![QUT ife — Institute for Future Environments]

STRATEGIC PLAN
2017–2020

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SEPTEMBER 2017

EXECUTIVE SUMMARY

The Institute for Future Environments (IFE) is one of QUT's flagship transdisciplinary research institutes. Its mission is to generate knowledge, technology and practices that make our world more sustainable, secure and resilient.

The purpose of this Strategic Plan is to guide the research investment and partnership engagements of IFE to ensure the institute delivers cutting-edge research that addresses grand societal challenges, harnesses QUT's research and infrastructure capability strengths, and nurtures productive partnerships to develop and deploy real-world solutions for industry, government and the community.

The plan articulates what success will look like for IFE towards 2020 and focuses on delivering excellence across three main dimensions: 1) research quality, 2) research impact, and 3) governance effectiveness. A key feature of this plan is that it is designed to be adaptable to meet the demands of the rapidly evolving global environment that surrounds and affects Australia's research and innovation system.

The plan uses the research capability strengths of QUT, but also aims to draw on deep connections and partnerships to maximise impact across the triple bottom line outcomes (economic, environmental and social). Central to this strategy is IFE's engagement with industry, government and the community to translate knowledge and innovation into robust technologies and practices that influence decisions being made by industry, businesses, policymakers and the community.

No single disciplinary approach can make our world more sustainable, secure and resilient. A perspective that recognises systems is needed and a careful integration of approaches is required. Access to QUT's core research and infrastructure capability strengths in the areas of big data, materials science, plant biotechnology, robotics, the business of technology, digital media, biomolecular science, education, and technology, regulation and society are also critical to how existing and new knowledge will be implemented through to utilisation and practice.

This plan will be delivered through three interconnected portfolios: *Research and Innovation*, *Research Infrastructure* and *Research Support*.

The *Research and Innovation* portfolio comprises four sector-focused research themes and three enabling platforms which deliver to several areas of sectoral relevance. The themes and enabling platforms are outcome-focused and have systematically planned for impact.

- **Growing the Global Bioeconomy Theme** — focusing on developing agricultural processes and products that are better for consumers, the environment and the economy
- **Managing for Resilient Landscapes Theme** — studying how our urban, agricultural and natural landscapes function, and how best to manage them to increase their resilience and adaptability
- **Infrastructure for Sustainable Communities Theme** — investigating how to design, operate and manage infrastructure that enriches communities while being sustainable, resilient and responsive to climate change
- **Embracing the Digital Age Theme** — investigating how Australia can identify and capitalise on the commercial and social potential of emerging digital technologies
- **Manufacturing with Advanced Materials Enabling Platform** — focusing on discovering and designing more efficient and sustainable materials for diverse applications

- **IntelliSensing Enabling Platform** — aiming to transform data collection, modelling, analytics and decision-making to address real-world challenges in the built, natural and digital environments
- **Transforming Innovation Systems Enabling Platform** — working to help Australia focus on research and development projects that matter, and to develop, evaluate and adopt innovations more easily.

The *Research Infrastructure* portfolio includes seven cross-organisational research facilities that underpin and catalyse research discoveries as well as ensuring deployment, demonstration and dissemination of research outcomes to our partners.

- **Central Analytical Research Facility (CARF)** — laboratories for electron microscopy, light microscopy, X-ray analysis, analytical chemistry, particle analysis, physical and mechanical properties analysis, environmental analysis, proteomics and genomics
- **Samford Ecological Research Facility (SERF)** — a base for research and education on the impact of urban development on ecosystems, located on a 51-hectare property in the Samford Valley north of Brisbane
- **Banyo Pilot Plant Precinct (Banyo)** — a general-purpose facility for large-scale research in traditional engineering (structural, mechanical and electrical), scientific applications, and product testing and validation

- **Mackay Renewable Biocommodities Pilot Plant (Mackay)** – converts biomass into renewable transport fuels, green chemicals and other bioproducts, and with industry partners develops new industrial processes and commercial products
- **Visualisation and eResearch (ViseR)** — uses cutting-edge software platforms, audiovisual and IT facilities, including unique equipment like The Cube, to develop innovative ways of modelling, visualising and interpreting complex information
- **Research Engineering Facility (REF), including the Da Vinci Precinct** — provides engineering services, including capabilities in mechatronics (robotics and UAVs), superconductivity, chemistry (lithium-ion battery production), and structural testing. Based at Brisbane Airport, the Da Vinci Precinct is purpose-built for researchers engaging in aerospace automation activities, giving them the ability to translate concepts from paper to flight-tested reality.
- **Digital Observatory** — enabling access to, and curation of, online communication (social media) data sets to explore research questions about attitudes to contemporary issues.

Critical to success across these areas is the alignment of professional *Research Support* capabilities in knowledge to innovation brokering, communications, financial and project management, and legal, contracting and research administration.

Professor Ian O'Hara at the Mackay Renewable Biocommodities Pilot Plant

Part 1: The challenge – creating a sustainable, secure and resilient world

IDENTIFYING GLOBAL AND NATIONAL DRIVERS AND UNDERSTANDING THE CHALLENGE

1.1 Global trends

Rising population and consumption levels are transforming the global economy and straining the environments — natural, built and digital — that support human communities. Food, water, energy and information security are major concerns and the economic power base is shifting to emerging nations, cities and large companies.

By 2050, the world will have to produce 50 to 80 per cent more food. The demand for natural resources and new materials is continually growing, while at the same time consumers expect their purchasing habits and the economy generally to have a lower environmental impact and greater social benefits.

Climate change is driving sea level rises and more severe weather patterns, which in turn threaten the stability of infrastructure systems and the health of natural landscapes and ecosystems. Climate change is also affecting the patterns of pests and diseases in natural and agricultural environments.

Advances in digital technology — especially in robotics, autonomous systems, sensor networks and mobile devices — are generating extraordinary volumes of data and giving us unprecedented power to extract information that helps us understand and manage natural and built environments. Computer modelling is combining with highly specialised equipment to allow precise design and additive manufacturing of advanced materials for specific purposes.

But these technological advances and the increasing connectivity and convergence of our natural, built and digital environments are giving rise not only to new opportunities, but also to new threats to our safety, security and privacy. Cybercrime is estimated to cost the global economy about US$113 billion annually, with 12 people becoming victims of cybercrime every second.

HOW THE WORLD IS CHANGING

- **Economic power shifting to emerging nations, cities and companies**
- **Urbanisation and the rise of the middle class in developing countries**
- **Rising global demand for natural resources, food and materials**
- **Expectation of decreasing environmental impact of economic activity**
- **Climate change affecting sea levels, weather patterns, infrastructure stability, and pests and diseases**
- **Increased likelihood of pandemics**

COTSbot, an underwater robot developed by Dr Matthew Dunbabin (on the boat) and Dr Feras Dayoub to autonomously detect and control crown-of-thorns starfish (COTS) on the Great Barrier Reef

1.2 National trends

The Australian population, like that of many countries, is growing, ageing and urbanising. Communities expect that public and private infrastructure – from energy and ICT networks to transport systems and buildings – will be integrated, sustainable and tailored to community needs. New ways of designing, building and managing infrastructure are emerging in the transition from the industrial to the digital age.

Established Australian industries, such as agriculture and mining, are being transformed by new technologies and global competition. Technologies including mobile devices, the Internet of Things, spatial information and big data analytics are having a significant impact on business productivity and processes. New opportunities and industries are emerging, and with them new challenges and risks relating to privacy, access, security, crime and intellectual property.

Australia's landscapes, ecosystems and natural resources are under pressure from population and consumption growth and climate change. The increasing frequency and diversity of shocks from weather, political, social, economic, and security events is leading to significant investment in response and recovery activities and systems.

The Australian innovation system – the path from discovery to deployment – is not working as well as it could. Many businesses and organisations do not have ready access to the knowledge and skills they need to be innovators; therefore we struggle with adoption of inventions as products, services or policy. Despite the myriad of electronic collaboration tools available, distance still often stifles the innovation process between industry and research organisations, both within Australia and between Australia and the rest of the world.

HOW AUSTRALIA IS CHANGING

- **Need to increase agricultural productivity and competitiveness**
- **Transformation of the mining industry, including the mining equipment, technology and services (METS) sector**
- **National conversation about commodities versus niche products**
- **Rising impacts of climate change on weather, pests and diseases**
- **Need for defence intelligence to keep pace with threats**
- **Increasing citizen expectations of governments regarding privacy and safety**
- **Low engagement between research sector and industry in Australian innovation system**

1.3 Understanding the challenge

As people, landscapes, cities and things become more connected, our natural, built and digital environments are converging. This convergence is generating new challenges and opportunities in relation to Australian industry competiveness, economic prosperity and environmental stewardship.

Responsible development and management of Australia's natural resources and infrastructure

The growing middle class in Asia, predicted to swell to 3.2 billion by 2020 and 4.9 billion by 2030,[1] is a striking example on Australia's doorstep of the escalating global demand for natural resources and materials. Productivity growth in the Australian economy has languished in recent decades. We need to raise productivity while reducing the impacts of our resource use and our urban and rural footprints, and while protecting the quality of our soil, water and air.

Australian communities are becoming more aware of the trade-offs between social, economic and environmental values when decisions about economic development are made. Industries must respond to community expectations by aligning profits with sustainable outcomes. Australia must also catalyse new industries that profit by helping to maintain the natural resource base and develop and use infrastructure optimally — factors which are critical to our future economic prosperity.

As the movement of people and things in and around Australia increases, pests, pathogens and invasive species are costing Australian agriculture about $10 billion per year.[2]

To compound the problem, changing weather patterns resulting from climate change are increasing the abundance and changing the distribution of pests and diseases.[3]

Building a more resilient Australia

The Australian economy is steadily becoming more knowledge-intensive, more specialised and more globally connected.[4] Our changing climate is generating more frequent heatwaves, storms and other extreme weather.[5] Australians expect that their governments will provide security against biological and other threats. As people and things become more connected, potential threats are becoming more diverse and spanning digital, natural and built environments.

Consequently, Australians need to prepare for a future of more frequent, more intense and more diverse shocks arising from weather, social, economic and national security events. Australia's capacity to anticipate and respond to these shocks — and flourish in spite of them — will be underpinned by the competitiveness and growth of several industries, including agriculture, resources, manufacturing and services.

Research has long played a significant role in helping nations understand and protect themselves against shocks. However, the relationship between most companies and the research sector is comparatively poor, with Australia ranking near the bottom of the list of OECD countries for the level of collaboration between business and research.[6] The Australian innovation sector must become better connected and better equipped to articulate and execute its role in managing shocks and building the resilience of our economy and society. To do so, the sector must build a deeper understanding of the shocks themselves, as well as of the impact pathways and dialogues between researchers, businesses and communities that will result in a more resilient Australia.

THE IMPACT OF IFE

In response to these global and national trends and challenges, IFE's research is designed to drive the following changes in the real world.

Responsible development and management of Australia's natural resources and infrastructure

- New industries that profit from maintaining Australia's natural resource base emerge and grow.
- Industry realises commercial opportunities by maximising Australia's geo-environmental context.
- Governments and the public understand the trade-offs between social, economic and environmental values.
- Trends in the condition of Australia's natural resources and infrastructure are monitored and reported.
- Low-impact materials improve sustainability across product lifecycles.

Building a more resilient Australian society

- Tools and information systems are developed that help governments, industry and communities to monitor and build the resilience of natural and built environments.
- The innovation system is more integrated and effective, so that research efforts are not wasted and research breakthroughs benefit society more quickly.
- Businesses and the public have greater confidence in responding to potential threats.
- Spatially informed, secure information workflows are adopted by governments and industry.
- Infrastructure supports meaningful social, cultural and economic conditions and vibrant and sustainable communities.
- Landscapes, coastlines and seascapes are managed for resilience.

Part 2: Institute for Future Environments

TACKLING AUSTRALIA'S GRAND SOCIETAL CHALLENGES AND OPPORTUNITIES THROUGH TRANSDICIPLINARY PARTNERSHIPS

ARTICULATING THE ROLE FOR RESEARCH AND INNOVATION THROUGH THE INSTITUTE'S PURPOSE, GOAL AND PRIORITIES

2.1 QUT's approach to research

In response to the global and national trends and challenges outlined in Part 1, QUT aspires to be a leader in delivering research solutions to real-world problems. The university is striving to build its reputation as an excellent research institution by conducting high-impact research that is:

- **transformative** – our research agenda reflects the human capital and innovation needs of the economy and we work closely with partners in government, industry and the community to define research problems and implement solutions
- **transdisciplinary** – researchers from across many fields at QUT come together to address problems that no discipline could solve in isolation
- **technology-focused** – we leverage deep technological capabilities aligned to the university's research strengths and priorities.

QUT's six faculties – Science and Engineering, Creative Industries, Business, Law, Education and Health – have broad expertise and research capabilities across the fields of STEM (science, technology, engineering and mathematics) and HASS (humanities, arts and social sciences). The university has especially strong research capabilities – and a commitment to invest further – in the following areas:

QUT'S RESEARCH CAPABILITY STRENGTHS

1. Biomedical engineering and health technologies
2. Biomolecular sciences
3. Chronic disease prevention and interventions
4. Creating and capturing value from new technology
5. Data science, computational modelling and simulation science
6. Digital media
7. Education for better outcomes
8. Health services
9. Injury prevention and management
10. Material science and engineering
11. Plant and industrial biotechnology
12. Robotics and computer vision
13. Technology, regulation and society

2.2 IFE's role

IFE harnesses the research strengths of QUT's six faculties and the research support services of QUT's divisions in responding to the grand challenges of industry, government and society. We assemble transdisciplinary research teams, provide cross-organisational research infrastructure, manage the research and innovation process and profile the impact of our research.

IFE's role is to provide **transdisciplinary leadership**. For QUT, transdisciplinarity requires leaders to be motivated by the research problem or challenge and to facilitate engagement by academics and other research staff. Through this engagement, academics and research staff bring their disciplinary expertise to the problem or challenge in dialogue with the research problem owner/s in industry, government and the community.

Development of this leadership skill set is a core role of IFE. Our priority is to put the real-world problem as the focus – not the individual's research agenda. Of course, both dimensions of focus are needed at a university – that is critical. However, QUT, through IFE, invests in skills development in its leaders to fully realise transdisciplinary research leadership. We do this by harnessing colleagues from across disciplines and engaging them in a dialogue with external stakeholders.

We have purposely not used the term 'interdisciplinary' in the above comments. Interdisciplinary research focuses on disciplines coming together to undertake research of interest – it is not usually focused on a societal challenge.

Our mission

Generating knowledge, technology and practices that make our world more sustainable, secure and resilient.

Our vision

To be renowned as a catalyst for:

- addressing global challenges that build a strong Australia, with a competitive economy
- delivering innovations through transdisciplinary collaboration
- nurturing the entrepreneurial spirit of researchers
- inspiring a generation to recognise STEAM (science, technology, engineering, arts and mathematics) as being at the heart of the country's competitiveness.

Our purpose

- Addressing grand societal challenges
- Harnessing QUT's disciplinary strengths
- Co-investing in strategic research, development and D3 (Deploy, Demonstrate and Disseminate) initiatives
- Forming productive partnerships to develop and deploy real-world solutions for industry, government, community and research organisations
- Providing state-of-the-art research infrastructure for research and research training, and for commercial and technical services

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2.3 IFE's structure

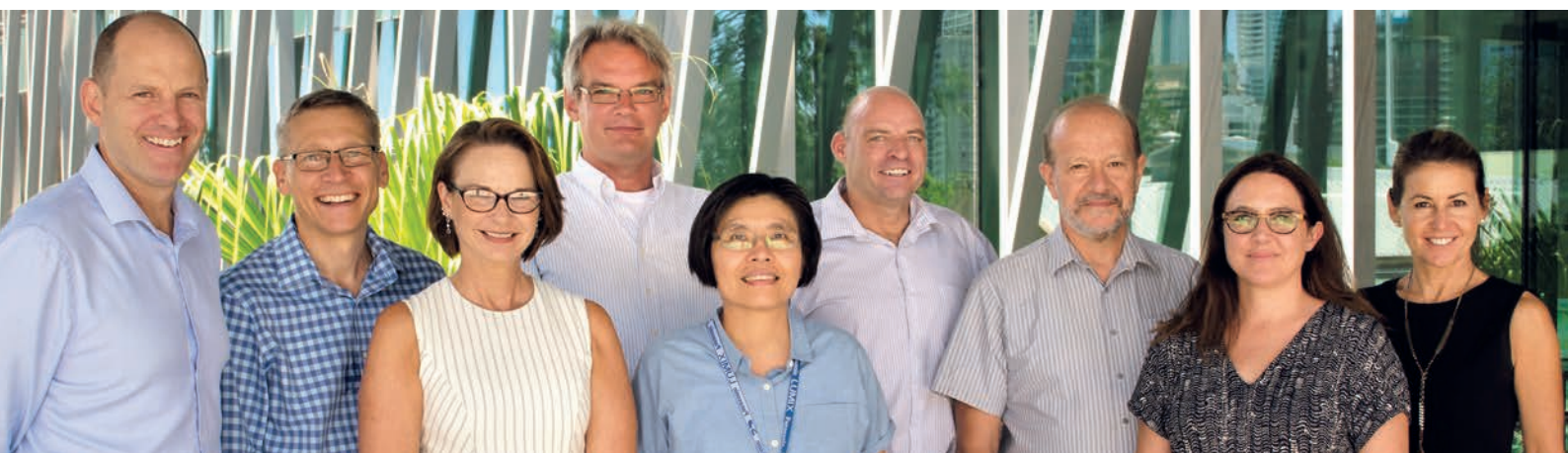IFE has three interconnected portfolios: Research and Innovation, Research Infrastructure, and Research Support.

RESEARCH AND INNOVATION

IFE's Research and Innovation portfolio comprises four research themes and three enabling platforms. Our four research themes are linked to specific sectors of the economy, namely the agricultural, environmental, infrastructure and ICT sectors. Broadly speaking, the themes investigate how these sectors can be made more sustainable – economically, environmentally and socially – and more attuned to the changing needs of society.

Our three enabling platforms develop technologies and systems with applications across many sectors of the economy and for many societal problems. These include technologies and systems such as robotics, sensor networks, nanotechnology, advanced materials, new partnership and business models, and innovation pathways.

IFE research themes

- **Growing the Global Bioeconomy Theme** – focusing on developing agricultural processes and products that are better for consumers, the environment and the economy
- **Managing for Resilient Landscapes Theme** – studying how our urban, agricultural and natural landscapes function, and how best to manage them to increase their resilience and adaptability
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- **Embracing the Digital Age Theme** – investigating how Australia can identify and capitalise on the commercial and social potential of emerging digital technologies

The leadership team of our Infrastructure for Sustainable Communities Theme

IFE enabling platforms

- **Manufacturing with Advanced Materials Enabling Platform** – focusing on discovering and designing more efficient and sustainable materials for diverse applications
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- **Transforming Innovation Systems Enabling Platform** – working to help Australia focus on research and development projects that matter, and to develop, evaluate and adopt innovations more easily.

RESEARCH INFRASTRUCTURE

IFE has state-of-the-art research infrastructure capabilities and expertise in digital data and e-research; characterisation; analysis and 'omics'; prototyping and fabrication; robotics and autonomous systems; and environmental systems and monitoring.

Our facilities play a vital role in enabling research on a scale beyond the reach of individual research groups or disciplines. The academic and technical staff in our facilities work closely with researchers and end user clients to identify and implement the best solutions to their problems.

IFE facilities

- **Central Analytical Research Facility (CARF)** – laboratories for electron microscopy, light microscopy, X-ray analysis, analytical chemistry, particle analysis, physical and mechanical properties analysis, environmental analysis, proteomics and genomics
- **Samford Ecological Research Facility (SERF)** – a base for research and education on the impact of urban development on ecosystems, located on a 51-hectare property in the Samford Valley north of Brisbane
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- **Digital Observatory** – enabling access to, and curation of, online communication (social media) data sets to explore research questions about attitudes to contemporary issues.

RESEARCH SUPPORT

The teams within our Directorate, in collaboration with QUT's divisions, support the research themes, enabling platforms and research facilities by helping them to build dynamic transdisciplinary research communities within QUT, forge strategic relationships and partnerships with industry and government, manage projects efficiently and profile the outcomes and impact of those projects.

Transparent and inclusive governance is a cornerstone of IFE's operations, ensuring the institute carries out the business of research in a professional and responsive way and builds a culture of being '**IFE**ctive'.

IFE support teams

- Knowledge to Innovation Brokering
- Research Project Delivery
- Research Administration
- Communications

2.4 Key relationships within QUT

QUT's science, technology, engineering and mathematics (STEM) academics are concentrated in its Science and Engineering Faculty and Health Faculty. Its social science academics are spread across the university's other four faculties – Creative Industries, Law, Business and Education. IFE brings together researchers from all six faculties to collaborate on large-scale transdisciplinary projects relating to our natural, built and digital environments.

IFE is linked most closely with the Science and Engineering Faculty and draws on capabilities from all six schools (Chemistry, Physics and Mechanical Engineering; Civil Engineering and Built Environment; Earth, Environment and Biological Sciences; Electrical Engineering and Computer Science; Information Systems; Mathematics) and their 21 disciplinary areas of capability.

Of course, understanding the broader political, economic and social systems within which new technologies and ideas operate is critical to ensuring they have an impact on the real world. Consequently, IFE draws on the social sciences expertise of QUT's other faculties, such as the Law Faculty's expertise in law, regulation, policy and ethics; the Business School's expertise in economics, management and entrepreneurialism; and the Creative Industries Faculty's expertise in design and creative practice.

IFE also supports several research centres at QUT, including the Centre for Tropical Crops and Biocommodities (CTCB, aligned to Growing the Global Bioeconomy); the Australian Research Council's (ARC) Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS, aligned to IntelliSensing) and Australian Centre for Robotic Vision (ACRV, aligned to IntelliSensing).

IFE's ethos of cross-organisation collaboration is embedded in every aspect of its operations. The leadership teams of IFE's research themes and enabling platforms include representatives from all six faculties, and the IFE's research investment targets transdisciplinary project proposals and projects that develop infrastructure capabilities. Moreover, our research support teams link with allied functions within QUT's faculties, divisions and Chancellery.

QUT's other major research institute, the Institute for Health and Biomedical Innovation (IHBI), studies health determinants and systems, injury prevention and trauma management, chronic disease and ageing. IHBI's research complements IFE's in several areas where the two institutes are studying similar subjects with different applications, such as genetics, bioinformatics and advanced materials.
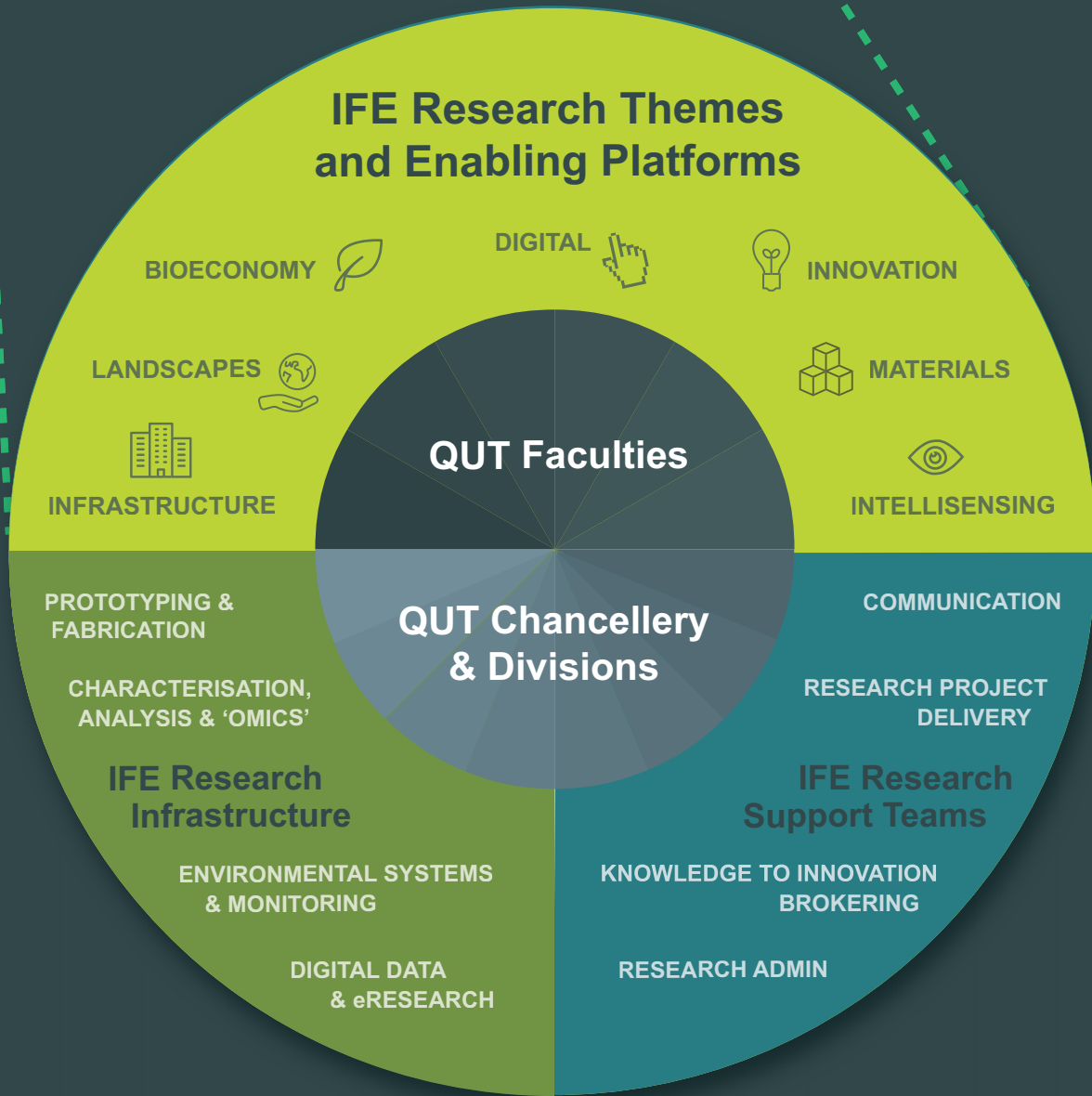

Researchers from the Centre for Tropical Crops and Biocommodities (CTCB): from left to right, Professor Peter Waterhouse, Professor Sagadevan Mundree, Professor Roger Hellens and Distinguished Professor James Dale

Catalysing Innovation

IFE partners with industry, government and non-profits on projects to improve our natural, built and digital environments.

IFE builds transdisciplinary teams of researchers from QUT's faculties, supported by first-class research facilities and research support professionals.

Industry, government & communities

Natural, built & digital environments

Real world impact

IFE Research Themes and Enabling Platforms

BIOECONOMY

DIGITAL

INNOVATION

LANDSCAPES

MATERIALS

INFRASTRUCTURE

INTELLISENSING

QUT Faculties

PROTOTYPING & FABRICATION

COMMUNICATION

CHARACTERISATION, ANALYSIS & 'OMICS'

RESEARCH PROJECT DELIVERY

QUT Chancellery & Divisions

IFE Research Infrastructure

IFE Research Support Teams

ENVIRONMENTAL SYSTEMS & MONITORING

KNOWLEDGE TO INNOVATION BROKERING

DIGITAL DATA & eRESEARCH

RESEARCH ADMIN

2.5 Alignment with national and state priorities

IFE's research themes and enabling platforms are aligned with the Australian Government's and Queensland Government's Science and Research Priorities, which articulate the research areas of greatest significance to the state and the nation.

IFE research theme or enabling platform	Australian Science and Research Priorities	Queensland Science and Research Priorities
Growing the Global Bioeconomy	• Food • Energy	• Delivering productivity growth and jobs for Queensland by developing enhanced production technologies, tools and practices particularly in the agricultural, mining, advanced manufacturing and supporting sectors including engineering services • Natural advantage cleaner, and renewable technologies development (eg. biofuels)
Managing for Resilient Landscapes	• Soil and Water • Environmental Change • Food	• Protecting our biodiversity and heritage, marine and terrestrial, with particular focus on the Great Barrier Reef • Building resilience and managing climate risk, through the design and development of construction technologies of extreme weather event resistance (floods, cyclones, droughts), particularly in tropical environments • Ensuring sustainable water use and delivering quality water and water security in variable climate and in a resources-intensive economy
Infrastructure for Sustainable Communities	• Transport • Energy • Environmental Change	• Ensuring the sustainability of our physical infrastructure critical for research and – correspondingly – strategically leveraging national programs (including making use of 'big data') • Natural advantage cleaner, and renewable technologies development (e.g. gas, solar) • Ensuring sustainable water use and delivering quality water and water security in a variable climate and in a resources-intensive economy
Embracing the Digital Age	• Cybersecurity	• Growing our knowledge intensive services through science, research and innovation • Ensuring the sustainability of our digital infrastructure critical for research and – correspondingly – strategically leveraging national programs (including making use of 'big data')
Manufacturing with Advanced Materials	• Advanced Manufacturing • Energy • Resources • Soil and Water • Transport • Environmental Change	• Delivering productivity growth and jobs for Queensland by developing enhanced production technologies, tools and practices particularly in the agricultural, mining, advanced manufacturing and supporting sectors including engineering services • Natural advantage cleaner, and renewable technologies development (eg. gas, solar, biofuels)
IntelliSensing	• Cybersecurity • Food • Resources • Environmental Change	• Growing our knowledge intensive services through science, research and innovation • Digital-enabled technologies, eg. development and application of advanced modelling, visualisation, sensing and simulation technologies, tools and practices, including robotics
Transforming Innovation Systems	• All (integrator)	• Growing our knowledge intensive services through science, research and innovation

Images below, top to bottom: Professor Nunzio Motta and Dr Bharati Gupta using a scanning probe microscope in IFE's Central Analytical Research Facility; researchers from IFE's Manufacturing with Advanced Materials Enabling Platform; robotics researcher Professor Michael Milford. Opposite page: Distinguished Professor Kerrie Mengersen using virtual reality technology to study and protect jaguars in the Peruvian jungle.
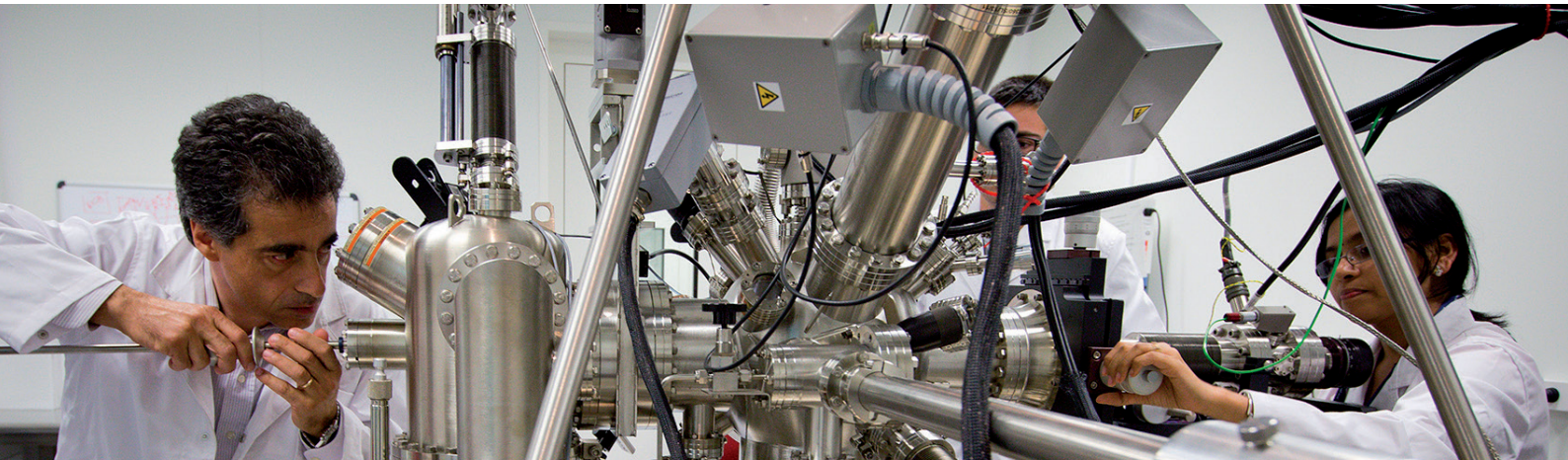
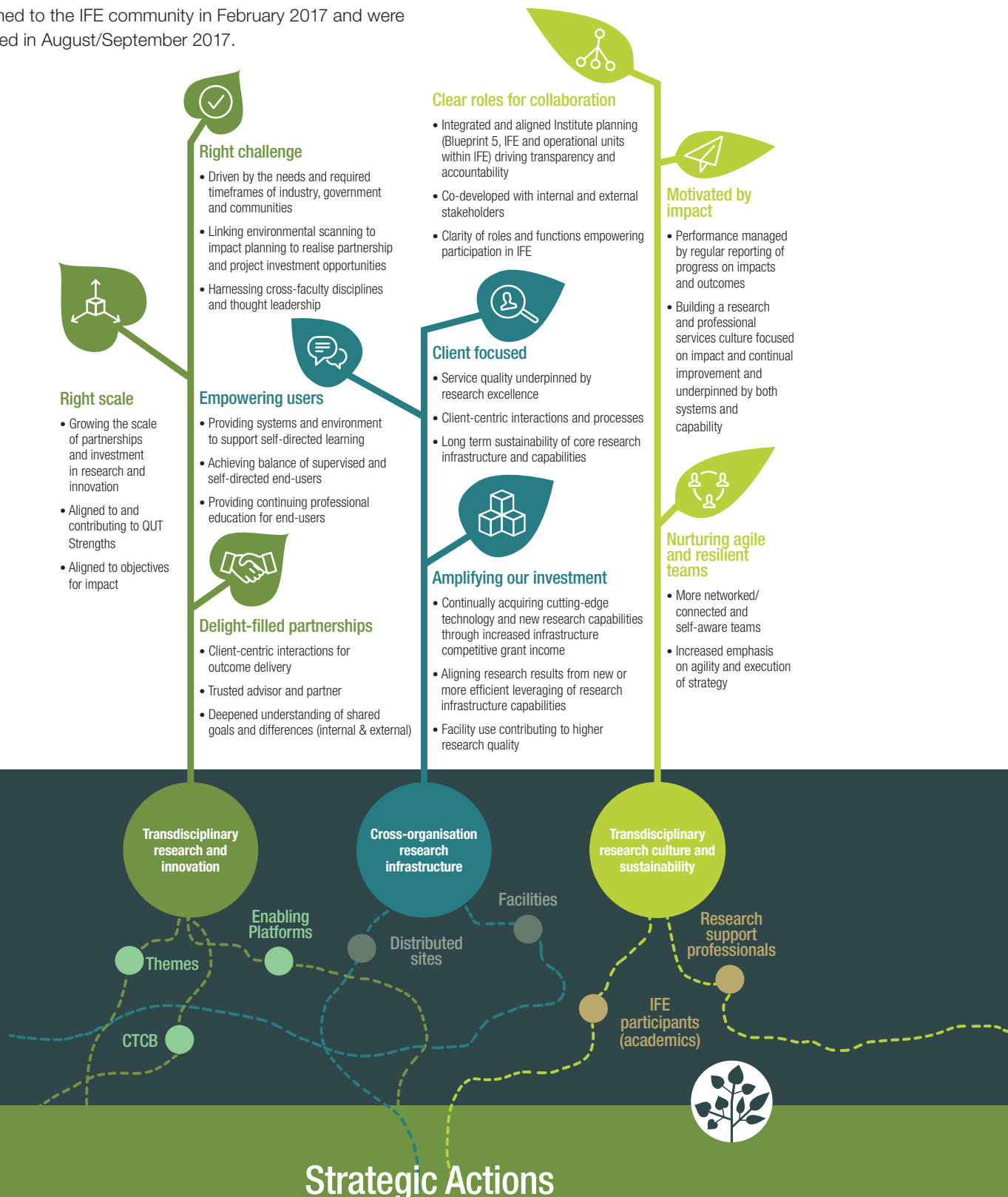# Part 3: What will success look like?

The success of IFE will be assessed on the three critical dimensions of excellence: 1) research quality; 2) research impact; and 3) governance effectiveness. Section 3.1 outlines the Strategic Actions for success that have been identified across these three dimensions. Clearly, the success of any single portfolio is dependent on the cohesive execution of the IFE strategy.

3.1 Strategic actions for success

IFE's 2017–2020 Strategic Plan is built on three Key Priorities representing major portfolios of the Institute's business, each one branching off into three sets of Strategic Actions, as shown in the diagram below. The Strategic Actions were developed through a series of consultations with IFE staff, IFE participants (academics working on IFE projects and using IFE facilities) and IFE stakeholders (QUT leaders and a subset of our end-user partners). The Strategy and Strategic Actions were launched to the IFE community in February 2017 and were adapted in August/September 2017.

Right challenge
- Driven by the needs and required timeframes of industry, government and communities
- Linking environmental scanning to impact planning to realise partnership and project investment opportunities
- Harnessing cross-faculty disciplines and thought leadership

Clear roles for collaboration
- Integrated and aligned Institute planning (Blueprint 5, IFE and operational units within IFE) driving transparency and accountability
- Co-developed with internal and external stakeholders
- Clarity of roles and functions empowering participation in IFE

Motivated by impact
- Performance managed by regular reporting of progress on impacts and outcomes
- Building a research and professional services culture focused on impact and continual improvement and underpinned by both systems and capability

Right scale
- Growing the scale of partnerships and investment in research and innovation
- Aligned to and contributing to QUT Strengths
- Aligned to objectives for impact

Empowering users
- Providing systems and environment to support self-directed learning
- Achieving balance of supervised and self-directed end-users
- Providing continuing professional education for end-users

Client focused
- Service quality underpinned by research excellence
- Client-centric interactions and processes
- Long term sustainability of core research infrastructure and capabilities

Delight-filled partnerships
- Client-centric interactions for outcome delivery
- Trusted advisor and partner
- Deepened understanding of shared goals and differences (internal & external)

Amplifying our investment
- Continually acquiring cutting-edge technology and new research capabilities through increased infrastructure competitive grant income
- Aligning research results from new or more efficient leveraging of research infrastructure capabilities
- Facility use contributing to higher research quality

Nurturing agile and resilient teams
- More networked/ connected and self-aware teams
- Increased emphasis on agility and execution of strategy

Transdisciplinary research and innovation

Cross-organisation research infrastructure

Transdisciplinary research culture and sustainability

Enabling Platforms

Facilities

Themes

Distributed sites

Research support professionals

CTCB

IFE participants (academics)

Strategic Actions

3.2 Research quality

CAPABILITY AND SKILLS

Research-based capability development within QUT is a shared responsibility of faculties, institutes and the Division of Research and Commercialisation. IFE aims to draw on **disciplinary** capabilities across QUT's six faculties. Most capability will be deployed from the Faculty of Science and Engineering, with deployment from Creative Industries, Business and Law already occurring, and the Faculties of Education and Health starting to engage to consider appropriate areas of deployment focus. IFE will need to increasingly integrate the social sciences to ensure its activities deliver impact across the triple bottom line.

In terms of **integrative** skills, the most pressing challenge IFE encounters is finding academics who can provide research leadership and 'path to impact' engagement in areas requiring the integration of different disciplinary skills. Often this requires well developed quantitative skills as well as engagement skills. These are the people who can provide the leadership we need to deliver to both industry and government stakeholders.

ACCESS TO KEY RESEARCH INFRASTRUCTURE

QUT's disciplinary and transdisciplinary research will be underpinned by access to and development of key research infrastructure capabilities – both assets and technical staff – which are managed by IFE. This will also require alignment to organisational initiatives across both IFE and IHBI (e.g. data repositories, genomics and eResearch). IFE research infrastructure assets have increasingly national and international importance for research underpinning several research disciplines and capabilities.

IFE will promote our investment in these infrastructure capabilities and also use them to foster collaborative links with other researchers, industry and government. We will share our publicly supported data to ensure others benefit from these resources.

3.3 Research impact

IFE is committed to delivering research excellence and innovation solutions with relevance and impact for Australia. Creating impact means innovative research results need to be translated and relevant for adoption and utilisation. A 'path to impact' methodology identifying 'who will be doing what differently', impact partners, specific outcomes and targets and an approach for tracking impact is critical for IFE's success.

STAKEHOLDERS OF INSTITUTE IMPACT

Impact for IFE is considered through its key stakeholders gaining benefit from our research and innovation efforts and partnerships. Consequently, impact for IFE will be achieved through partnerships and engagement where:

- **Government, industry and innovation sectors** are identifying improved practices or technologies for their business needs.

- **Government, industry and innovation sectors** are better able to respond to emerging business needs and opportunities – via capabilities and new technologies.
- **Policy development and implementation** is supported by robust information assets and collaborative dialogue that engages stakeholders.
- **Community** decision making and debates are collaborative and better informed.
- **National capability** is strengthened to a critical mass that meets challenges and realises opportunities.
- **'Research'** is contributing to and benefiting from the global research effort.

IMPACT PARTNERSHIPS

There are four main categories of impact partnership that will enable IFE to achieve impact:

1. **Industry policy and practice:** Innovation to enhance technologies, practices and analyses; providing strategic input to R&D investments; co-investment in areas of national priority that align with IFE goals as well as research input to industry policy and programs.

2. **Private sector:** Innovation to enhance technologies and practices delivering triple bottom line benefits.

3. **Government policies and programs:** Research support for national policy development and program implementation on areas of national priority.

4. **International R&D:** Catalysing effort as well as national and international partnerships with governments, industry and business as part of Australia's response to globally relevant challenges.

INSTITUTE IMPACTS

The success of IFE will be determined by our ability to articulate triple bottom line outcomes (economic, environmental, social) against each of IFE's research themes and enabling platforms, and to develop and implement an effective impact evaluation framework, identifying not only lag indicators of impact, but importantly lead indicators enabling management towards achieving impacts. Table 1 outlines the planned IFE impacts by research theme and enabling platform.

Table 1   IFE's impacts for its research themes and enabling platforms

Research theme or enabling platform	Impacts
Growing the Global Bioeconomy	1. Bioeconomy inputs are more sustainable 2. Health benefits of diets increase 3. Bioeconomy industries are profitable
Managing for Resilient Landscapes	4. Improved resilience and condition of natural and managed ecosystems 5. Increased resource use efficiency and productivity 6. Increased ecosystem goods and services
Infrastructure for Sustainable Communities	7. Infrastructure is resilient and provides net positive benefits to the environment 8. Connected and enriched communities (stewardship) 9. Financially sustainable infrastructure
Embracing the Digital Age	10. Digital age contributes to a more resilient society by fostering strong and inclusive communities 11. An increased value of technology and digitally transformed businesses based in Australia 12. Individuals benefit from digital transformation through improved costs of living, access to services and quality of life
IntelliSensing	13. Increase productivity through IntelliSensing 14. Enhance decision making for triple bottom line sustainability 15. Enable digital-physical markets and business
Manufacturing with Advanced Materials	16. Global industry using more advanced materials are more resource efficient 17. Materials life cycle uses are more environmentally sustainable 18. Healthy communities and individuals: industry shares equitably the benefits of new materials with communities
Transforming Innovation Systems	19. Improved revenue resilience of Australian industries 20. The nation focuses resources on projects that matter 21. Distance is no longer an impediment to connected innovation

PATHWAYS TO IMPACT METHODOLOGY

IFE's Pathways to Impact Methodology recognises four main components for implementation success:

- **A CULTURE** that embraces the mobilising force of the IFE goal and the triple bottom line outcomes that IFE is aiming to achieve
- **LEADERSHIP** that is focused on improving the resources investment, types of activities undertaken, quality of research outputs and knowledge to innovation engagement to ensure impacts are realised
- **CAPABILITY** of staff that empowers them to talk about the benefits of IFE's research, not just the activities and outputs from their projects, as well as capability for better informed decision making to accelerate delivery of benefits and maximise their expected value
- **SYSTEMS** that enable definition, measurement and analysis of IFE's progress not only for the purposes of institute, theme, enabling platform and facility governance, but also for future institute program reviews.

3.4 Governance effectiveness

Success for IFE will also see two key governance elements being deployed to ensure IFE is on track for achieving its goals.

EXTERNAL TO IFE EXPERTISE

Institute Advisory Committee (IAC): The IFE engages external national and international leaders, who play an integral role in achieving research and innovation goals for Australia and globally, to advise IFE on the opportunities and risks it faces in an ever-changing national and international context for its research impact imperatives.

Institute Governance Committee (IGC): This team will track progress of IFE and advise on opportunities and risks through the lens of QUT's overall organisational strategy (Blueprint) and the context for QUT in national and international higher education systems.

INTERNAL IFE GOVERNANCE

An IFE Leadership Team will engage its research impact and infrastructure leaders, as well as research support leaders, to develop and execute strategy, track progress and identify risks and opportunities within the context of IFE's operations and external engagements.

The leadership team of our Manging for Resilient Landscapes Theme

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Professor Peter Talbot at the advanced lithium-ion battery facility at IFE's Banyo Pilot Plant Precinct

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