# Transforming Industries, Shaping Lives and Communities

SWINBURNE UNIVERSITY OF TECHNOLOGY

## RESEARCH AND INNOVATION STRATEGY 2020

# FOREWORD – VC

Not just research for its own sake, but research that transforms industries and shapes lives and communities. This is the ambition that we at Swinburne bring to our research energies.

In 1908 our institution was founded on the premise that our work would be shaped by industry and community needs. It is this practical and responsive perspective that continues to characterise our approach to research problems and challenges. And while there have now been recent discussions about the importance of research impact amongst policy makers and the broader community, talented researchers at Swinburne have always endeavoured to deliver on this promise.

Inspiring research requires attention to the outcomes that are delivered. Delivering research results with impact also requires focus. At Swinburne, we know that we can achieve greatest impact by ensuring that our research efforts are directed to key areas that are critical to Australia's future. This is why we have remained focused on areas of particular strength in the domains of science, technology and innovation.

At Swinburne, we also know that we cannot achieve ambitious outcomes by standing still. As industry and community expectations change, we change with them. It is for this reason that we are working at the forefront of entrepreneurial activity associated with translational research, new business development and commercialisation.

By remaining true to ourselves and to our history, we know that we can achieve the greatest impact for the industries and communities we serve. I hope you can join us in this exciting vision for our future.

**Professor Linda Kristjanson**
Vice-Chancellor and President
Swinburne University of Technology

# OUR RESEARCH VISION: TRANSFORMING INDUSTRIES, SHAPING LIVES AND COMMUNITIES

We aim to be a leading university in science, technology and innovation, with real impact that transforms industries, shapes lives and communities

# FOREWORD – DVC(R&D)

Technology and innovation are at the heart of Swinburne University of Technology. I am reminded of this every day by the railway line that passes through the University campus and connects it to the rest of the city and the world. It is symbolic of the fact Swinburne was established more than 100 years ago, originally as a college of technical education, by local industrialists, business people, engineers and technologists—entrepreneurs who wanted to make an impact on the economy and society, and provide employment for the nation.

Swinburne deliberately does not try to do everything. In the past 25 years as a university of technology, we have focused unashamedly on science, technology and innovation. Our main strengths are in astronomy and physics, where we rank in the top 100 in the world[1]; engineering, materials science, computer science and information technology; design and innovation. We also have substantial capability and research excellence in health studies, in neuroscience and mental health in particular; and the humanities and social sciences, particularly in assessing and measuring the impact of technology on society.

These are exciting times that are full of opportunity, but there are also significant social, industrial and environmental challenges. Universities of the future must continue to undertake research that addresses fundamental questions, but must also be prepared to create impact by transforming industries, shaping lives and communities. This is our vision. Swinburne's research and innovation strategy enables us to make this contribution, both locally and globally.

Our strategy focuses on what we need to do to achieve this vision until 2020. It focuses on ensuring research excellence in our focus areas, delivering transformative innovations and impact, creating contemporary and relevant PhD programs and establishing deep international and industry partnerships.

The strategy also communicates the main elements of our research ecosystem. It supports the development of the Swinburne Innovation Precinct where design, manufacturing and digital innovation meet the commercial world to create technology-based innovations at the interface with humanity. Our Research Institutes focus on driving interdisciplinary research with impact that is inspired and informed by the needs of our external partners, while our Research Centres foster and support discipline-specific deep research and excellence in our focus areas. At the core of all activity are our researchers and their shared commitment to the University's heritage and vision.

Over recent years Swinburne research has led to significant commercial successes—establishing and supporting companies involved in new technologies, such as intelligent medical, sports and wearable devices, clean energy systems, IMAX movies, and many other innovations. Swinburne researchers have developed novel carbon nanofibres that vastly increase the efficiency of solar cells; super-thin, lightweight lenses that open the way to more efficient supercomputers; new imaging techniques that can pinpoint the source of some forms of epilepsy; and better information storage systems. They have also been involved in determining how best to deploy technology, for instance, ways to improve use of the internet and a better understanding of successful commercialisation.

These are examples of our many achievements to date. This strategy will enable the future.

**Professor Aleksandar Subic**
Deputy Vice-Chancellor (Research & Development)
Swinburne University of Technology

[1]Academic Ranking of World Universities, 2015

## Antibacterial solutions inspired by nature

"Nano-patterns in nature could have a range of commercial and medical applications, by mimicking the highly textured surface of insect wings, we hope to develop nano-structured materials that kill bacteria."

**Professor Elena Ivanova**

Professor Elena Ivanova and her colleagues are researching antibacterial solutions inspired by nature.

# OUR OBJECTIVES

Our objectives are designed to connect the institutes, research centres and staff across the University with our vision and strategy.

## Objective 1:

> Increase our capacity for sustained excellence and world-leading research in science and technology.

- By increasing the number of high-performing research staff in our focus areas and across aligned disciplines.
- By developing world-renowned research concentrations in our focus areas and within research centres and institutes.
- By providing access to the best possible research infrastructure in our focus areas both on-campus and through partnerships.
- By growing external research income substantially, by diversifying our funding sources and through involvement in large, collaborative initiatives.

Overhauling the Southern Hemisphere's largest radio telescope

## Objective 2:

> Drive economic and social impact through translational research and innovation.

- By establishing deep external partnerships in focus areas that are aligned with our research strengths and innovation capabilities.
- By tackling big challenges and opportunities in industry and society through interdisciplinary collaborations.
- By fostering an environment that encourages and supports a diversity of impacts across different disciplines.
- By developing an 'innovation ecosystem' that integrates our resources and focuses on high value-added outcomes through design-led innovation.

# Using nanotechnology to shine the light on Alzheimer's disease

Director of Swinburne Nanotechnology Facility Professor Saulius Juodkazis is developing novel nano-textured surfaces for optical detection of extremely low concentration of biomarkers and trace concentration of gases. A biomarker of Alzheimer's disease – beta amyloid – was detected on nano-textured surfaces.

"Using a synthetic beta amyloid, we have shown that a nanotextured sapphire surface could detect the biomarker at the sort of concentrations found in the spinal fluid of individuals with early-stage Alzheimer's disease. Early detection, and therefore treatment, of Alzheimer's disease can significantly slow progress of the disease."

**Professor Saulius Juodkazis**

The team is developing sensor substrates which are simple to fabricate and new statistical data analysis which makes measurements quantitative. This is still a missing functionality of sensors working on light scattering and the major obstacle to bring this new technology into the field of medical applications.

Testing for dementia using sensors inspired by insect wings.

Professor Paul Stoddart with the ARC Training Centre in Biodevices team.

## Objective 3:

> Develop globally competitive higher degree research graduates for rewarding careers within and beyond academia.

- By developing new models of higher degree by research studies including the Practice-based PhD and Partnered PhD.
- By embedding a Graduate Certificate in Research and Innovation Management within the PhD program to provide all our students with a foundation in entrepreneurship and innovation.
- By embedding professional development and career planning in the research training program, including generic and professional skills, and broad inter-disciplinary skills.
- By involving our higher degree by research students with industry and research partners nationally and internationally, through research projects, joint ventures and placements.

## Objective 4:

> Extend the reach, scale and reputation of our research through deep international partnerships.

- By developing Joint Research Centres, Labs and Incubators in high-impact areas in collaboration with international partners.
- By establishing our offshore presence in select countries to enhance international research engagement, access to high quality higher-degree research students, industry collaborations and transitional funding.
- By increasing research capacity and performance in focus areas at Swinburne Sarawak campus through deep partnerships, joint developments and regional collaborations.
- By developing and nurturing deep mutually beneficial research collaborations with international researchers in areas of common interest leading to joint research outcomes.

# OUR FOCUS

Our research and innovation strategy is focused on the following high impact outcomes defined by the Swinburne 2020 Plan.

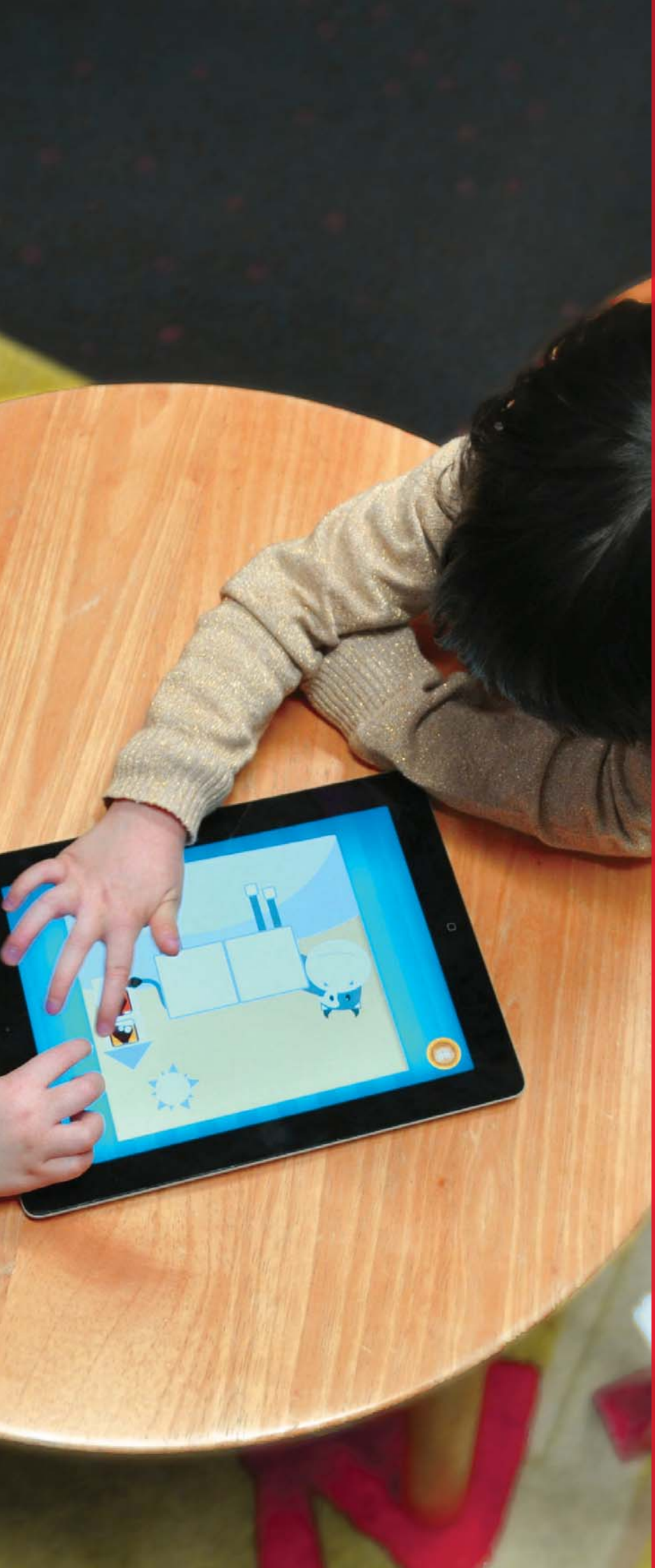
**Inspirational science and technology:**
Focused on science and engineering to drive new discoveries and stimulate development of frontier technologies and materials

**Future manufacturing:**
Focused on high value-added manufacturing through integration of advanced manufacturing systems, processes and materials with design and information technologies to create new business opportunities globally

**Sustainable futures:**
Focused on addressing sustainability issues that confront our society and urban environments, informing public debate and influencing government policy

**Digital innovation:**
Focused on digital technology and innovations that will change the way we work, communicate and socialise, through advances in information and communication technologies, business innovation and design

**Personal and social wellbeing:**
Focused on improving health and wellbeing, tackling quality of life and social issues, and addressing the contemporary needs of diverse communities and individuals



## Babylab

"The research undertaken within the Swinburne Babylab is focused on revealing how infants and children learn and develop through the study of perception, problem-solving, social behaviour, learning and brain development. Our results not only contribute to the understanding of the human condition, but they also have important practical impacts. Our work is clarifying the impact of "screen time" on children's learning and development; detailing how various activities affect children's executive functioning; and evaluating early psychophysiological markers for autism in infants."

**Dr Jordy Kaufman**
Director of Swinburne Babylab

## Developing a better understanding of body image illness

Professor Susan Rossell, a cognitive neuropsychologist, is studying MRI and MEG data in order to develop improved treatments for body image illnesses.

"Our recent work in anorexia nervosa has implicated a brain region and neurotransmitter system in the aetiology of the illness that has been previously overlooked. Building on these initial studies will be critical long term, as we work to develop novel and improved therapeutic interventions."

**Professor Susan Rossell**

# OUR APPROACH

**To achieve the objectives and high impact outcomes in our focus areas, we encourage, support and invest in research and innovation that:**

- Aspires to the highest quality as judged by our peers and those who fund and use our research
- Focuses on outcomes and impact through close engagement with industry and the communities we serve
- Informs public debate and policy development
- Enthuses our research students and provides them with a range of capabilities for rewarding careers within and beyond academia
- Positions our research internationally among the leading science, technology and innovation universities.

**This will be based on:**

- Attracting and developing high quality staff and students in our focus areas aligned with our research strategy and expectations
- Creating a stimulating research environment that encourages innovation and collaboration
- Providing access to outstanding research infrastructure that supports our high impact areas
- Ensuring that we conduct our research ethically and with integrity
- Pursuing strategic national, regional and international partnerships that increase our capability and our impact.

**Our commitments:**

- We will develop our staff as researchers across their career life cycle, from early career researcher to postgraduate supervisor and research leader, through timely, bespoke researcher training, development and support programs
- We will recognise the importance of research productivity, quality and impact and respect that they differ across disciplines and stage of research career
- We will define and implement research performance expectations for our staff transparently and consistently
- We will support our staff in their research engagement with industry which will enable them to achieve their goals and aspirations, in line with the research innovation strategy.

"Everyone's talking about innovation. We need to just do it. That's what Swinburne is doing."

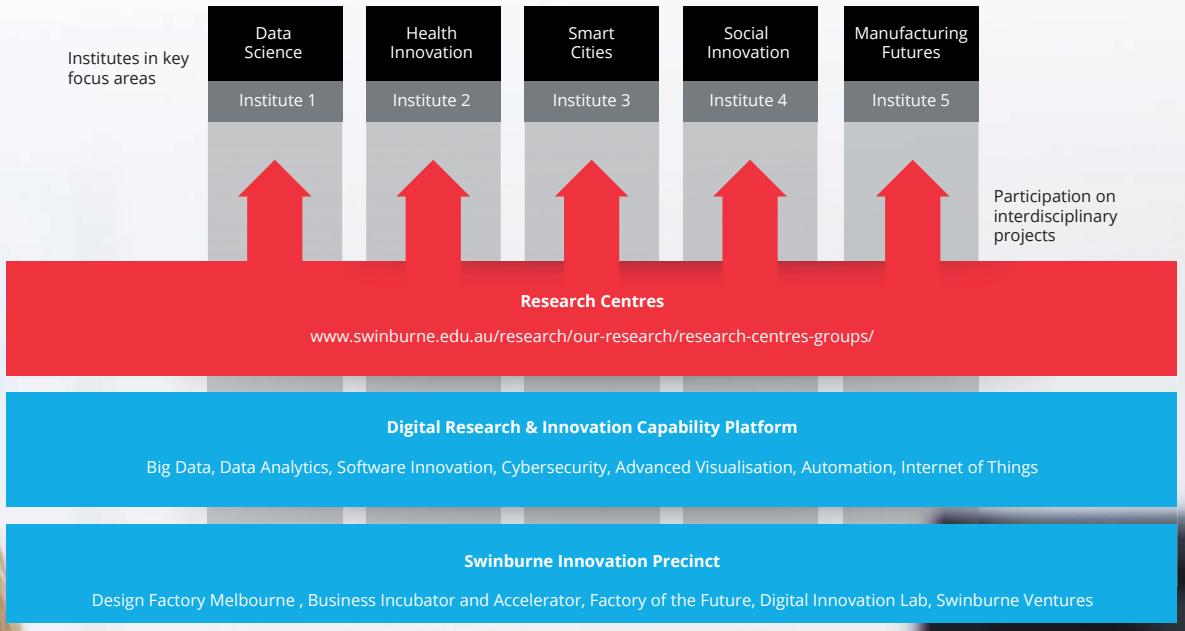
**Dr Elaine Saunders of innovative hearing aid company Blamey Saunders Hears.**

# OUR RESEARCH & INNOVATION ECOSYSTEM

We are committed to achieving research quality and impact at world-leading level in select areas, and to developing research capacity across our disciplines in support of our research strategy. We aim to achieve this objective by supporting multidisciplinary and inter-disciplinary research across the spectrum of scale and impact.

# Overview of the Swinburne Research Ecosystem.

We are focused on collaborative interdisciplinary research in high impact areas built on advanced capabilities and excellence in select discipline areas.



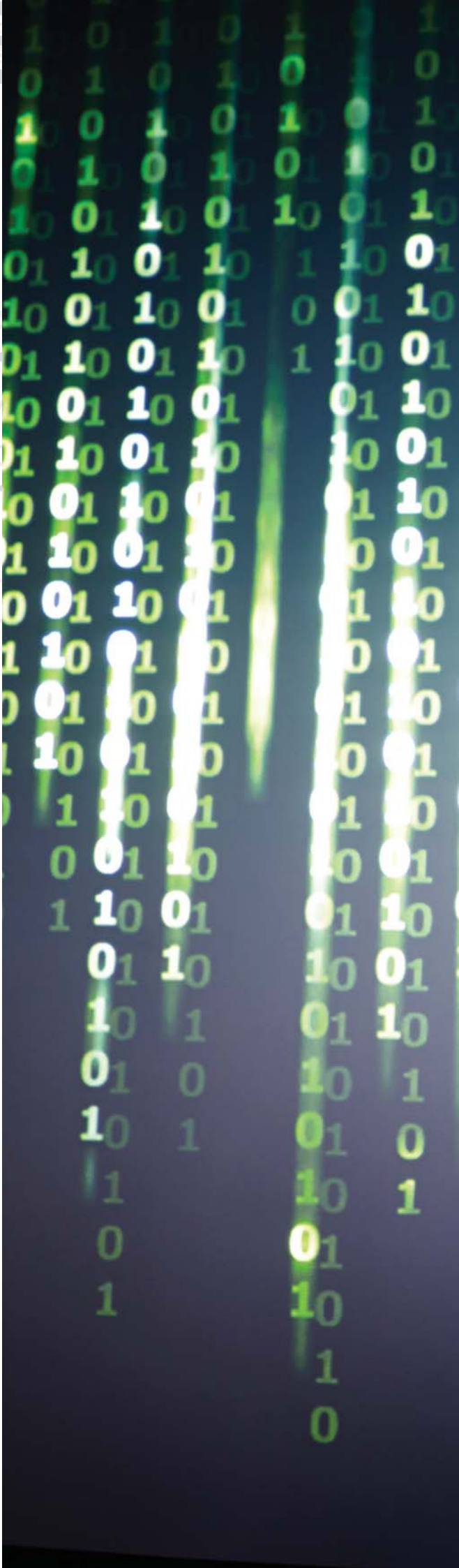

Our Swinburne research institutes will work at the frontiers of research and innovation in strategic focus areas in line with our Swinburne 2020 Plan. The Institutes enable and facilitate research collaboration across the University, with multidisciplinary and interdisciplinary research teams tackling big challenges and problems with potential for transformative economic and social impact. The Institutes are outwardly focused and outcome-oriented, aligned with and responsive to state, national and global priorities for industry growth and development, and associated research funding opportunities.

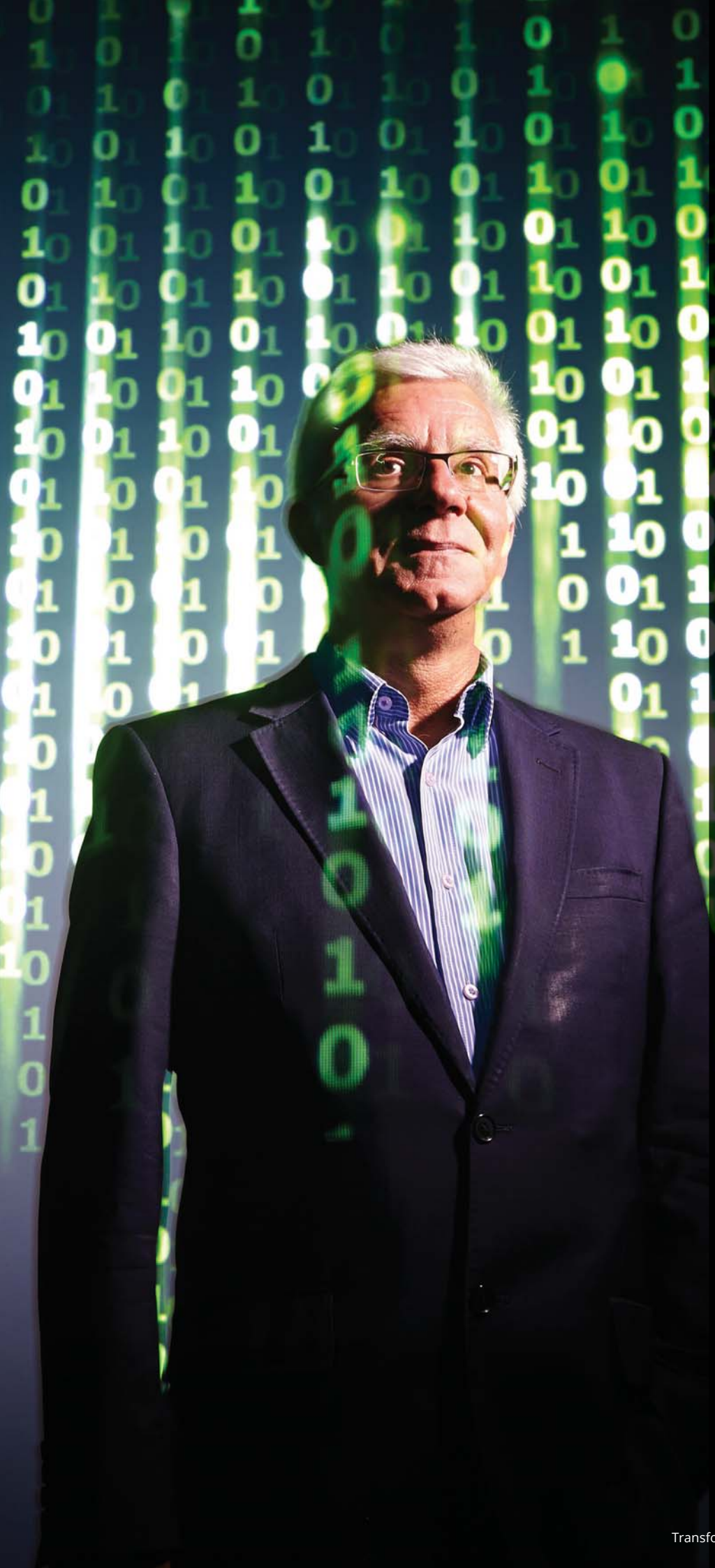
Our Faculty-based Research Centres drive deep, discipline-based research. They are expected to have significant critical mass in focus discipline areas in terms of research activity, excellence and quality of their outputs. They are the engine room of our research performance but are also cohesive, collegial and collaborative environments that support and develop our research talent, from early career researchers through to senior professors and research leaders. They are integral in enabling Swinburne to achieve research excellence and international reputation.

Our Research Groups are the foundation level of our research ecosystem. They are established when the quality, scale and impact of research grows beyond the capacity of an individual researcher. Ongoing development and peer support is of paramount importance with our Research Groups. Over time, with growth in capability, performance and activity, new Research Centres may form from Research Groups.

# DIGITAL RESEARCH & INNOVATION CAPABILITY PLATFORM

A strategic differentiating capability underpinning our Research Institutes and Research Centres is the Digital Innovation Capability Platform that provides a unique, high-level enabling capability and a clear pathway to innovation and commercialisation via our Digital Innovation Lab. This platform includes strategic capabilities and Key Labs in Big Data and Data Analytics; Software Innovation; the Internet of Things; Cybersecurity; Advanced Visualisation; and Automation. This synthesis of high-level digital research capability across the University, underpins the application areas of the Institutes. It also drives a digital strategy that aims to position Swinburne as the digital disruptor of our sector. Furthermore, via this capability platform we are able to articulate a coherent strategy for the development of digital research infrastructure for the University at present and for the future.





## Big Data Research Driving Our Impact

Director of Swinburne Centre for Big Data and Data Analytics Professor Timos Sellis is developing with his team new ways to best perform complex analysis on vast information incorporated from different sources and formats. Timos and his Centre also explore ways to quickly and accurately process continuous data feeds from moving sources such as cars and people.

"Big data research aims to develop new methods to derive knowledge from data, to devise new data infrastructures to manage, curate and serve data to communities as well as to drive innovation in all sectors of life."

**Professor Timos Sellis**
Director Swinburne Centre for Big Data and Data Analytics

# OUR INNOVATION PRECINCT

Our Innovation Precinct creates the innovation ecosystem that supports our 2020 Vision of the University as a leader in science, technology and innovation and a catalyst of entrepreneurial activity.

The Innovation Precinct integrates research-led innovation and entrepreneurship across the University, providing connectivity between the University's diverse and distinct innovation capabilities. The Innovation Precinct framework brings Manufacturing Innovation, Design Innovation and Digital Innovation together with Business Innovation to drive economic growth and social impact through interdisciplinary collaboration involving students, staff, mentors, business and industry.

Swinburne Research with our technology transfer company Swinburne Ventures, supports the translational research and commercialisation efforts of the Innovation Precinct. Our Mentoring Program supports entrepreneurial teams by providing students and staff with an opportunity to learn from the best through Entrepreneur-in-Residence partnerships with leading international innovation hubs. The best teams have the opportunity to access proven accelerator programs both nationally and globally.

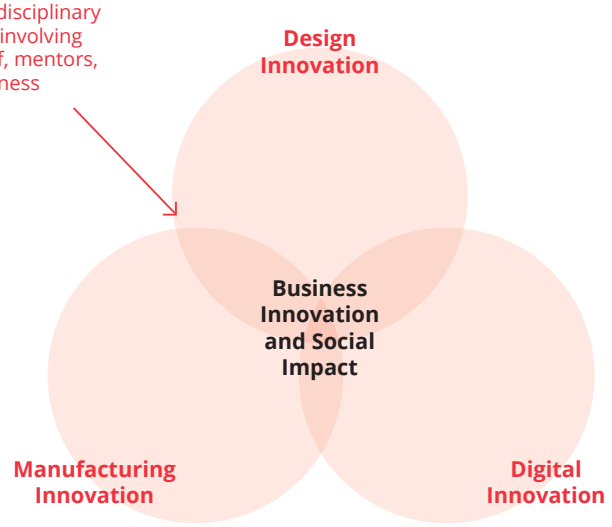
## Swinburne Innovation Precinct.

### Strategic Objectives

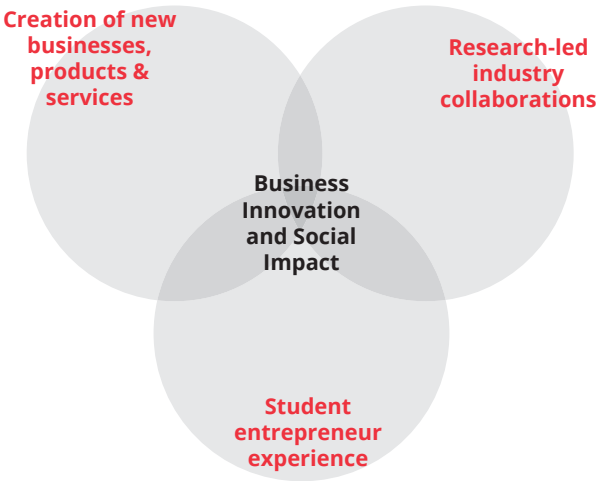
- Expose all our students to the "Swinburne Innovation and Entrepreneurship Experience"
- Grow impact of our research through research-led innovation and commercial outcomes
- Contribute to economic development through the creation of innovative high value-add products, services and workforce in our high impact areas.

### Strategic Framework

Disruptive innovation through interdisciplinary collaboration involving students, staff, mentors, industry, business

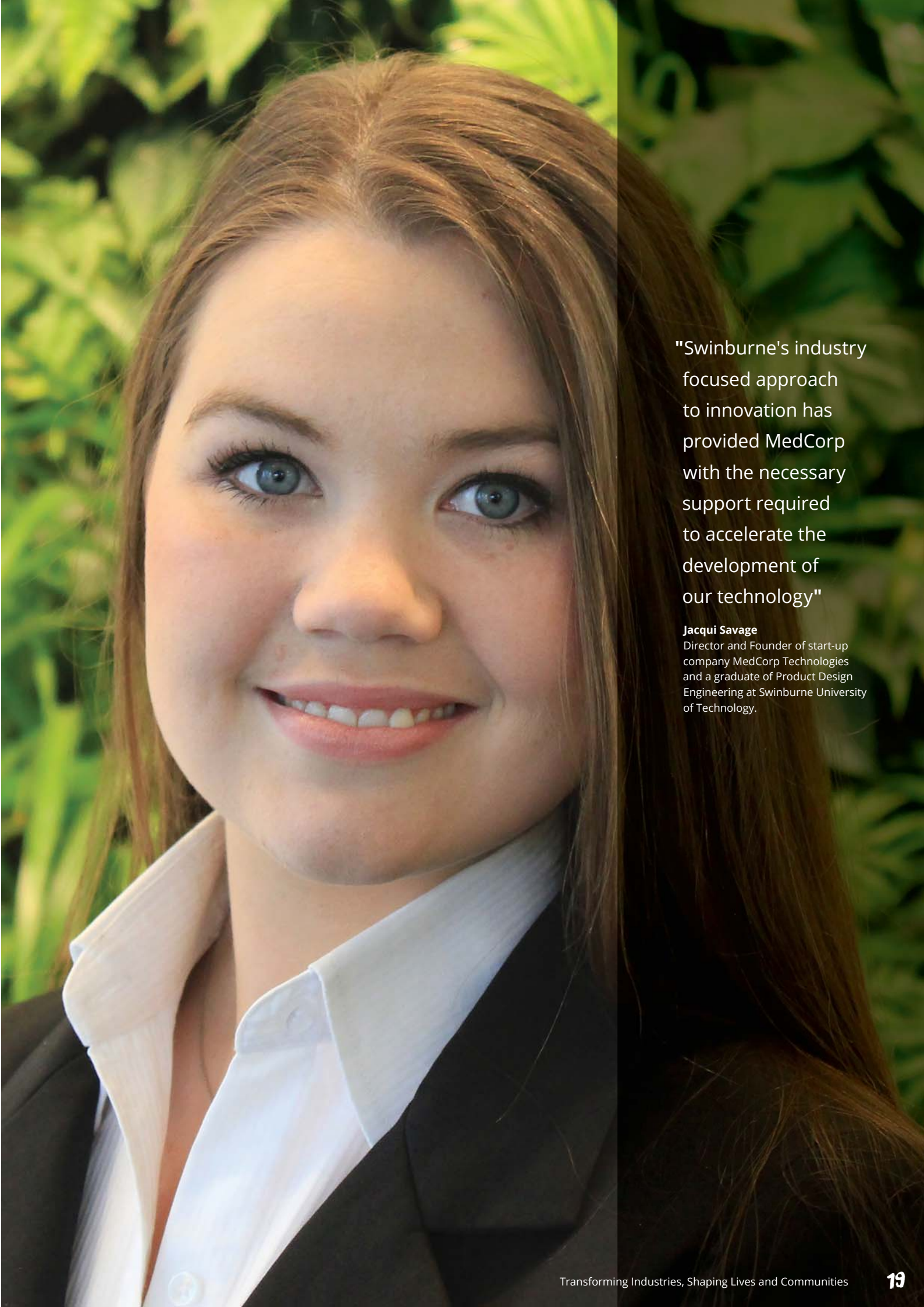



Strategic Framework




Value-added Activities

The Innovation Precinct represents an integrated network with the Faculties, Research Centres and Institutes and connects with industry to enable staff and students to scale-up research-led ideas into real-world solutions, working technologies and services. It prevents promising innovations from falling into the 'valley of death' – the critical gap between government and university funded research and industry-led development and commercialisation.



"Swinburne's industry focused approach to innovation has provided MedCorp with the necessary support required to accelerate the development of our technology"

**Jacqui Savage**
Director and Founder of start-up company MedCorp Technologies and a graduate of Product Design Engineering at Swinburne University of Technology.

# FACTORY OF THE FUTURE

"The Factory of the Future represents our industry portal for advanced manufacturing, where we work with our industry partners to solve key industry challenges through integration of innovative design platforms, advanced manufacturing technologies and materials, and information systems. This includes applications such as automation of carbon fibre composite parts production and graphene products fabrication. The outcomes of our work will be commercialisation of new technology enabling Australian companies to capitalize on the expanding international market by connecting to global supply chains."

**Professor Bronwyn Fox**
Director Factory of the Future

# DESIGN FACTORY MELBOURNE

"Design Factory Melbourne powers industry and university co-creation across disciplines and diverse expertise areas within the Swinburne Innovation Precinct to drive impact of global relevance through research and design-led innovation."

**Associate Professor Anita Kocsis**
Director Design Factory Melbourne

# 2020 RESEARCH TARGETS

By 2020, all our research will be rated at world standard or above and we will be recognised globally within the **top 2%** (top 300) of universities for our research excellence and impact.

**Research Excellence and Reputation:**

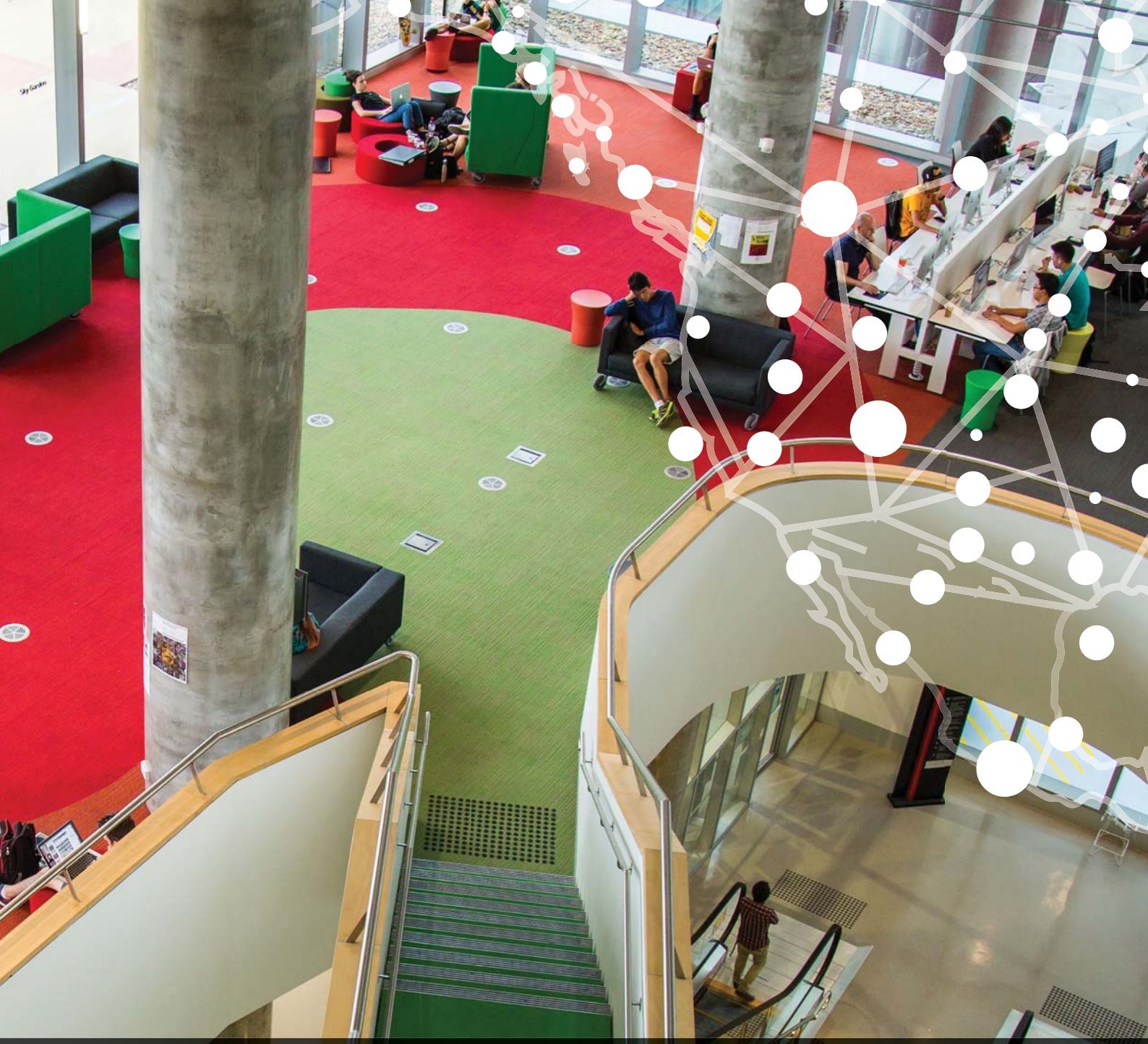
- All our research will be rated **at or above** world standard.
- All our Research Centres will be rated **well above** world standard.
- Our Key Disciplines in focus areas will be rated in the **top 100** in the world.

**Research Impact:**

- At least **50 per cent** of our research income will come from industry and business, and will support high-impact projects in focus areas.
- At least **50 per cent** of our research projects will focus on innovation, translational and social outcomes, and show evidence of economic and social impact.
- At least **50 per cent** of our higher-degree research students will undertake research in collaboration with industry, business or community organisations.

**Internationalisation:**

- We will establish **Joint Research Centres and PhD programs** with our international partners in each of our focus areas.
- We will have at least **200 higher-degree** research students offshore undertaking research in collaboration with international partners including universities and industry.
- At least **half** of our research publications will involve international collaborators.



Annually Swinburne University of Technology will achieve:

≥$50 MILLION IN EXTERNAL RESEARCH INCOME

≥1500 HIGHER DEGREE RESEARCH STUDENTS

≥2000 RESEARCH PUBLICATIONS, MAINLY IN HIGH-QUALITY JOURNALS

≥$5 MILLION RESEARCH COMMERCIALISATION INCOME

WWW.RESEARCH.SWINBURNE.EDU.AU