

# Blockchain and Industry 4.0

Why Blockchain is at the heart of the Fourth Industrial Revolution and Digital Economy?



# Contents

- 03** Introduction
- 04** What is Blockchain?
- 05** How will Blockchain transform industries and the economy?
- 06** How does Blockchain support Swinburne's Industry 4.0 Strategy?
- 07** What is the future of the Digital Economy driven by Blockchain?
- 08** Industry 4.0 Digitalisation Platform
- 09** Digital Supply Chains
- 10** Conclusion
- 11** Authors
- 12** About Capgemini and Swinburne

# Introduction

We are immersed in the fourth industrial revolution that is fundamentally changing the way we live, work and relate to one another. Industry 4.0 is an emerging era of connectivity and interaction among parts, machines and humans that have the potential to create enormous production and efficiency dividends, improvements in the quality of life and sustainable environmental outcomes. Swinburne's Industry 4.0 Strategy is currently focused on addressing key priorities of national importance including the following:

- How can Australian industries successfully implement Industry 4.0 strategies, technologies and practices across key growth sectors?
- How can Australia's manufacturing industry access global value chains by becoming more agile, innovative and productive?
- How can Australia develop work force capabilities in partnership with industry and business to lead industry transformations and growth in the global context?

The fourth industrial revolution will be established on trusted networks that remove the need for middlemen. Simple processes that are currently tackled manually or in a segregated manner will be undertaken in an integrated way using digital, autonomous systems, underpinned in many cases by Blockchain technology. This document aims to provide insights around four core questions:

**1**

What is Blockchain?

**2**

How will Blockchain transform industries and the economy?

**3**

How does Blockchain support Swinburne's Industry 4.0 Strategy?

**4**

What is the future of the Digital Economy driven by Blockchain?

Swinburne University of Technology partnered with Capgemini, a global leader in consulting, technology services and digital transformation, to develop this paper.

# What is Blockchain?

To explain the basic principle of a Blockchain we will use an example of a marriage ceremony. The concept of a marriage ceremony has existed for thousands of years. While a marriage ceremony may vary in different cultures and geographical locations, in most cases it requires the presence of an invited group of witnesses during the ceremony to provide evidence of the event that involves a formal agreement between parties.

In a way, Blockchain technology mimics a wedding ceremony by using the power of a distributed ledger to keep trusted records of the “agreement/transaction” within an invited community. The replicated records across multiple users can validate the authenticity of the synchronised contents of the agreement or transaction.

Since 2008, the development of Bitcoin became the first example of a Blockchain application. This widespread cryptocurrency provides a real-life solution to the challenge of trust in a decentralised

system. It has the power of making transactions untraceable but also verifiable and permanent. A centralised bank becomes unnecessary in this case because every agreement, every process, every task, and every transaction has a unique digital record and a signature that can be identified, validated, stored, and shared. Valid transactions are collected into blocks that are permanently sealed.

This decentralised digital transaction makes any intermediaries such as agents, brokers, and even bankers unnecessary.

Individuals, organisations, and machines will be able to communicate seamlessly and autonomously, conduct transactions independently, and interact effortlessly and safely. This is the promise of Blockchain technology.



# How will Blockchain transform industries and the economy?

The transparent consensus mechanism of Blockchain makes it possible to verify the validity of transactions and how information has been modified or created in the process. While the initial focus of Blockchain technology was on applications in the finance sector, we are seeing far more potential in the physical world of manufacturing, agriculture, healthcare, supply chains and logistics. Blockchain technology enables new business models, innovative organisational forms and work processes. It is changing the paradigm from hierarchical organisations to self-organising economies. Blockchain has opened the door for many new possibilities in the way value can be directly transferred between participants in a convenient and trusted manner. With smart contracts, execution of workflows will be used for automation of regulatory workflows. Reporting and monitoring of required data, checking of compliances, and approval processes will become easier than ever.

Today, applications of Blockchain technology are emerging across all sections of society and industry. For example, in the finance sector, Blockchain can simplify business processes while creating safe, trustworthy records of agreements and transactions. A global consortium of more than 80 institutional members has formed to develop proof of concepts and prototypes of finance systems that are disrupting the finance sector by

automatic execution of finance transactions in real-time. Furthermore, in case of food supply chains for example, a Blockchain-enabled ecosystem can facilitate an end-to-end service that alleviates interruptions in supply chain occurrence of fraudulent products. By integrating supply chain management with an Internet of Things (IoT) system that supports an automated machine-to-machine communication an optimal and safe value transfer can take place across the entire process.

Succeeding in the next industrial era requires manufacturing companies to define and shape their core value drivers enabled by digital technologies. Industry 4.0 will drive operational efficiencies through Smart Factories and Smart Supply Chains as well as grow opportunities through innovation and bespoke solutions to increase customer value. They will ultimately lead to completely new business models and service offerings enabled through digitalisation.

It is becoming evident that Blockchain has the potential to be more impactful by combining cyber and physical systems through integration with Industry 4.0 technology platforms such as the Internet of Things (IoT), Robotics, 3D Printing, Augmented Reality and Smart Sensors. Industrial and business models are being designed based on these end-to-end services that are completely interconnected and secure using Blockchain technology.

## Industry 4.0

Fusion of the physical and the virtual world into smart cyber physical systems

### Core value drivers

#### Smart Solutions

Smart products and services enabling new value propositions and business models

#### Smart Products

Extended innovation embraces the creation and distribution of ideas across organisational borders

#### Smart Supply Chains

Highly integrated and automated supply chains enabled by digital technologies and cyber physical systems

#### Smart Factory

New level of self-organisation and process optimisation is enabled in the use of cyber physical system integration and decentralised production control

### Technology enablers (selection)

Internet of Things

Robotics and Autonomous Systems

3D Printing

Augmented Reality

Cloud Computing

Intelligent Data Analytics and AI

Cybersecurity

Community Platforms

### Blockchain

New way for securing trust, transferring value and storing data

# How will Blockchain support Swinburne's Industry 4.0 Strategy?

At Swinburne University of Technology we have placed Industry 4.0 at the heart of our Strategy. In the first stage we have focused on the transformation of the manufacturing sector through digitalisation of the entire value chain from design through to manufacturing and delivery of high value-add products. An example of the implementation of this Strategy is the Swinburne Factory of the Future that is being transformed into an Industry 4.0 Facility through a \$135 million industrial digitalisation grant awarded by Siemens. The Digital Research and Innovation Capability Platform that underpins this development will be used to support Industry 4.0 initiatives and use cases across other industry sectors represented by our Institutes, including Smart Cities, Health Innovation and Social Innovation Research Institutes.

At the heart of our Industry 4.0 Strategy is Blockchain that represents a technology capability platform that potentially supports all industry applications. The areas include supply chain and trade across manufacturing, food, pharmaceutical, health and creative industries.

The fourth industrial revolution will be established on trusted and interconnected networks that remove the need for middlemen activity. "Distributing trust" across participants, Blockchain will drive entire new manufacturing business models. Blockchain's disruptive characteristics have already been experimented and tested within the financial sector, where broker activity is being challenged by platforms that can verify information quickly and safely without manual involvement. Beyond financial services and after professional services (such as property and legal services), Blockchain represents a technology capability platform that supports potentially all industry applications, including:



**Healthcare:** With Blockchain, healthcare organisations can capture an individual's lifetime medical history. Privacy can be maintained via permissioned Blockchains, where confidentiality is established through an agreement. To maintain doctor/patient privacy parties can view essential transactions and request relevant information when necessary.



**Education:** Educational institutions are turning to Blockchain as a way to avoid fraudulent certifications as well as to ease record-keeping needs for students and alumni. While existing paper-based certification systems may be subject to loss or fraud, the need for a centralised database of credentials and achievements has become critical in the face of an increasingly mobile and digital population.



**Government:** Governments are turning to Blockchain as a potential means to better serve their citizens and improve processes for public administrative functions. The ability to record transactions on distributed ledgers offers new approaches for governments to improve transparency, prevent fraud, and establish trust.



**Logistics/Transportation:** Blockchain is poised to create major cost and time saving opportunities for the supply chains, logistics, and transportation sectors. It can be seen as a new method of tracking any kind of product shipment or transaction, tracking performance across the life-cycle of the product while supporting environmentally and socially responsible procurement.

Swinburne's presence and partnerships in Silicon Valley, Tel Aviv, Hong Kong and Stuttgart have enabled Swinburne to immerse itself in the world's most mature innovation ecosystems to fast track these developments.

Sources: Blockchain: Funding the Fourth Industrial Revolution?

- Information Age Shaping the fourth industrial revolution - Cognizant

"We are at a fundamental change in the way we live, work and relate to one another. It is a new chapter in human development, enabled by extraordinary technology advances commensurate with those of the first (steam), second (electricity) and third (computing) industrial revolutions."

Klaus Schwab  
Founder and executive chairman of the World  
Economic Forum

# What is the future of the Digital Economy driven by Blockchain?

From 2018 onwards we expect to see a vast uptake in deploying Blockchain solutions at scale. From awareness to transformation, we see three major waves in the Blockchain adoption maturity:

## Wave 1: Awareness

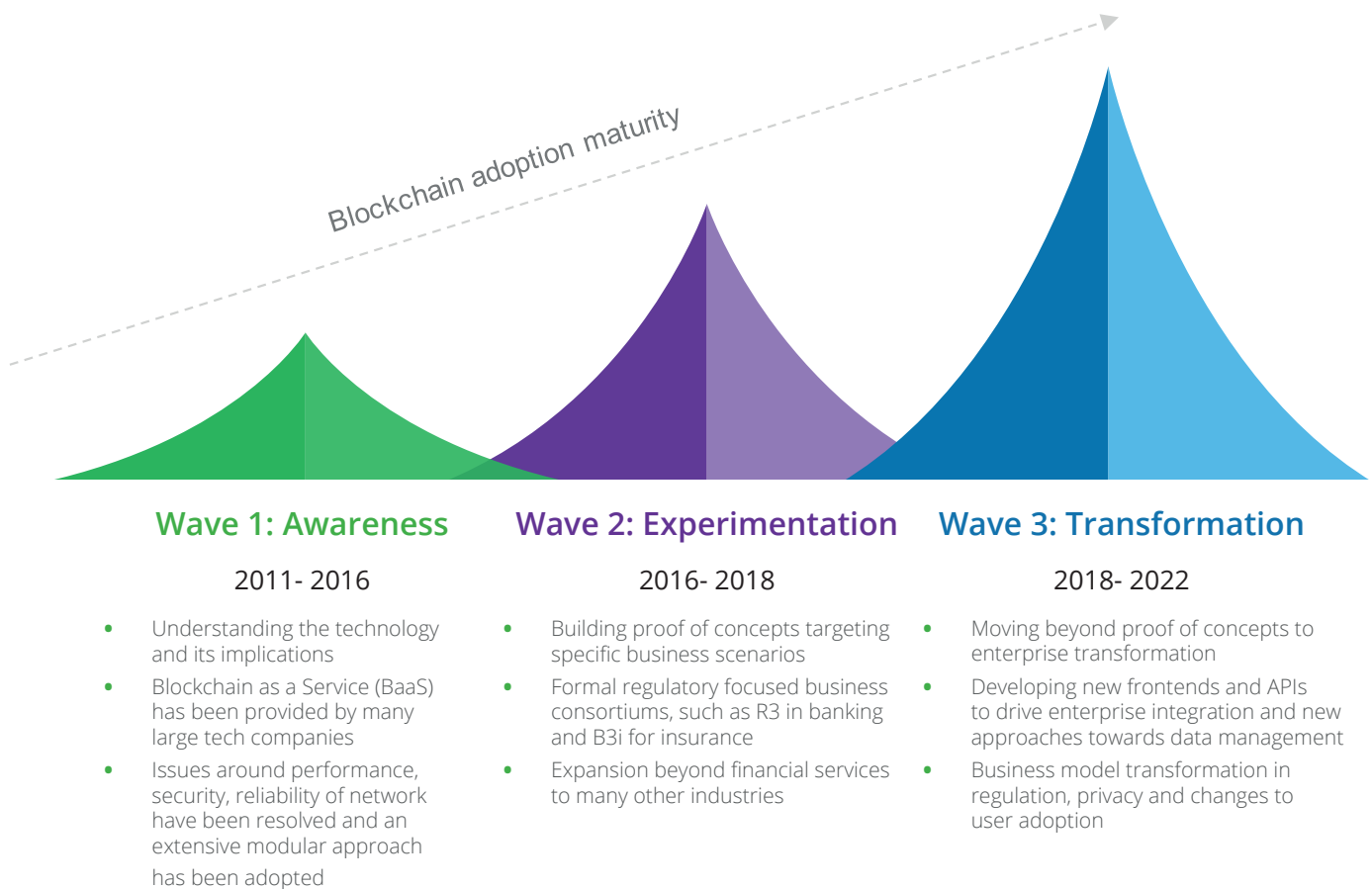
Organisations have invested in understanding Blockchain technology, its implications and creating awareness. This has been ongoing for the past 3-5 years and will continue to mature.

## Wave 2: Experimentation

Organisations have been building proof of concepts to experiment on specific business scenarios. These user cases have been used to prove the business value and establish the business case prior to a full scale Blockchain implementation.

## Wave 3: Transformation

While Waves 1 and 2 continue to make inroads, we foresee a third wave where organisations will undertake entire Enterprise Transformation where the full potential and value of Blockchain will be realised.



# Industry 4.0 Digitalisation Platform

The Swinburne Research and Innovation Ecosystem has established an Industry 4.0 technology platform that underpins all industrial verticals. The platform encompasses key technology labs including the Blockchain Lab as elements of the platform that together provide the necessary technical underpinning with the required capability levels.

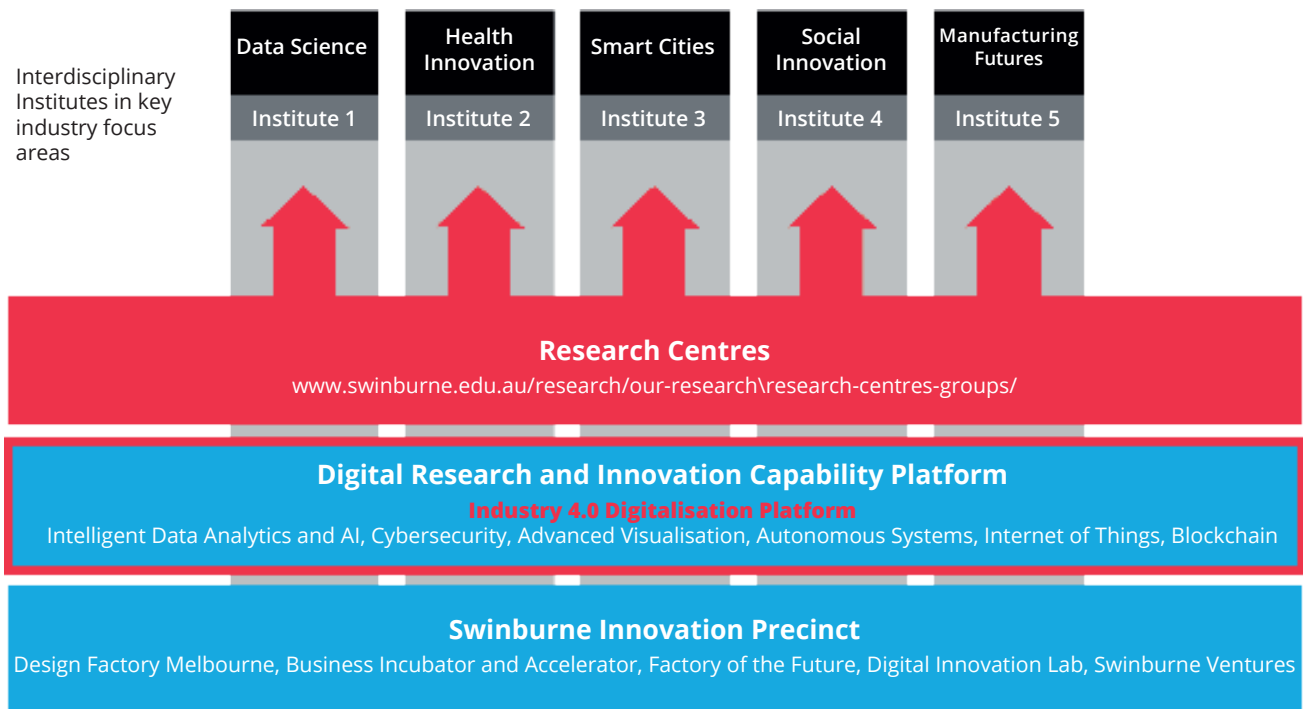


Figure 1



# Digital Supply Chains

## Traditional Supply Chain

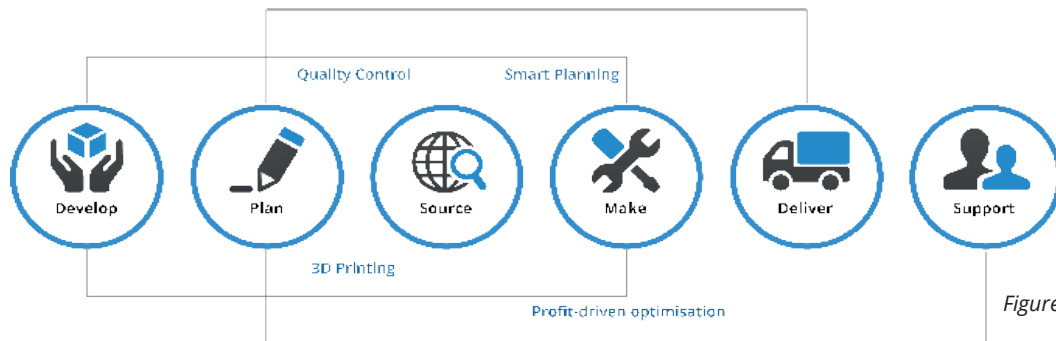


Figure 2

The digitalised supply network is enabled by Blockchain technology acting as the network's core infrastructure. It is supported and empowered by the Internet of Things (IoT) which provides increased connectivity, sophisticated data-gathering and high performance analytical capabilities. Tracking devices and smart sensors are also delivered by the IoT environment which connect physical objects with data, enabling more efficient manufacturing processes, smarter supply chains and new business ecosystems.

At the core of the supply network, Blockchain enables trusted transactions via smart contracts making automatic data transmissions across system-wide assets. The continuous physical-to-digital-to-physical cycles provide significant improvement compared to traditional supply chains resulting in a new, fully connected and trusted digitalised supply network.

## Digital Supply Chain

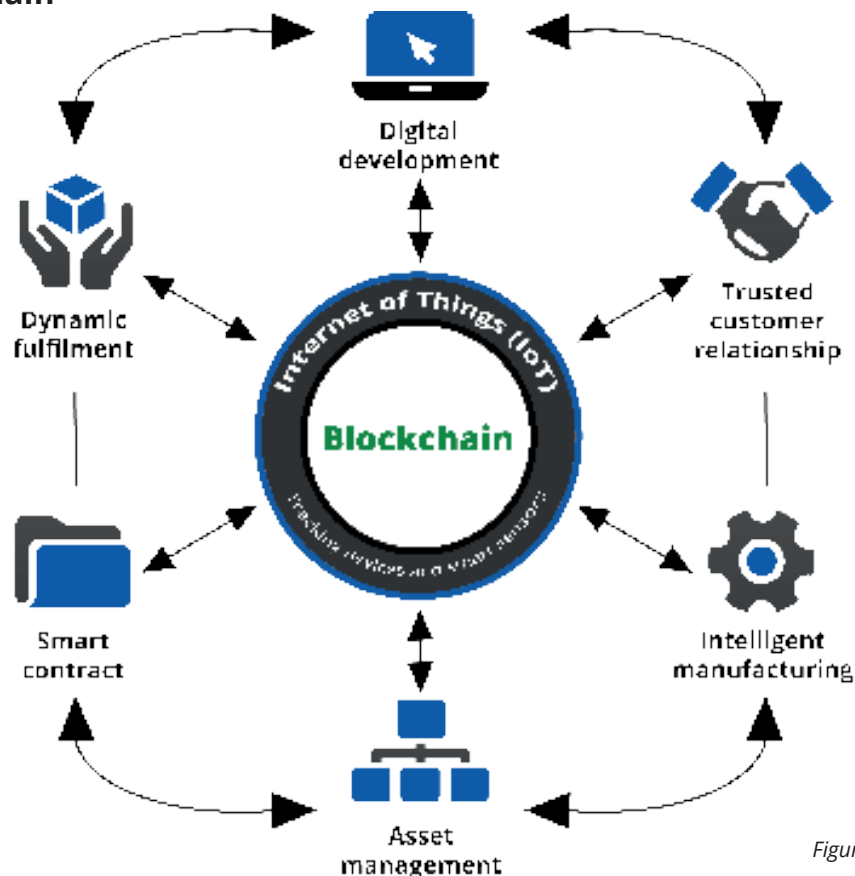


Figure 3

# Conclusion

We have entered a new industrial revolution, fuelled by the advancement of digital technologies. The fusion of the physical and the virtual world into cyber physical systems will have a disruptive impact on every business domain and industry sector.

The timely implementation of Industry 4.0 is capable of propelling Australia towards a global industry leading innovator. At Swinburne University of Technology we have placed Industry 4.0 at the heart of our Strategy. We are currently focused on developing the industrial innovation leaders of tomorrow through collaboration with industry, business and government. An exemplar of the implementation of this Strategy is the Swinburne Factory of the Future that is being transformed into an Industry 4.0 Facility through an \$135 million industrial digitalisation grant awarded by Siemens that has a capability development enterprise for SME's.

This Strategy is further supported by the development of the first national Industry 4.0 Testlab in collaboration with industry, first Diploma in Advanced Technologies (Industry 4.0) in partnership with Siemens and the Australian Industry Group, Centre for Future Work, Research Institutes focused on Manufacturing 4.0 (Manufacturing Futures Research Institute), Society 4.0 (Social Innovation Research Institute) and Cities 4.0 (Smart Cities Research Institute). Fundamental to this Strategy is the Swinburne Digital Research and Innovation Capability Platform encompassing the key capabilities illustrated in the diagram (*Figure 1*).

The Internet, Social Networking and e-Commerce brought the third industrial revolution. Emerging and foundational technologies such as IoT, Cloud, AI, Robotics and Blockchain are driving Industry 4.0. By securing trust, transferring value and storing data Blockchain will automate processes and remove any manual activities.

Blockchain technology will become a fundamental pillar of Industry 4.0. In implementing Blockchain, the global manufacturing landscape will grow to become more agile and more productive as the community embraces an interconnected distributed ecosystem that maintains trust and verifiable ownership. Value and originality will once more be redefined.

Industry 4.0 will be the next stage of modern manufacturing and will see a paradigm shift towards smart factories that merge cyber and physical systems. However, there are several unexplored areas when it comes to deploying Blockchain solutions across the manufacturer supply chains at scale, such as:

- What is the scope of Blockchain ecosystems and how will they operate?
- To what extent will regulators embrace and drive the adoption of Blockchain technology and develop appropriate standards and certification practices?
- How will enterprises integrate Blockchain with other emerging technologies such as Internet of Things and Artificial Intelligence?
- How are enterprises going to redesign and measure value and efficiency in their business processes in a Blockchain world?

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## About Capgemini

A global leader in consulting, technology services and digital transformation, Capgemini is at the forefront of innovation to address the entire breadth of clients' opportunities in the evolving world of cloud, digital and platforms. Building on its strong 50-year heritage and deep industry-specific expertise, Capgemini enables organisations to realise their business ambitions through an array of services from strategy to operations. Capgemini is driven by the conviction that the business value of technology comes from and through people. It is a multicultural company of 200,000 team members in over 40 countries. The Group reported 2016 global revenues of EUR 12.5 billion.

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People matter, results count

## Swinburne University of Technology

Swinburne University of Technology is an internationally recognised research-intensive university that is focused on delivering research that creates economic and social impact. Our researchers are producing innovative research solutions to real-world problems across a range of disciplines and sectors. In 2017, Swinburne was listed within the top 2% of higher education institutions by the prestigious Academic Ranking of World Universities (ARWU) and we were also listed within the top 2.1% and top 2.2% by the Times Higher Education University World Rankings and QS World University Rankings. We are committed to delivering world-leading research outcomes and innovations in select areas of science, engineering and technology. In 2017, Swinburne launched a number of exciting initiatives that will drive out future research achievements. Our new 'Innovation Precinct' in Hawthorn, Melbourne, is a hub of world-class research-led innovation activity, and our recently launched Research Institutes focus on big challenges facing our industries and society.

[research.swinburne.edu.au](http://research.swinburne.edu.au)