



Welcome to the machine-to-machine economy

Opportunities and challenges in a
connected world



Contents

| | |
|---|----------|
| The machine-to-machine economy | 3 |
| Entering the Fourth Industrial Revolution | 3 |
| Smart machines | 3 |
| Machines talking to machines | 4 |
| Four steps in the evolution of the machine-to-machine economy | 4 |
| Mega trends leading to the machine-to-machine economy | 5 |
| Benefits of the machine-to-machine economy | 5 |
| Making the machine-to-machine economy real | 6 |
| Monetisation opportunities in the machine-to-machine economy | 6 |
| What we've been doing | 6 |
| Australia, let's talk | 6 |

“The machine-to-machine economy will fundamentally transform our perspective of what is possible between people and machines. The opportunities are limited only by our own imagination.”

**Dilan Rajasingham,
Head of Emerging Technology, CommBank**



The machine-to-machine economy

Entering the Fourth Industrial Revolution

The Fourth Industrial Revolution will usher in an era of radical automation, with billions of connected, smart machines interacting with humans and with each other and generating a growing share of global GDP. Welcome to the machine-to-machine (M2M) economy.

Industrial Revolutions are rapid developments that create dramatic change. The First Industrial Revolution saw society shift from an agrarian to an industrial model, with advances in transport and early mechanisation due to steam power. This was the start of machine labour.

The Second Industrial Revolution took us a step further, with electricity enabling mass production, and railroads and the telegraph connecting the world.

The Third Industrial Revolution saw the introduction of digitisation through the invention of computers and the internet. These technologies connected people and value chains and brought in new levels of efficiency and automation which reshaped multiple sectors of the economy, displaced powerful incumbents and overturned established business models.

The convergence of emerging technologies is accelerating the pace of change and the opportunities that it brings. Today, we stand on the edge of the Fourth Industrial Revolution¹ – merging the physical (from the first and second industrial revolutions) and the digital (from the third) with the biological. And, as in the previous industrial revolutions, machines will play a dominant role. The difference is that now they are becoming “smart.”

Smart machines

We’ve never been more connected. Billions of people use the internet and it’s hard to imagine life without it.

As the cost of computer chips keeps going down, it’s now easy to connect all kinds of things to the internet. From smart phones and TVs to cars and tractors, our everyday items are becoming connected. In fact, it is estimated that between 20 and 50 billion connected things will be in use worldwide by 2020². This is called the Internet of Things.

This connectivity is also enabling us to control things from anywhere in the world, while equipping things with sensors enables us to gather digital information about the world around them. As the Internet of Things converges with artificial intelligence, a growing population of smart, connected devices will eventually operate autonomously, creating new business models and new value in the process³.

“We’re headed for a tectonic shift in how we think about the way enterprises and assets are managed. It will be an epic battle of the business models.”

Paul Brody, Principal & Global Innovation Leader, Blockchain Technology, Ernst & Young

¹ <https://www.weforum.org/about/the-fourth-industrial-revolution-by-klaus-schwab>

² Gartner press release, <https://www.gartner.com/newsroom/id/3165317> and

Cisco white paper, https://www.cisco.com/c/dam/en_us/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf

³ <https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition>



Machines talking to machines

Smart, connected machines are now starting to make decisions and independently react to the world around them. For example, using sensors, your fridge can tell when you're out of milk, and send you a message on your phone to pick some up on the way home.

Taking this a step further, using machine-to-machine communication, your fridge could pass this message to your local supermarket's ordering system, where your groceries would be selected from the warehouse and a driver notified to deliver your groceries directly to you.

The machines that we've built to support us are now able to do more – in a much more efficient and effective way – freeing us up to spend more time doing what matters to us.

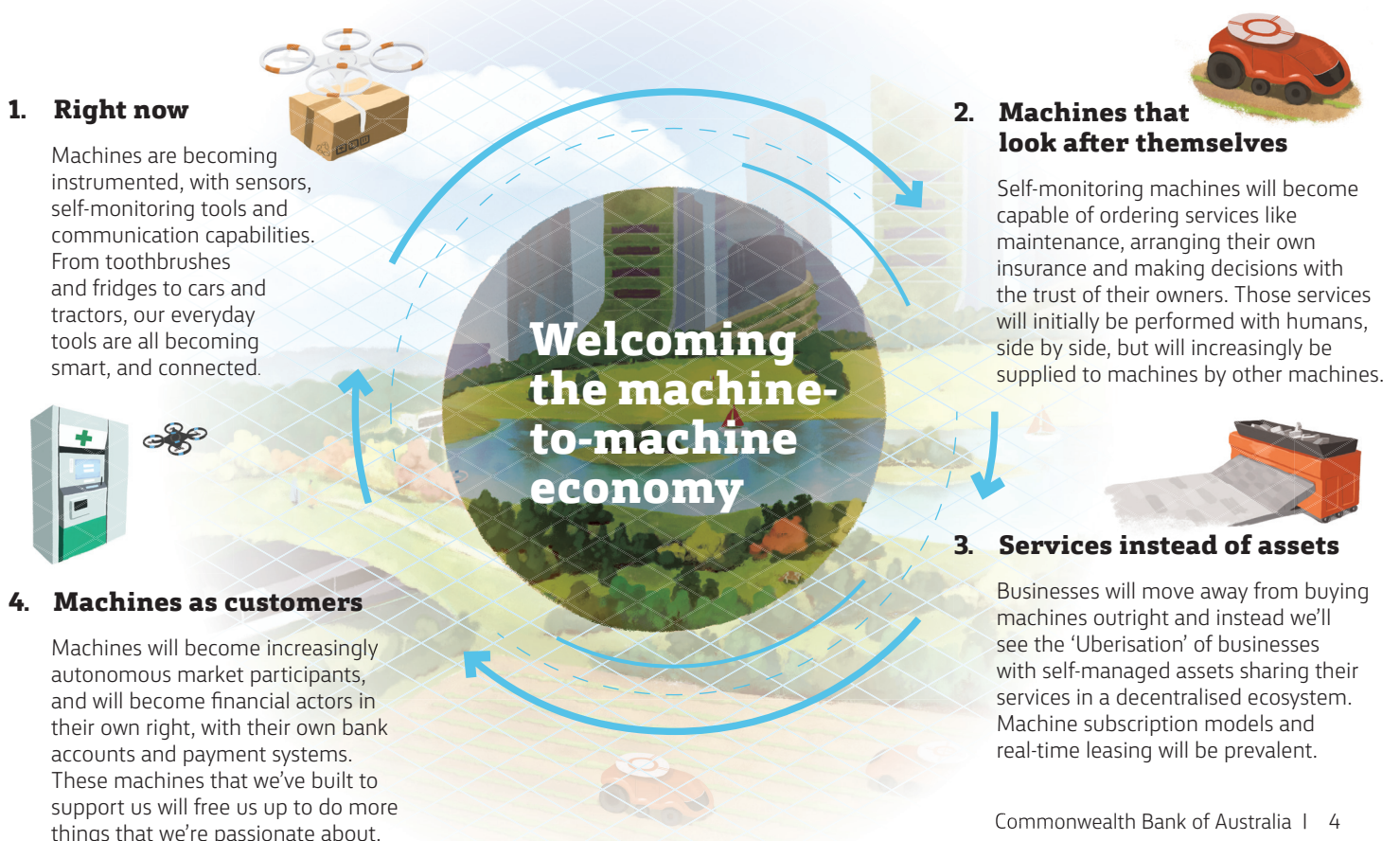
However, to take advantage of the new opportunities this presents, and to truly create new business models and value, we need machines to do more than just automate mundane tasks. We need them to create more value out of the services that they provide.

One way to do that is to develop autonomous or semi-autonomous machines with the power to make their own decisions, buy and sell services, operate in markets, and participate in the economy as a new class of market participant. This is the machine-to-machine economy.

“As a business, your real need isn't for a truck, a bulldozer or a drone. It's the ability to ship some goods, move some earth, or inspect a bridge. So why should you spend time overseeing maintenance and managing assets that could just as easily manage themselves?”

Andrew Despi, Manager,
Emerging Technology, CommBank

Four steps in the evolution of the machine-to-machine economy





Mega trends leading to the machine-to-machine economy

The convergence of three major trends is leading to the emergence of the machine-to-machine economy. These include:

The sharing economy. Sometimes described as the ‘Uberisation’ of business, it is characterised by increased productivity of existing resources. This new market will see self-managed machines sharing their services, possibly in a decentralised ecosystem.

The Internet of Services. Businesses like AirTasker and ServiceSeeking have created digital marketplaces for all kinds of services. Smart machines will not only buy services like maintenance, inspections and insurance through the Internet of Services. They will also sell their services as a product, with businesses paying per hour, per hectare or per outcome, rather than buying assets outright.

Automation. The widespread adoption of artificial intelligence and machine learning means that computers can now mimic some of the things that humans are capable of, but at scale. Pre-programmed machines embedded with computer chips and artificial intelligence require less oversight, making them significantly more efficient.

Benefits of the machine-to-machine economy

The machine-to-machine economy promises significant benefits for people, businesses and the broader economy.

- Automating mundane tasks will free people up to do the things that matter most to them
- New business models will emerge e.g. “as a Service,” reducing the need for businesses to own, maintain and manage assets and reducing risk exposure to asset obsolescence cycles
- Shared machines will lead to cheaper products and services as the utilisation of machines increases and the cost per unit goes down
- Not needing to purchase machines outright will reduce barriers to entry in many industries, enabling a new generation of entrepreneurs to participate in the economy
- Better utilised machines means that there will be less waste of the limited resources required to manufacture them
- As new business models and marketplaces emerge, new jobs and industries will be created

Distributed autonomous organisations

Distributed autonomous organisations (DAOs) are designed to operate without human oversight, using a decentralised model underpinned and controlled by a network of smart contracts on a blockchain.

The distributed nature of a DAO means that day-to-day decisions aren’t made by a human management team, but via a series of coded algorithms embedded in smart contracts. In effect, once a DAO is set up, it can essentially run itself. For example, imagine a website robot that can build websites, acquire funds and use those funds to buy power and processing capability – effectively everything a normal company would do, except that in this case every step would be highly automated and regulated by digitised contracts.

These autonomous organisations aren’t just theory. The creation of the Ethereum platform in 2015 saw the launch of several fledgling DAOs, including Dash, The DAO and Digix.io. Imagine if machines could be managed in a similar way, with a mixture of artificial intelligence and human creativity being used to evolve the DAO in ways we can’t even imagine.



Making the machine-to-machine economy real

Monetisation opportunities in the machine-to-machine economy

In this new economy the opportunities for monetisation are limited only by our own creativity. What we do know is that smart machines will range from simple sensors that digitise data about the world around them, to sophisticated robots. Different machines will have different abilities. Some will be able to move while others will be fixed, some will collect data while others will require access to data to operate, some will have access to the energy grid while others will operate on batteries and will need to recharge.

Whatever their form, smart machines will need to exchange services with each other, and with humans. This will enable new opportunities for monetisation. For example:

- The machine renting and operating itself
- Repairs, maintenance and inspections
- Retiring / recycling the asset (see Circular Economy⁴)
- Capital as a service (embedded finance and insurance)
- Energy as a service (enabling any machine to recharge)
- Bandwidth as a service (uploading / downloading large amounts of data)
- Storage and computing as a service (processing large volumes of data from sensors)

What we've been doing

We've been working to understand how these trends could impact our clients and the broader business landscape. Recently, we partnered with Ernst & Young and its global leader for blockchain and Internet of Things, Paul Brody. Paul's work on IBM's ADEPT project broke new ground by integrating the Internet of Things with blockchain to create semi-autonomous appliances that could perform predictive maintenance, then use a virtual "wallet" to order parts and supplies.

Our research has confirmed that many high value physical assets in business are significantly under-utilised. A key observation is that the different and complementary capabilities of various machines will inevitably lead to a market for machines to share services with one another.

To date, our research has identified over 20 potential use cases for machine-to-machine economy experimentation. The implications could be especially significant for sectors including manufacturing, logistics, resources, agriculture, energy and infrastructure.

We are currently working with our partners and customers to understand how banks can provide value added services to smart machines by leveraging Internet of Things data and automating processes and marketplaces using blockchain-enabled smart contracts.

Our focus is on exploring cases where there is immediate value, as well as understanding the long-term implications of automation on the financial services industry.

Australia, let's talk

The emerging machine-to-machine economy raises many questions. Businesses, regulators and financial institutions need to act now if we are to realise all the benefits the new economy promises to deliver.

This is not a vision of the distant future – most of the technologies needed to put it into action already exist. We're standing on the cusp of something that is perhaps unexpected and possibly will come with unexpected consequences. But it is also an opportunity.

⁴ <https://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/moving-toward-a-circular-economy>



Most importantly, we have to address, individually and collectively, moral and ethical issues that make us question the human condition. We have to rethink our ideas about economic and social development, value creation, privacy and ownership, and even individual identity. As automation takes over production, how will we think about jobs, cities, even well-being?

These discussions should guide us in our design of the required regulatory and business frameworks. We believe it's important to have these discussions and put the required frameworks in place now.

Regulation.

How do we incorporate global regulatory guidelines into smart machines? How do we safely and consistently authenticate individual machines? An elegant solution would be a single, global register based on a public certificate with a public-private key combination, although there are distributed alternatives.

Security, privacy and trust.

Technology is rapidly transforming economies around the world, creating new opportunities for growth and prosperity. But this revolution will also create new issues around safety, privacy and security that the world is only beginning to fully understand. In this new interconnected world, security is a shared responsibility. All of us – whether we're in the private sector, working for the government or more broadly in the community – have a role to play in ensuring a strong, secure and resilient modern economy.

Increasingly intelligent machines.

In the short term, it's easy to envisage smart contracts with built-in guardrails embodying essential regulatory and business rules – from reporting requirements to transaction value limits. But as artificial intelligence (AI) begins to arrive at scale, the question is whether these mechanisms will be enough. That's why it's important for intelligent machines to learn about regulation and socially responsible behaviour, as well as about business. In the same way as we educate our children to follow social norms, we need to ensure our machines are not only smart, but ethical.

Reducing Waste.

Not having access to detailed and real-time information about where things are, what state they are in, and what the demand for them is creates huge amounts of waste in our society. Rethinking the idea of ownership can also lead to less waste. Did you know that most cars are only used about 5 per cent of the time?⁵ Consider the efficiency and liveability gains a city could make if we made the shift away from car ownership to a model of car sharing.

The future of jobs.

The Fourth Industrial Revolution also raises many questions around the future of work. Some experts predict that automation and new technologies will reduce the global job market by seven per cent. In response, many countries and states around the world are trialling a concept called UBI, or Universal Basic Income – a periodic cash payment unconditionally delivered to all, without means-testing or a work requirement. Supporters of UBI argue that it would not only mitigate the effects of the joblessness expected to follow automation, but also free up people's time to spend on more creative pursuits, solving the world's real problems rather than doing chores.

It feels like a bold new world, but it's not far away and we all need to be ready for it. CommBank is ready to collaborate. Talk to us about how we can all benefit from the machine-to-machine economy.

⁵ <http://fortune.com/2016/03/13/cars-parked-95-percent-of-time/>



About the author



Dilan Rajasingham

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Understanding the potential implications of new technology is one way we can continue to evolve to meet our customers' changing needs.

As head of our Emerging Technology team, Dilan is at the forefront of exploring the disruptive power of new technology, and its potential to enhance our customers' wellbeing.

Dilan has a deep technical skillset in strategy, architecture and technology implementation across multiple industries, as well as a proven ability to build impressive global networks of collaborators to commercialise concepts and technology.

He is passionate about innovating to better our world and collaborating with Australia's technology ecosystem to ensure Australia remains a leader in technology. As a highly engaging and practiced speaker, he is often called upon to help explain abstract ideas, complex technologies and their social implications in a simple way.

Emerging Technology at Commonwealth Bank

Commonwealth Bank's Emerging Technology team identifies emerging technologies that are expected to radically change the status quo in financial services in the medium to long term (5-20 years). We conduct experiments to solve real business challenges, commercialise outcomes and share our learnings with our people, customers and communities. Our deep emerging tech capability allows the bank to follow fast with any disruptive play as well as create new market opportunities to keep us ahead of our competitors.

The team's current focus areas include big data, cyber, identity, blockchain, smart machines, Internet of Things, Ag-tech, and next-generation compute, including platforms and atomic computing (e.g. quantum computing).

Email us at EmergingTech@cba.com.au.

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