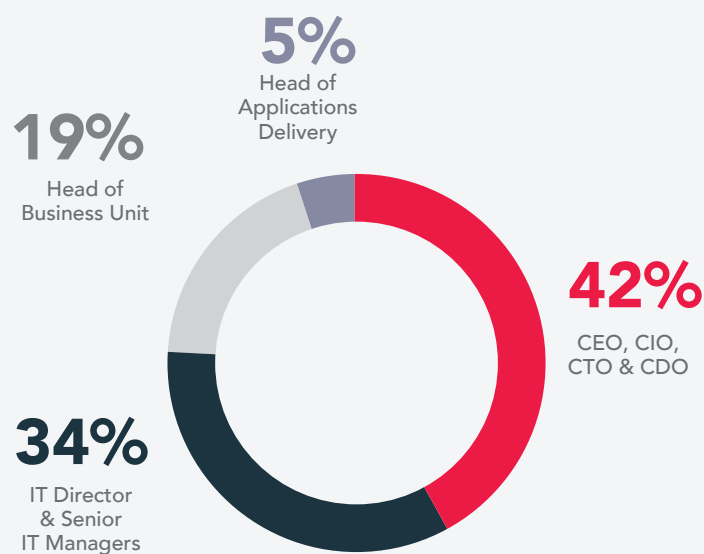
# Appendix:

## Overview of IoT Actualisation Quotient study

The goal of this study was to understand the IoT maturity of enterprises in Australia, Hong Kong, and Singapore and the impact of IoT adoption on business performance. In each selected country, 100 respondents were surveyed. The study also looked at respondents' attitudes and perceptions towards IoT and other enabling technologies, and how these enterprises are implementing IoT in their organisations. As a result of the study, the Internet of Things Actualisation Quotient (IoT AQ) was created to quantify enterprises' digital maturity in their IoT journey. The quotient was successful in measuring IoT maturity and linking this maturity to business outcomes.

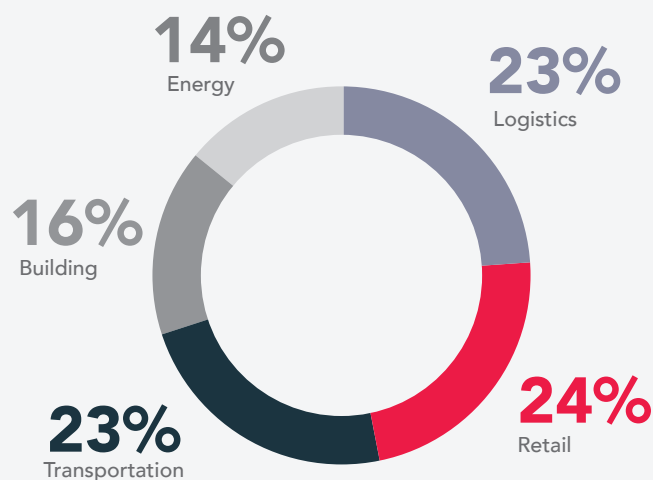
### Survey demographics by job designation, Australia, Hong Kong, and Singapore, 2018

Frost & Sullivan surveyed 300 IT decision leaders, including C-suite leaders, heads of business units, head of application delivery, and IT directors and senior IT managers involved in driving IoT strategy as well as implementing IoT systems.



### Survey demographics by vertical, Australia, Hong Kong, and Singapore, 2018

In developing the 2018 IoT AQ Report, Frost & Sullivan surveyed respondents from enterprises across diverse industries including logistics, transportation, building, retail, and energy.



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