Introduction – '*Hobart Science and Technology Precinct*' business case

In 2016 and following the relocation of Medical Sciences and IMAS, the University sought to build on its success in securing support from all levels of government to fund the Northern Transformation in Burnie and Launceston, by developing a concept to create a new purpose-built Science, Technology, Engineering and Maths facility in the Hobart CBD. The University worked with Infrastructure Australia to develop a *'Hobart Science and Technology Precinct Business Case'* with the objective of securing Federal Government funding support.

While the business case was shortlisted as a priority initiative by both Infrastructure Australia and Regional Development Australia Tasmania, the proposal ultimately did not secure Federal Government funding.

Since this business case was prepared, the University has significantly evolved its strategy to self-fund the transformation of its southern campuses to provide critical teaching and research facilities in the heart of the CBD, including in relation to STEM facilities. This has included an extensive master planning process involving community consultation through multiple processes, with learnings from these processes continuing to inform future plans for how we can best provide modern purpose-built STEM facilities in southern Tasmania.

It should be noted that the *'Hobart Science and Technology Precinct Business Case'* and associated documents was intended for Infrastructure Australia rather than as a public document. However, given the interest in the document from a range of parties, it is now being released in full, while recognising that many of the considerations have now been further developed.

Hobart Science and Technology Precinct Business Case

Commercial-in-Confidence

University of Tasmania

www.utas.edu.au

9 November 2016

Confidentiality

The University of Tasmania requests that this written submission not be published on the Infrastructure Australia website. A publishable version will be provided to Infrastructure Australia for use on its website.

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Table of Contents

EXECUTIVE SUMMARY

The University of Tasmania is proposing a **$400 million development** on University owned land in Hobart between Elizabeth, Melville, Argyle and Bathurst Streets. The proposed 48,500 m^2 new, science, technology, engineering and maths (STEM) facilities would house more than 3,000 students and 700 staff, with student numbers increasing by a further 1,500 over eight years. Facilities will be designed for use by a range of schools that will move from Sandy Bay and be co-located, including: maths; physics; earth sciences; chemistry; engineering; information and communications technology; geography; and agricultural science. This configuration will allow us to develop new cross disciplinary options in both curriculum and research and embed industry partners within the complex. The University of Tasmania's proposal has been shortlisted as a priority initiative by both Infrastructure Australia and Regional Development Australia Tasmania. The **University is seeking $250 million in Federal Government funding**, with further funding to be met by contributions and support from the University and State Government. Economic modelling indicates a **cost benefit ratio of at least 1.65**, reflecting significant benefits and offering a substantial return on investment.

The University of Tasmania has a transformative agenda for Tasmania. The considerable social and economic benefits to Hobart and Tasmania which will be realised through the Hobart Science and Technology Precinct will contribute significantly to the State's long-term economic transition. The projected economic impact of the Precinct which includes an increase in students, staff, research activities and construction is **$3.3 billion nationally** over a 30 year period. **The estimated increase to GDP is $2.3 billion.** The 775 jobs supporting the construction period would reduce the State's unemployment level by 0.3%, while 100 ongoing academic and support jobs would contribute to Hobart's scientific and technological human capital.

Like many communities, Tasmania is in economic transition. The island has, for many decades, been supported by commodity-based industries and manufacturing that are now closing, shrinking or attempting renewal. Low employment and wages 20% below the national average have been a persistent feature of the State economy. The economic transition is severely hindered by low productivity, a shrinking workforce, poor educational attainment and limited private sector investment. These trends are evident in Hobart, which is not achieving its potential as an innovative, modern capital city that spearheads the State's economy. Hobart's unemployment rate remains high at 6.2%[1] and population growth is low, with the city struggling to attract and retain talented people.

The need for transformative action is clear. There is a growing, community-wide recognition that the future prosperity of the State must be founded upon investment in people; a future based on innovation, new knowledge and a skilled workforce with the ability to use knowledge in creative ways. The STEM disciplines are key to unlocking the innovation potential of Tasmania. It is, however, the interface between STEM and other domains that will provide a sustainable base for innovation to propel economic growth in Tasmania. Scientific and technological innovation is critical to future-proofing established and growing industries.

As the sole university on the island, the University of Tasmania serves as the State's key provider of tertiary education, the training ground for the professions and the most important research provider. It is also a major economic contributor in its own right; one of the largest businesses and employers outside government. The University's strategic relocation of key

[1] ABS Labour Force Survey, August 2016

facilities into the CBDs of Hobart, Burnie and Launceston is creating complex ecosystems of education, employment, innovation and social opportunity, designed to reinvigorate the urban centres. This is already having a significant positive impact on the Hobart CBD. However, despite its reputation as one of the leading Australian universities in STEM, the University's facilities at the suburban Sandy Bay campus are no longer fit for purpose. Moreover, facilities, staff and students are distributed across a number of buildings which inhibits collaboration.

This proposal closely aligns to the Prime Minister's Smart Cities Plan, underpinning the revitalisation of Hobart as a productive, accessible and liveable city that attracts talent, encourages innovation and creates jobs. The location of a Science and Technology Precinct in the CBD opens up exciting opportunities. The integration of the University's infrastructure and the porosity of the boundaries between academia, industry and the community will stimulate new economic sectors and generate applied solutions to local, national and global problems. The opportunities for economic renewal are extensive, particularly at the interface between STEM and the other University CBD precincts. The intersection of STEM with the Medical and Health Science Precinct creates opportunities in biotechnology, medical devices, smart foods and health services. Combined with the creative industries, STEM offers opportunities in additive manufacturing, new media, smart design and gamification. In the Marine and Antarctic sector, the interface with STEM could provide the impetus for logistics, biosecurity and defence-related industries. The physical alignment of STEM with the Enterprize Tasmania Innovation Hub, co-founded by the University with the Tasmanian Government, supports commercialisation of intellectual property.

The social impacts would also be considerable through civic and urban rejuvenation, increased participation in higher education, population growth and greater cultural diversity. Colocation with central transport hubs will improve access for students from suburbs with traditionally low participation rates. It will also support suburban renewal as more areas become accessible for University staff to live in and as environmental impacts are reduced through an anticipated increase in public or active transport use by staff and students.

As set out in the following pages, the new Hobart Science and Technology Precinct will:

- Build Hobart's human capital;
- Establish Hobart as a knowledge-led economy and a national centre for innovation
- Revitalise and position Hobart as a 'Smart City';
- Stimulate the local economy;
- Improve overall economic productivity;
- Enhance the international profile of the city; and
- Enable Hobart and the State to respond to a changing economy.

As such, the Hobart Science and Technology Precinct offers the opportunity to partner with the Australian Government to pilot a model of innovation-led urban renewal for the nation that may be relevant in many other Australian cities, particularly regional cities.

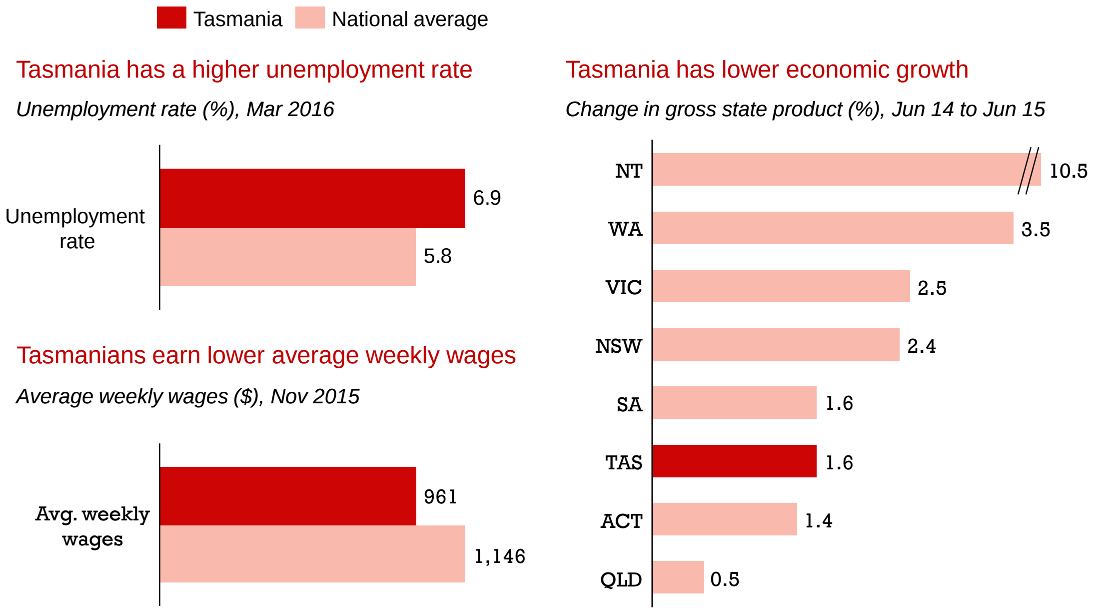
PART 1: STRATEGIC ALIGNMENT

1 SITUATION ANALYSIS

1.1 Tasmania faces economic challenges

Tasmania faces well-known challenges, with sustained poor performance against key economic indicators. Employment outcomes and economic growth in particular sit well below the national average (Figure 1.1).

FIGURE 1.1: TASMANIAN PERFORMANCE AGAINST KEY ECONOMIC INDICATORS



The Tasmanian unemployment rate is almost 1% higher than the national average.[1] Additionally, Tasmanians earn the lowest weekly full-time wages in the country, taking home ~$180 less per week than the national average.[2]

Tasmania has one of the lowest economic growth rates in Australia. For the period June 2014 to June 2015, Tasmania experienced the third lowest economic growth rate in Australia at 1.6%, significantly lower than many other States and Territories including Western Australia (3.5%), Victoria (2.5%) and New South Wales (2.4%). [3]

The implications for the State and the nation are significant. One in four Tasmanians lives below or very close to the poverty line and Tasmania scores worse than the Australian average in almost every indicator of social disadvantage[4]. Tasmania's economic performance affects the outcome of all other States and Territories. Tasmania is a net recipient of national GST revenue, receiving $1.58 in benefits and services for every $1 of tax paid.[3]

[1] Various Australian Bureau of Statistics Data, March 2016

[2] Various Australian Bureau of Statistics, 2014-15

[3] Australian Bureau of Statistics, 2014-15

[4] West J. , 2013

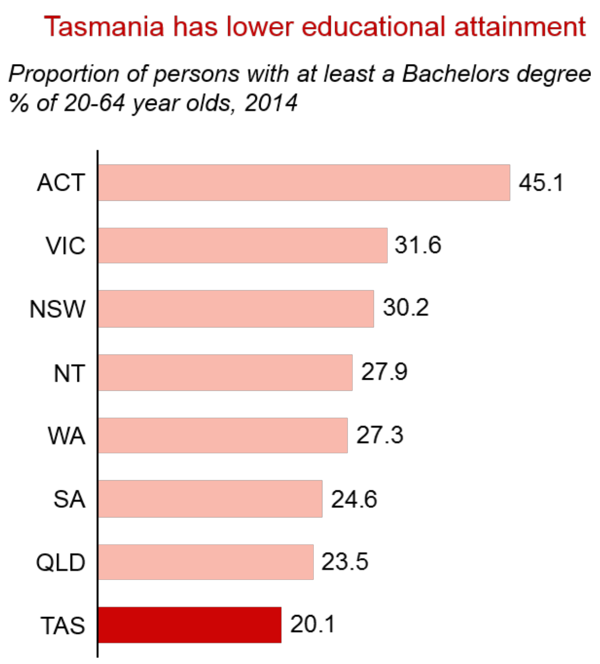
1.2 Tasmania's economic transition is constrained

Tasmania's economy has historically relied on commodity-based industries. However, scale, geographical isolation and regionalisation put the State at a distinct disadvantage in these traditional export industries. If Tasmania is to redress its performance in employment and economic growth, it will need to refocus its economy on innovation-based industries borne from human ingenuity and new knowledge. Indeed, the State has made some progress. Industries such as advanced manufacturing, precision agriculture, natural resource management and aquaculture are on promising trajectories. These industries require ongoing science and technological innovation to ensure their continued growth. Yet Tasmania, like Australia, performs poorly on measures of innovation. Further, the broader economic transition needed to drive greater progress is being hindered by a number of key deficits:

Skills and education deficit – Tasmania has the lowest educational attainment in Australia.

Tasmania has the lowest proportion of people with a bachelor's degree or higher in Australia, with just 20.1% having completed university compared with 45% of people in ACT, 31.6% in VIC and 30.2% in NSW. Since 1971, the gap in educational attainment between Tasmania and other Australian states and territories has widened. Education is closely correlated with social mobility. Without improvement in educational attainment, many Tasmanians are destined to continue an intergenerational cycle of poverty and unemployment, while productivity and economic growth will be constrained.[5]

FIGURE 1.2: TASMANIAN EDUCATIONAL ATTAINMENT



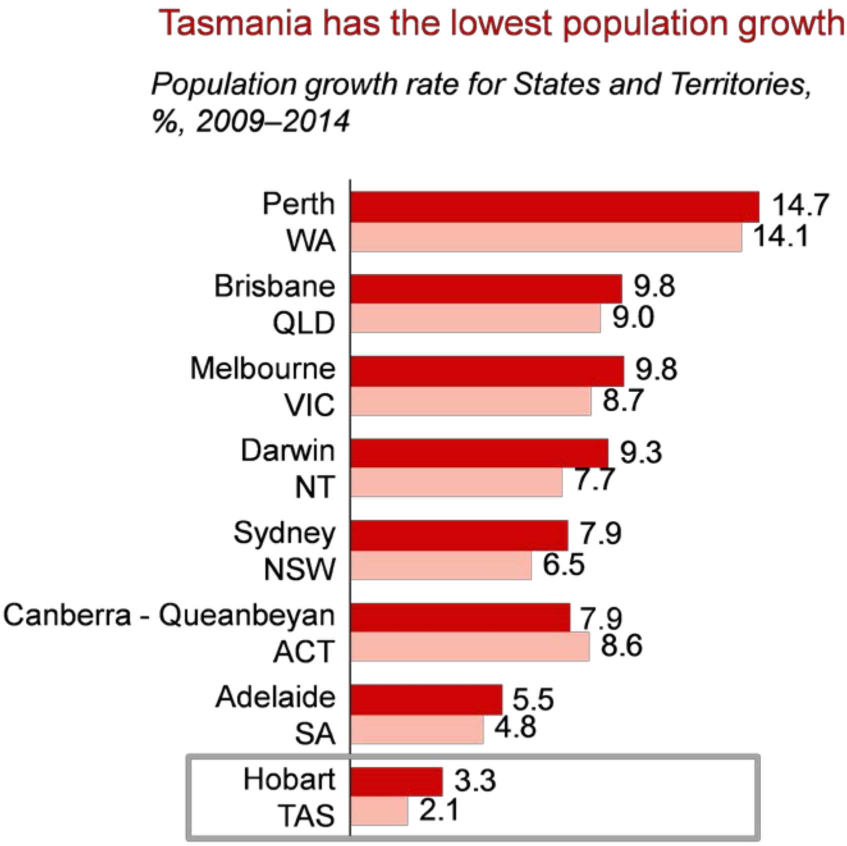
"… the low level of educational attainment of Tasmanian workers is probably the single most important reason why productivity in Tasmania is significantly below the level on the mainland". ***Former Merrill Lynch Chief Economist Saul Eslake***

[5] ABC News, 2013

Shrinking workforce – Tasmania has the lowest population growth rate in Australia. Tasmania experienced the lowest population growth rate amongst all Australian States and Territories for the period 2009-2014. This trend is consistent at the city level, where Hobart and Launceston had the lowest population growth rates in the country. The Australian Bureau of Statistics and State Government[6] projections show that if current trends continue, Tasmania's population will be in decline by 2050. Tasmania also has the oldest and fastest ageing population in Australia.[7]

Poor employment and education opportunities have been identified as key reasons for the departure of young Tasmanians, and the State's lack of appeal to young migrants from Australia's major cities. Further, perceived lack of opportunities including in employment, business and education, are preventing many expatriate Tasmanians from returning. The State Government has identified improving the liveability of cities as a key strategic intervention to attract and retain young people.

FIGURE 1.3: TASMANIAN POPULATION GROWTH RATE



"Without intervention, population ageing is likely to affect the ability of Government to provide essential services … Population ageing is also likely to affect the future supply of labour in Tasmania, and our economic growth." ***Tasmanian Government Population Discussion Paper, 2015***

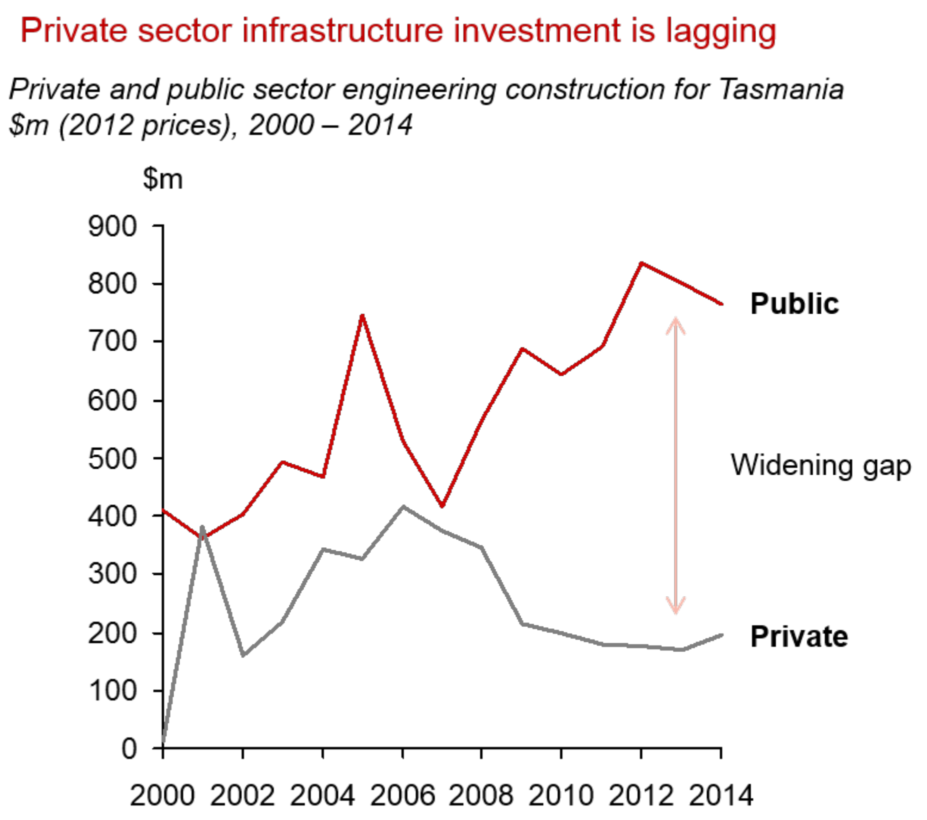
[6] Department of State Growth, 2015

[7] Ibid.

Limited private sector investment – Private sector investment in infrastructure is near record lows.

Investment in 2014 was less than half that recorded in 2006, with the gap between public and private investment more than $500 million per annum. This was the largest gap between public and private investment in infrastructure in Australia as a percentage of total investment. The large gap in Tasmania exists against a backdrop of a rising private sector share in infrastructure investment Australia wide, rising from around 40% in 2006 to over 50% in 2013.[8]

FIGURE 1.4: TASMANIAN PRIVATE SECTOR INFRASTRUCTURE

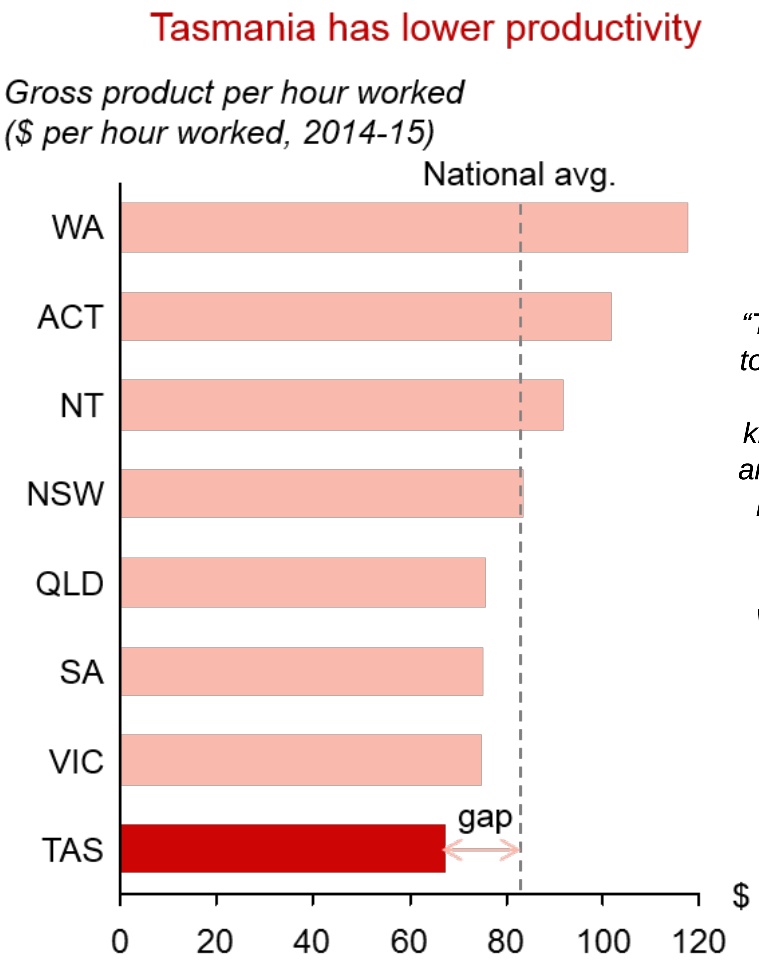


[8] Business Council of Australia, 2013

Productivity – Tasmania is almost 20% less productive than the national economy.

For each hour worked in 2014-15, Tasmanian workers produced an average of $67 worth of goods and services, less than in any other State or Territory and $16 per hour below the national average of $83.[9] Bringing productivity levels closer to the national average is critical to the future growth of the State's economy. Education and skills are central to addressing poor productivity.[10]

FIGURE 1.5: TASMANIAN PRODUCTIVITY RATES



"The more educated workforce leads to increases in productivity among all workers due to the sharing of knowledge and skills across workers and from shifts in the industrial mix to knowledge-based activities. These productivity gains translate into higher output and earnings for all workers." ***Dr Dennis Hoffman, Arizona State.***

[9] Eslake, 2015

[10] Hoffman, 2015

1.3 Hobart does not achieve its potential as an innovative modern capital city.

Hobart faces many of the same challenges as the rest of the Tasmania. The unemployment rate remains high at 6.2%[11] and population growth is low, with the city struggling to attract and retain talented people.

Yet Hobart does have some important elements that provide the foundations for innovation and growth. It is home to a number of flagship scientific centres, as well as cutting-edge research and innovation at the University of Tasmania. The capital city hosts 6,000 businesses, with the highest number (933) in the professional, scientific and technical services sector. Education is also a key industry, with 4,576 people employed in Hobart. However, Hobart is constrained in its ability to leverage these elements because:

- the infrastructure is not connected in a way that supports collaboration, both across academic disciplines or industry sectors; and
- the infrastructure is not configured for growth.

In these aspects, Hobart does not achieve its potential as a modern, dynamic capital city that spearheads the State's innovation and economic development. Investing in infrastructure in Hobart, to improve liveability, employment opportunities, productivity and economic growth, is a logical and sustainable approach to moderating the growing infrastructure pressure challenges faced by Australia's larger cities.

The City of Hobart has committed to focusing its efforts on supporting city growth, vibrancy and culture through enhancing participation in city life and has identified higher education as a key sector for future development.

> "*The growth of higher education through UTAS has many flow on benefits into our community. There is investment; increased international visitation; but also the education of our community itself is an important outcome for the City and the Council will strive to support the ongoing and increased presence of UTAS in the City*."[12] **City of Hobart, Economic Development Strategy 2013-2018.**

1.4 Higher education can be a catalyst for an economic transition in Hobart and Tasmania.

Collaboration and education underpin innovation-led city renewal.

Universities have long played an integral role in regional and national economic development. In 2013, the sector contributed $25 billion to the national economy (direct and indirect), equivalent to 1.5% of GDP. Education is also Australia's largest service export and largest export industry overall[13]. Higher rates of university participation are linked to higher levels of productivity, higher living standards and higher wages, even for those without a university degree.[14]

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[11] Australian Bureau of Statistics, 2016

[12] Hobart City Council , 2013-2018

[13] Deloitte Access Economics, 2015

[14] Cadence Economics, 2016

> ***"Education** is an enabler of productivity and growth for virtually every part of the economy."* **Deloitte, 2014[15]**

Collaboration between university and industry is associated with approximately a 70% increase in the chance of achieving "new to the world" or "creative" innovation. [16] Businesses that collaborate on innovation with research organisations are three times more likely to experience productivity growth, improved sales and exporting activity.[17] Further, businesses that collaborate with universities are more likely to produce radical or highly novel innovations. This is particularly the case in high-tech industries like biotechnology, electronics, chemicals and aerospace where university connections are crucial. The presence of research institutions in a given region of Australia is correlated with a higher level of innovation activity and aligned economic growth.

Despite its significance to the nation's economic prosperity, collaboration in Australia between research and business has been poor. Australia ranks last in the OECD in terms of industry engagement with university research.[18] Within this national context, the University of Tasmania has a clear role to play in a Tasmanian economic transition towards innovation-based industries borne from knowledge and human ingenuity. Already the University is closely linked to industry, currently hosts the highest number of Australian Research Council funded industrial training centres and has embedded linkages with key industrial sectors (e.g. agriculture, fisheries and aquaculture, engineering, forestry). The University has nearly 1,400 current higher degree by research students with 25% of these directly benefitting from industry funding and up to 50% engaging with industry during their candidature.

As the only university on the island, the University of Tasmania has an important social mission.

The University of Tasmania is pursuing a strategic mission to raise educational attainment in Tasmania and to direct its research and enterprise for the future prosperity of the State. As the sole university on the island, it is unique in the higher education sector. It acts as both a university and a university system, with responsibility for delivering tertiary education to the entire population and for generating the majority of innovation. The University of Tasmania serves as the training ground for the professions, teaching the vast majority of the State's nurses, doctors, lawyers, teachers, scientists, politicians and other professional workers. It also directs its capital expenditure to facilitate urban regeneration, while its global activities provide an invaluable conduit between Tasmania and the world.

> "*Education is one of the greatest opportunities to determine and change the social and economic future [of the State]".* **Tasmanian Premier Will Hodgman.[19]**

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[15] Ibid

[16] Department of Industry Tourism and Resources, 2006

[17] Australian Government, 2015

[18] Davis, 2015

[19] Hodgman, 2015

The University is Tasmania's single greatest source of research and innovation, with a strong track record in industry collaboration.

The University of Tasmania is the greatest producer of the two components of innovation – human capital and intellectual property.

> "The talent and skills of our people is the engine behind Australia's innovative capacity" ***National Science and Innovation Agenda Report***[20]

It is the largest research provider on the island, where there is relatively limited funding allocated through CSIRO or Defence Science and Technology Group. Every dollar invested in University research increases Tasmania's economic output by $1.60 and Australia's overall economic output by $4.80.[21] In 2015, the University of Tasmania:

- invested more than $200 million in research and ranked ninth among Australian universities in terms of research income;
- attracted $68 million in public sector, industry and Cooperative Research Centre funding to support collaborative research projects with industry including small to medium enterprises in Tasmania (e.g. Houston's Farm, Petuna Aquaculture and Marinova) through to global firms (e.g. General Electric, Hyundai MSoft and the International Finance Corporation);
- 92% of the University's research was rated at world standard or above, with a particularly strong performance in the STEM disciplines; and
- has four areas of science ranked in the top 200 in the world: Earth and Marine Sciences (top 100); Agriculture and Forestry (top 150); Geography; and Environmental Science[22].

While Australia lags in terms of collaboration between research and industry, the University of Tasmania has demonstrated particularly strong performance in this area. It leads the nation in terms of Industrial Transformation Hub (ITH) funding, which sets the highest national benchmark for industry engagement. The University hosts national ARC Industrial Transformation Training Centres in Naval Manufacturing; Horticulture; and Portable Analytical Separation Technologies; and ARC Research Hubs in Aquaculture; Food Industry Futures; Mining Value Chains; and Forestry. A range of other major initiatives provide the framework for collaborations across academia, industry, government and the community. These include the Antarctic Gateway, the Marine Biodiversity Hub, the Digital Services Innovation Precinct, the Creative Digital Industries Hub and the Tourism Education and Research Network (TRENd), the Tasmanian Law Reform Institute and the Institute for Social Change.

The University's track record in supporting industry growth is illustrated by examples such as:

- The development of a scab-resistant potato that contributes to the protection of a farm gate value of more than $500 million per annum in Australia.[23]

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[20] Ibid

[21] University of Tasmania Impact Statement 2015

[22] QS World University Rankings by Subject, 2015

[23] ACIL Allen Consulting, August 2015

- The University's Centre for Ore Deposit and Exploration Science (CODES) which has delivered economic returns to Australia of over $1.1 billion over the past 24 years. CODES has contributed to the discovery to 9 ore deposits, with a total in-situ value of $235 billion.[24]
- The Tasmanian Institute for Agriculture has delivered $100 million worth of industry innovation in the past five years. A range of breakthroughs have supported the Tasmanian agricultural industry, including new varieties of disease-resistant poppies and innovative irrigation techniques.
- Model simulation and research and the Australian Maritime College has been used to redesign $5 billion worth of Australian and international port infrastructure.
- World's first development of a 'closed loop' life cycle for spiny lobster and creation of a commercial research facility to develop market opportunity.
- The University with State and Federal support and industry partnerships was an early adopter of the 'Internet of Things' science. We have developed the capacity to design, manufacture and deploy network-activated sensors, and complete rich data harvesting and analytics through an innovative security enabled platform. The Sense-T initiative now addresses agribusiness, water resource management, food security, logistics and transport dynamics as well as health and emergency management issues of significance to Tasmania and communities further afield.

University research collaborations have also supported significant social advancements with national and global impacts:

- Researchers at the University of Tasmania's Menzies Institute discovered the link between infant sleeping positions and Sudden Infant Death Syndrome. Their work has saved the lives of countless babies and informed medical guidelines globally.
- The Tasmania Law Reform Institute's work led to the legalisation of same-sex adoption, vendor disclosure laws and improved women's and victims' rights in relation to sexual offences including the introduction of delayed complaint provisions across Australia and Norfolk Island. The Institute's recommendations also enabled a suite of amendments to the criminal laws surrounding child sex offences and consensual assault.

The University is a major industry in its own right.

The University of Tasmania is the State's second largest employer, with more than 7,500 people on the payroll serving 37,000 students. Its operations total $0.6 billion and it is the largest non-government organisation in the state in terms of capital expenditure. In 2014, the University's economic impact on Tasmania was calculated at $1.7billion, including $930 million to Gross State Product, equivalent to 3.7%.[25] From 2011-2015, University infrastructure spend accounted for 13% of the State's total expenditure on building and structures and 9% of total asset purchases[26]. During the period 2009-2018, the University will

[24] MinEx Consulting, 2014

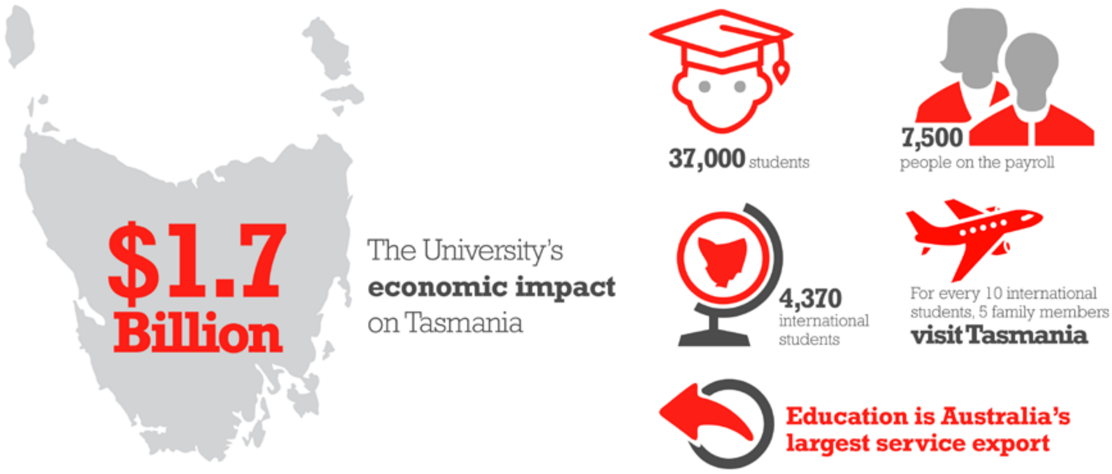
[25] University of Tasmania Impact Statement 2015

[26] Australian Bureau of Statistics, June 2016

invest more than $0.75 billion on infrastructure and capital expenditure in Tasmania (excluding the proposed $400 million Science and Technology Precinct).

Each year, around 300,000 international students commence study in Australia, the majority of whom are enrolled in higher education. Australia is the fifth most popular destination for international students, attracting nearly 6% of the world's international students[27]. This $16 billion industry is Australia's largest services export, and third-largest overall export behind 'iron ore, coal and natural gas' sector. In Tasmania, international education was worth $164 million to the Tasmanian economy in 2014-15 and continues to demonstrate strong potential for future growth.[28] There remains significant opportunities to expand the higher education sector in Tasmania, both in terms of international and domestic student growth. The University of Tasmania is seeking to expand the numbers of international students from the current level of 16% to 25%, in line with national averages.

FIGURE 1.6: UNIVERSITY CONTRIBUTION TO TASMANIAN ECONOMY



The University of Tasmania is strategically relocating its facilities into the CBDs.

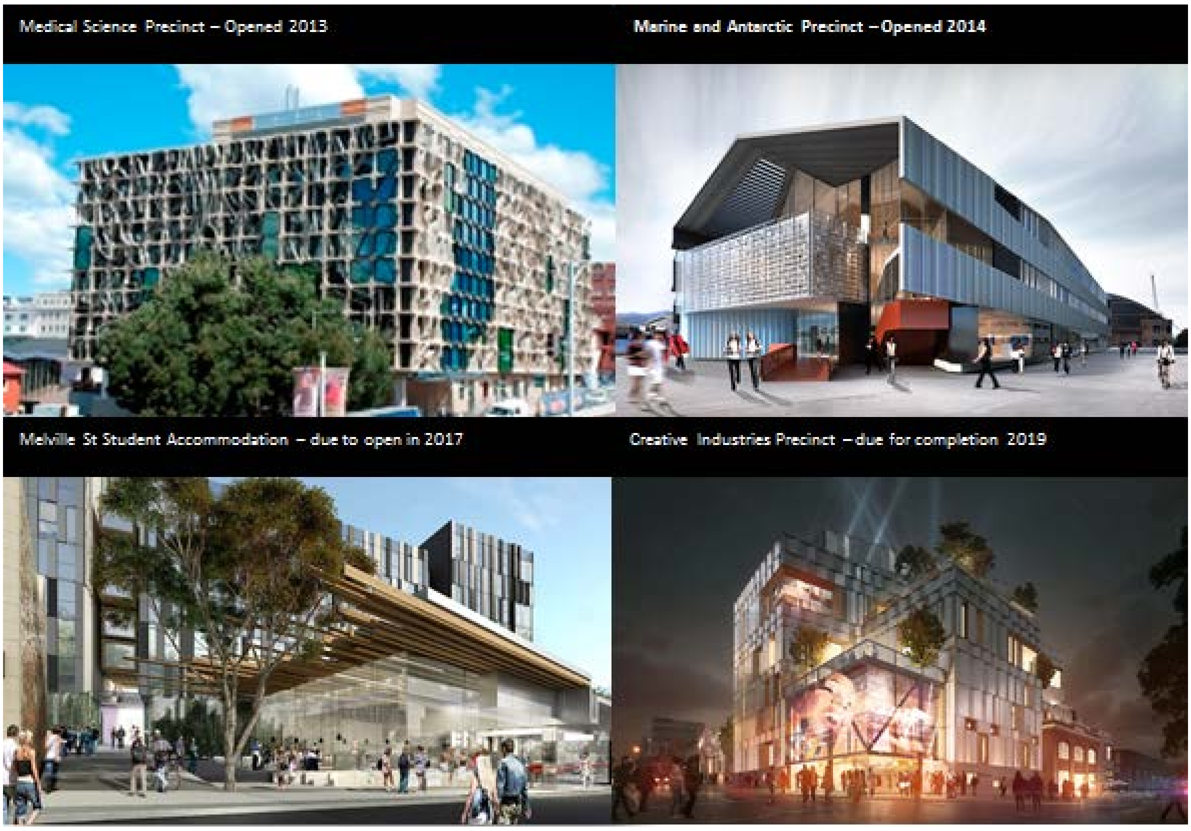
The University is strategically relocating facilities into the centres of Hobart, Launceston and Burnie. The city campuses are creating complex ecosystems of education, employment, innovation and social opportunity, reinvigorating the urban centres and opening access to those from suburbs with traditionally low participation rates. In Hobart, this is already generating considerable positive impact with thousands of staff and students bringing life to the CBD and businesses booming around development sites. Students are both a workforce and a consumer base in vibrant inner city precincts.

> *"The benefits from the University's investment in this inner city development are already visible with more cafes and retail shops opening in the area, bringing the place to life." -*
> **Director, Terroir**

[27] OECD, 2014

[28] Department of State Growth, 2016

FIGURE 1.7: UNIVERSITY OF TASMANIA'S HOBART CBD INVESTMENTS



2 THE OPPORTUNITY

2.1 STEM holds the key to unlocking the innovation potential of Tasmania

The Federal Government has recognised the importance of the STEM disciplines in generating economic growth in Australia. It estimates that by shifting 1% of the workforce into STEM-focussed jobs, the nation's GDP would increase by $57.4 billion.[29] Further, three quarters of jobs in the fastest growing industries will require workers skilled in the STEM disciplines. In 2015 as part of the National Science and Innovation Agenda, the Federal Government announced a $48 million package to increase the levels of digital literacy as well as skills in science, technology, engineering and mathematics. A further $13 million was earmarked to raise the participation of women in STEM.[30]

> *"At the core of almost every agenda is a focus on STEM: science, technology, engineering and mathematics. It is the almost universal preoccupation now shaping economic plans … It is the knowledge that STEM will offer and the sensible application of that knowledge that are the means to the end: building a stronger Australia with a competitive economy."* **Ian Chubb, former Australian Chief Scientist[31].**

As in the broader Australian economy, it is the interface between STEM and other sectors that will provide the base for innovation to propel economic growth in Tasmania. The effective garnering of emerging solutions from cross-disciplinary teams and the use of complex data will be critical to future-proofing established and growing industries such as advanced manufacturing, precision agriculture and aquaculture, as well as climate science and development of future health care systems. These disruptive applications of STEM outputs are also a vital component in developing the new, innovation-based industries that will be critical to Tasmania's future growth within the international knowledge-based economy.

TABLE 2.1: TASMANIAN INDUSTRY OPPORTUNITIES

Identified Industries with opportunity for Tasmania[32]	
• Advanced Manufacturing • Antarctic and Southern Ocean • Mining and Mineral Processing • Aquaculture and Fisheries • Logistics • Energy • Digital Services and IT	• Tourism • Applied Science Research • Medical Technologies • International Education • Forestry and Wood Sciences • Food and Precision Agriculture

[29] Australian Government, 2015

[30] Ibid

[31] Australian Government Chief Scientist, 2014

[32] Government, 2015

This is an evolution in the application of science away from specialist disciplinary teams and will require a step-change for Australian universities, which largely adhere to discipline-centric models. Instead, we are now in a phase where the most important science involves broad multidisciplinary approaches with large and porous teams bringing their aggregate expertise to bear around 'wicked' problems. There are three key elements that must be considered in order to amplify impact and application from the STEM disciplines:

1) **Locally specialised, globally integrated:** The knowledge base of science is rapidly expanding and in terms of agriculture, ecology, aquaculture, natural resource management, energy, molecular sciences, genomics and ICT it is becoming both locally specialised and more globally integrated. To address major challenges such as climate change, food security, and energy renewables, demands attention from multi-functional teams working towards locally engineered solutions which in Australia advantage the relevant 'blue' and 'green' economies, leverage suitable 'smart' models and provide novel place-appropriate frameworks for action.
2) **Data:** The fundamental needs of the scientist are converging and each field is now faced with both increasing volumes and velocities of data-capture, data-integration, data-analysis, data-storage and data-retrieval problems. The mining of big data, and emerging utility of the Internet of Things are also re-defining how we might approach key scientific challenges and dynamically facilitating scientific and technological innovations.
3) **Design:** The design principles to bring about a step change in STEM-led innovation are well understood and, to a limited extent, have already been well applied within the fields of applied biomedical sciences, for example. The Walter and Eliza Hall Institute in Melbourne was the first Australian example of a shared work environment for hundreds of scientists – forcing cross-discipline interactions in equipment-use, services and social places. This model is now widely adopted around the world with the recent completion of the Crick Institute in London (UK), dedicated to cancer research.

   We know that this can also work in Tasmania, as demonstrated through the success of the Marine and Antarctic Precinct, which brings together a novel and competitive configuration of researchers from across a wide range of disciplines to address such challenges as climate change, food security and natural resource management. Now recognised internationally as one of the best Marine and Antarctic research centres in the world, the Precinct brings over $680M of economic benefit per annum to Tasmania, including in both existing and emerging industries. And, as the host for Integrated Marine Observing System and related national programmes (e.g. ACE CRC, Antarctic Gateway) it generates wider economic value for the 'blue' economy of Australia. Another gain has been the opportunities for novel technology development: marine and Antarctic researchers working closely with several industry sectors (e.g. marine engineering, feedstock, biosecurity, ICT and tourism) have completed a world first in developing the complete 'closed loop' life cycle for lobsters and created a new, sustainable aquaculture industry for Australia which is already attracting international investment.

These three elements are underpinned by world-class STEM expertise as delivered by the University of Tasmania, home to one of the most research-intensive science faculties in the country.

2.2 The University of Tasmania is investing in world-class STEM infrastructure.

Quality STEM infrastructure is critical for:

- The expansion and transition of the Tasmanian economy
- Preparing innovative and entrepreneurial graduates
- Attracting the best staff and students
- Increasing scientific literacy across the community and driving productivity improvements
- Producing innovative research to future-proof Tasmanian industries
- Creating new industry segments that underpin Tasmania's future economy

> "*To continue to attract the best students, lecturers and researchers in the world, higher education institutions need to continue to invest. We find clear evidence of the ongoing need for further capital investment in the sector, both by government and the sector itself.*" ***Higher Education Funding Council for England.***[33]

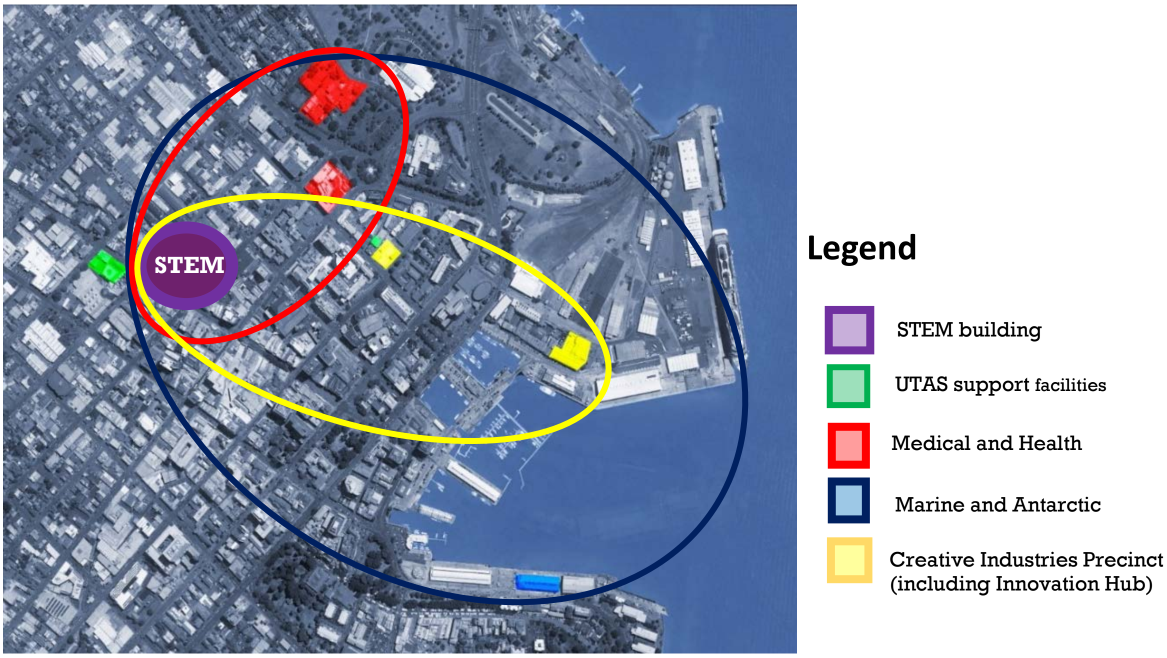
The present STEM facilities at the University's Sandy Bay campus are ageing and fragmented; the buildings confine the individual faculties into silos, rather than connecting them. They also lack the modern technical infrastructure that characterises a high-end research environment. The challenge for the University of Tasmania is to renew aging infrastructure in a manner that addresses the innovation drivers outlined above (locally specialised and globally integrated, data and design). The standard Australian university model of renovation and refurbishment department-by-department over a decade or more would only serve to entrench disciplinary silos, create barriers to innovation and isolate facilities from the commercial context that drives the economy. Instead, the University is pursuing an exciting opportunity to augment existing investments in the CBD and establish a superior foundation for a knowledge-based economy.

The University of Tasmania has already invested significantly in new facilities in the Hobart CBD, with $220 million in infrastructure completed over the past five years and a further $217 million committed to developments that are underway. These investments are creating three themed precincts linked to Tasmania's burgeoning industries – Medical and Health Sciences, Creative Industries, and Marine and Antarctic. The University has also invested in a city-based innovation hub, partnering with businesses and the State Government to create an environment which fosters and supports the commercialisation of good ideas. New, inner-city student accommodation will be completed in early 2017, bringing 430+ students to live and work in the CBD. The University will soon redevelop the Theatre Royal Hotel, based centrally in the city, into a valuable social space for staff and students, with spaces to draw together government, industry and the community to meet and interact.

In this context, bringing STEM into the city would serve as an interface between the facilities mentioned above, making STEM the centrepiece of innovation. It would allow Tasmania leverage the "STEM opportunity" into a catalyst that drives economic and social outcomes while stimulating a vibrant and cosmopolitan environment in the city centre.

[33] Higher Education Funding Council for England, 2015

FIGURE 2.1: STEM AT THE HEART OF HOBART CBD PRECINCTS



The benefits of collocating STEM with other CBD precincts will be seen in applied outcomes important to Tasmania and Australia in fields such as: climate sciences, wood sciences, precision agriculture, aquaculture, transport logistics, economic geology, ICT, and the digital and creative arts. These sectors are all anticipated to benefit from strategic investment in research and collaboration with industry because they each offer opportunities unique to Tasmania, the University and Hobart[34]. They all have emerging opportunities for growth, built on unique Tasmanian assets, are large enough to impact the wider economy, offer global applications for export, and can leverage technology to disrupt the current models.

The intersection of STEM and Medical and Health Science creates opportunities in personalised medicine, public health, biotechnology, medical devices, smart foods and health services as well as serving to attract larger corporate enterprises. We are inspired by the models for dynamic clustering used in Denmark and the success of their relatively new 'Bio Science Precinct'. This Precinct has drawn contributions from engineering, ICT, clinical medicine, design and natural sciences to stimulate investment from major multinationals[35].

The strategic relocation of the STEM facilities with the Creative Industries, Arts and Design will serve as a critical stimulus for the interaction and knowledge exchange processes. This will generate the potential for burgeoning new start-up businesses in gamification, mHealth, software engineering, additive manufacturing and environmental monitoring and management, for example[36], and enhance the growth potential of existing SMEs in the creative sector.

In the Marine and Antarctic sector, the interface with a new Science and Technology Precinct will provide the impetus for logistics, biosecurity and technologies relevant to the defence industries.

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[34] Office Co-ordinator General, Invest in Tasmania 2015

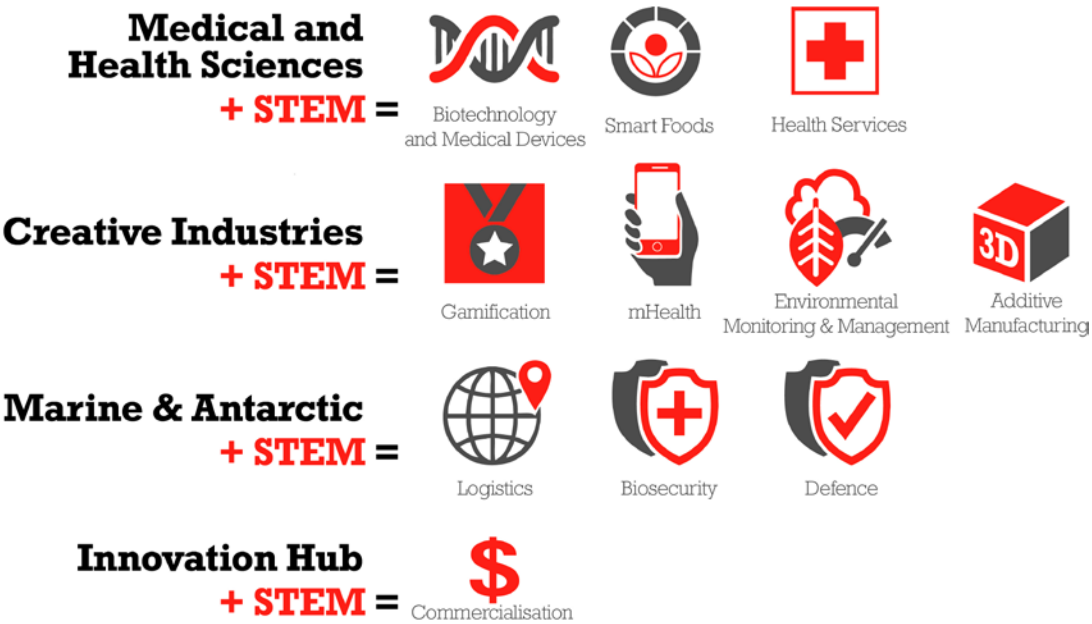
[35] University of Copenhagen, 2012

[36] Lichtenberg, Woock, & Wright, 2008

The new Hobart Science and Technology Precinct also provides interesting opportunities for the co-location of other key partner organisations with complementary science interests and a need for a flow of graduates to drive future developments. For example, the Tasmanian element of the Bureau of Meteorology (BoM) and the new Climate Science Centre are both likely candidates and their alignment with this initiative would foster new dynamic and valuable interactions with CSIRO and other research partners. This would build further on collaborative partnerships which have secured the successful footprint of Sense-T and the new Advanced Sensor Manufacturing Facility. The genesis of a dedicated Science and Technology Precinct provides Tasmania with a new beacon of excellence in applied science enabled to develop the sensor technologies and the new hardware for application in smart cities, smart communities and precision agriculture. Moreover, the development of a new Science and Technology Precinct in close proximity to the new Enterprize Tasmania Innovation Hub supports student enterprise and new options to create value out of the intellectual property that is the product of university research.

> "*We need to encourage Australia's world-class researchers and businesses to collaborate to shape our future industries and generate wealth*"[37] **National Science and Innovation Agenda.**

FIGURE 2.2: NEW INDUSTRY OPPORTUNITIES BY COMBINING INTERDISCIPLINARY INNOVATION



[37] National Science and Innovation Agenda Report 2015

2.3 Hobart can establish itself as a knowledge-rich innovation capital.

Hobart has the potential to establish itself as a national centre for knowledge creation and innovation, underpinned by a cohesive network of advanced, fit-for-purpose, intertwined infrastructure. The University envisages city life flourishing in and around iconic university buildings in the Hobart CBD, with smart porous spaces that seamlessly integrate community and education. The synchronous development of new social and economic infrastructures will foster a culture of enterprise and entrepreneurship and support innovation in new and existing industries, helping to attract new inward investment. High quality facilities would attract and retain students and staff, while state-of-the-art research infrastructure will attract industry and foster research excellence, thereby cementing the University's reputation as a leading STEM university within the top 2% of research universities worldwide. By creating an environment for economic regeneration and jobs growth, Hobart will be a more attractive option for both businesses and citizens looking to relocate from overcrowded metropolitan centres, where there is considerable pressure on existing infrastructure. The economic reinvigoration of the city centre connected to the world through the re-developed Hobart airport and provision of new student accommodation will provide a stimulant for further international student growth.

This proposal is timely as it positions Hobart as an ideal place to pilot a model of innovation-led urban renewal that may be relevant in other Australian cities, particularly regional cities. The State of Tasmania is the perfect size for testing new policies and approaches; it is small enough to manage complex programs while large enough to extract meaningful analysis. Hobart in particular presents a superior foundation for a knowledge-based smart city. Developments of this kind in Tasmania build on the Australian Government's proposal for 'city deals' and follow on from precedents in UK and Europe where the city deal model is bringing together universities, industry and government to successfully promote urban regeneration.

There are a number of Australian-based examples (including Deakin and Queensland University of Technology) and international case studies that are relevant to Hobart: Freiburg, Germany; Manhattan, Kansas, USA; Cambridge, UK; Lincoln, UK and Aalto, Finland. Each of these cities have relatively small populations (< 300K) but have centred their economies on university precincts that serve as a source of economic and social rejuvenation.

> *"Universities are being founded as instruments of economic and social rejuvenation. In these cases, it is the university or college which is to rebuild the town or region – and not the other way around."* **The Academic Cooperation Association.**

In a major report on the Competitiveness of Cities by the World Economic Forum in 2014, 32 cities across the world were assessed against a backdrop of global megatrends (technological change; industrial clusters and global value chains; urbanisation and the growth of the middle-class; rising social inequalities and long-term sustainability) [38]. The Report noted that throughout history, cities have been the major technological, innovation and economic heart of regional and national economies and this looks certain to intensify. It identified that key institutions play a critical role; that "soft connectivity" in the form of social capital is as important as "hard connectivity" and critically, that education is the ultimate "soft connectivity". The links between government, universities and industry is key to success. The Report cites several US cities such as Boston, Pittsburgh and St. Louis that have escaped post-industrial decline through investment in knowledge-intensive infrastructure and digital nodes that have in turn inspired major inward foreign

[38] World Economic Forum, 2014

investment and the physical location of new foreign enterprises alongside local innovators in educational precincts. A competitive and smart city is one which spurs ideas and fosters innovation and entrepreneurship.

CASE STUDY 2.1: CAMBRIDGE

Case Study	Description
Cambridge as a university town [39]	In 1970, a proposal was worked out whereby certain forms of growth - in particular, the establishment of high-tech firms – would be prioritised and this has since then formed the guideline for development around Cambridge. A number of high-tech spin-offs and consulting firms emerged from the university's competencies in the areas of electronics, instrument development and computing. This then led to the creation of new companies. In the period 1994–95, some 87 new firms were set up in high-tech sectors and in 1996, Cambridgeshire had 28,000 people employed in high-tech companies. The town's success encouraged entrepreneurs from other parts of the UK to locate in the university area and large multinationals established small branch offices in the region. They were attracted by sources of innovation (knowledge), possibilities for financing, a high quality of life in the region, a sufficient critical mass of competencies in terms of management and organisation, and finally the interaction between local initiatives and international collaboration. Today, Cambridge is one of the UK's top three growing economies. 

[39] Looy, Debackere, & Andries, 2003

CASE STUDY 2.2: LINCOLN

<table>
<tr><th>Case Study</th><th>Description</th></tr>
<tr><td>Lincoln's University-led city revitalization[40]</td><td>
Lincoln is a cathedral city and the county town of Lincolnshire, within the East Midlands of England with a population of 130,200. The University of Lincoln has its origins tracing back to 1861 with a main campus based in the centre of the city undergoing significant redevelopment in the 1990's.
Lincoln has rapidly moved up in the university rankings, having risen 60 places in 4 years. In 2016, it was ranked among the top 40 English universities for the first time by The Complete University Guide.
The University's main campus in Lincoln was the first new city centre campus to be built in the UK for decades. More than £150 million has been invested, transforming a city centre brownfield site, revitalising the area and attracting investment from the retail, leisure and property sectors. Economists estimate that the University has created at least 3,000 new jobs and that it generates more than £250 million every year for the local economy – doubling previous local economic growth rates.
"Fuelling growth…also means reviving great towns and cities. A university can be the heart that pumps new life into a town or city. Lincoln University is a wonderful example. …The University's ethos is that it is all about turning out graduates with the skills employers really want. A few years ago Siemens were considering pulling out of the region because they couldn't find enough of the right graduates. So the university partnered with them on setting up an engineering school. It is a mark of their success that a major Italian engineering firm called Bifrangi recently set up in Lincoln close to the university. This is growth and transformation in action." UK Universities and Science Minister David Willetts
Lincoln, UK. Pop 130,200

</td></tr>
</table>

[40] UK Universities and Science Minister David Willetts, 2014

3 SOLUTION ASSESSMENT

3.1 Project options

It is clear that further investment in STEM capabilities, greater integration with other discipline areas and increased collaboration with industry is essential to contribute to Hobart and Tasmania's economic renewal. In addition, the financial and economic analysis indicates that pursuing the proposed Hobart Science and Technology Precinct is the only solution that will deliver on the investment goals and generate the economic impact to deliver real change.

The University of Tasmania has considered a number of solutions involving investing in its STEM facilities. The current situation ('do minimum') is provided as the 'base case' to enable comparison to two alternative investment options. Each solution is outlined below including an assessment against the broader investment goals and an outline of the cost/benefits for each.

1. Base Case – Maintain current STEM facilities on Sandy Bay Campus
2. Redevelopment of the STEM facilities on Sandy Bay Campus
3. Hobart Science and Technology Precinct development in Hobart CBD

Option 1: Base Case – Maintain current STEM facilities on Sandy Bay Campus

TABLE 3.1: BASE CASE ASSESSMENT

Features	Assessment
• Complete identified backlog asset refurbishment to existing STEM buildings on Sandy Bay campus to maintain buildings as fit-for-purpose. • Estimated cost of asset refurbishment is \$60M* over a 3 year period. • The current situation is that the existing STEM buildings on Sandy Bay campus are near end of life, with a total GFA of approximately 50,000m^2 spread over multiple buildings.	• Maintain buildings as currently occupied. • No additional net benefit in additional student numbers or research value. • Maintain 'status-quo'. • Will not contribute to improving economic growth and revitalisation of Hobart • Fails to achieve the University's strategic objective of central city integration and improving accessibility of education for local, domestic and international students. • Continued inefficiencies in delivering science teaching across two sites. • Unable to realise benefits of shared, multi-disciplinary facilities connected to industry and government • The prospect of creating new industries is diminished. • Less attractive to international students and numbers maintained at current levels.

*This asset refurbishment amount for the current STEM facilities on the Sandy Bay campus has been used as an estimate of the likely future refurbishment capital costs to be incurred, to keep facilities in a "fair" condition. In practice it is difficult to fully alleviate the asset deficiencies on buildings of such an age, especially with regards to WH&S and access issues. This amount has been generated through a facilities audit on a per building basis considering factors including environmental comfort (heating, ventilation, air quality), provision/amenity (safety, security, power, data) and legislative compliance (disabled access, fire egress and access). Any reduction in capital expenditure produced by being unable to address refurbishment issues, would be offset by an increase in structural maintenance and the continuation of the provision of lifecycle teaching, IT and research expenditure over the same time frame. This level of investment is forecast to arrest the current decline in Hobart STEM enrolments. As such this baseline of student load has been removed from all scenarios to show the incremental net benefit from additional student or research benefits.

Assessment against Investment Goals

TABLE 3.2: BASE CASE ANALYSIS

Build Hobart's human capital	Revitalise and increase the attractiveness of Hobart CBD	Stimulate the local economy	Improve overall economic productivity	Enable Hobart to respond to a changing economy
✕	✕	✕	✕	✕

TABLE 3.3: COST BENEFIT ANALYSIS: BASE CASE

NPV - $M	Discount Rate 7%
Costs	
Capital Costs	51
Additional Operating Costs	-
Additional Maintenance Costs	-
Earnings Foregone Whilst Studying	-
Student Education Costs	-
Australian Gov Contribution	-
Total Costs	**51**
Benefits	-
Student Benefits	-
Research Benefits	-
Car Parking Benefit	-
Residual Building value	4
Land Value Vacated	-
Additional Student Revenue	-
Total Benefits	**4**
	-
NPV	(46)
BCR	0.09

Option 2: Redevelopment of the STEM facilities on Sandy Bay Campus

TABLE 3.4: REDEVELOPMENT ASSESSMENT

Features	Assessment
• Rebuild existing STEM buildings on Sandy Bay campus of the University of Tasmania. • Estimated cost of capital investment is $429M over a 4 year period which would include demolition and relocation/housing costs during construction period. • The current situation is that the existing STEM buildings on Sandy Bay campus are near end of life, with a total GFA of approximately 50,000m^2 spread over approximately multiple buildings. • Current space efficiency is poor at 17.5m^2/EFTSL compared with the industry benchmark of 8m^2.	• New facilities will enhance the quality of staff, students and research undertaken in the STEM disciplines. • Expected to increase student numbers by 500. • Significant disruption to teaching and research activities by the temporary relocation and housing of STEM activities during rebuild. • Will not contribute to improving economic growth and revitalisation of Hobart. • Miss the opportunity to position more people in the heart of the CBD and ability to create Hobart as a new knowledge and innovation capital. • Fails to achieve the University's strategic objective of central city integration and improving accessibility of education for local, domestic and international students. • Continued inefficiencies in delivering science teaching across two sites. • Unable to realise benefits of shared, multi-disciplinary facilities connected to industry and government. • The prospect of creating new industries is diminished. • Less attractive to international students and numbers are unlikely to increase.

Assessment against Investment Goals

TABLE 3.5: REDEVELOPMENT ANALYSIS

Build Hobart's human capital	Revitalise and increase the attractiveness of Hobart CBD	Stimulate the local economy	Improve overall economic productivity	Enable Hobart to respond to a changing economy
✓	✕	Partly	✕	✕

TABLE 3.6: COST BENEFIT ANALYSIS: REDEVELOPMENT

NPV - $M	Discount Rate 7%
Costs	
Capital Costs	313
Additional Operating Costs	18
Additional Maintenance Costs	-
Earnings Foregone Whilst Studying	11
Student Education Costs	6
Australian Gov Contribution	13
Total Costs	**361**
Benefits	
Student Benefits	107
Research Benefits	14
Car Parking Benefit	1
Residual Building value	16
Land Value Vacated	-
Additional Student Revenue	23
Total Benefits	**162**
NPV	(200)
BCR	**0.45**

Option 3: Hobart Science and Technology Precinct in Hobart CBD

Table 3.7: Hobart Science and Technology Precinct Assessment

Features	Assessment

• Constructed centrally on existing University-owned land, approximately 48,500 m^2 new, fit-for-purpose STEM research and teaching facilities in the Hobart CBD.
• The Precinct will house approximately 700 people, plus teaching space.
• $400M estimated development cost.
• Teaching will be delivered to more than 3,000 students, increasing by a further 1,500 over 8 years.
• Spaces, laboratories and equipment designed for multi-disciplinary use by a range of schools that will move from Sandy Bay to the new precinct, including:
  o maths, physics, earth sciences, chemistry
  o engineering
  o information and communications technology
  o geography
  o agricultural science
• New disciplines will be introduced as a result of STEM's physical colocation with the city-based Medical, Creative Industries and Marine and Antarctic Precincts.
	• New facilities enable increased capacity to deliver education in the STEM disciplines – foundation skills and knowledge critical to Tasmania's future.
	• The Precinct will deliver innovation infrastructure for Hobart, providing an interface between STEM and other sectors.
	• Brings volume of students and staff into the heart of Tasmania's capital city – people and activity that will revitalise the city and deliver significant economic benefits to local business trade as well as social benefits through staff and student infrastructure (eg. Staff Club).
	• Enhance student experience and access by centrally locating STEM teaching facilities.
	• Activation of suburbs surrounding city-centre.
	• Indirect benefits to Tasmania and nationally, from increasing international and interstate students and their visitors.
	• New facilities will enable new research dollars to be attracted to Tasmania, delivering significant economic multipliers.
	• Enhanced environmental outcomes from a city location through smart and sustainable building design and increased use of public transport.
	• Porous and interactive building and open space designs that increase community engagement with STEM.
	• Greater connection to city-based businesses and government that enable improved collaboration and pathways for students.
	• Deliver on community expectations for further investments in the CBD.

Assessment against Investment Goals

TABLE 3.8: HOBART SCIENCE AND TECHNOLOGY PRECINCT ANALYSIS

Build Hobart's human capital	Revitalise and increase the attractiveness of Hobart CBD	Stimulate the local economy	Improve overall economic productivity	Enable Hobart to respond to a changing economy
✓	✓	✓	✓	✓

TABLE 3.9: HOBART SCIENCE AND TECHNOLOGY PRECINCT ANALYSIS

NPV - $M	Discount Rate 7%
Costs	
Capital Costs	269
Additional Operating Costs	110
Additional Maintenance Costs	1
Earnings Foregone Whilst Studying	63
Student Education Costs	35
Australian Gov Contribution	73
Total Costs	**550**
Benefits	
Student Benefits	605
Research Benefits	86
Car Parking Benefit	1
Residual Building value	19
Land Value Vacated	57
Additional Student Revenue	135
Total Benefits	**905**
NPV	355
BCR	**1.65**

3.2 The Hobart Science and Technology Precinct is recommended

Option 3 is the University's preferred investment option. The University of Tasmania envisages Hobart as a dynamic knowledge and innovation capital, with teaching and research facilities strategically linked throughout the CBD. The facilities would be connected to key social and economic infrastructure, including transport hubs, government offices and industry headquarters. This model provides the opportunity to partner with the Australian Government to pilot a model of innovation-led urban renewal for the nation.

IMAGE 3.1: ARTIST'S IMPRESSION - AN ICONIC SCIENCE AND TECHNOLOGY INFRASTRUCTURE DEVELOPMENT ON THE UNIVERSITY-OWNED SITE BETWEEN ELIZABETH, MELVILLE, ARGYLE AND BATHURST STREETS

IMAGE 3.2: ARTIST'S IMPRESSION – LOCATION IN THE HEART OF THE CBD

TABLE 3.10: SUMMARY OF HOBART SCIENCE AND TECHNOLOGY PRECINCT PROPOSAL

Factor	Preferred Option – Proposed Outcomes
Construction	Single build, open space on street frontage in Hobart CBD. Build of greenhouse space to be undertaken as part of construction phase.
Duration	Four year construction timeframe. Opening in Semester 1, 2021 to students.
Location	6,700m^2 University owned site in Hobart CBD (between Elizabeth, Melville, Argyle and Bathurst streets). Currently vacant site with one small tenanted building and large carpark. Alternative sites for greenhouse activities also being investigated.
Estimated investment cost	$400M
Estimated annual operating cost	Improved from current (estimated annual operating cost)
Use efficiency	8m^2/EFTSL – based on the national benchmarks for space utilisation for science-based disciplines specified by the Tertiary Education Facilities

	Management Association. Greatly increased over existing efficiency on STEM buildings in Sandy Bay campus.
Impact on University operations	Single move of all STEM functions, generate significant efficiencies from having colocation of disciplines enabling sharing of facilities and equipment.
Student experience	Integrated with city, ready access to all facilities, close to employment, housing and entertainment. Design and landscaping to encourage and facilitate community participation.
Transport access	Connected with existing city hubs for public transport, enhanced accessibility.
Quality of facilities	New, high quality fit-for-purpose facilities for modern teaching models of the future and research facilities, incorporating state-of-the-art ICT and sensing technology.
Teaching	Flexible – adaptable to changing pedagogy.
Research opportunities	Encourage multi-disciplinary research, enabling additional research funding to be generated due to improved high-quality facilities. The Science and Technology Precinct will serve as a centrepiece and interface between the three city-based precincts that have been built / are in the process of being built – Health and Medical Sciences, Creative Industries, and Marine and Antarctic.
Growth	Projected increase of 1500 students, including 500 international, numbers over 8 years. Greater ability to attract students. A visible and accessible precinct will also raise awareness of the STEM disciplines in Tasmania and promote scientific literacy across the population.

Unique building design and features

- The Hobart Science and Technology Precinct will be designed to respect discipline strengths but challenge STEM professionals to think outside their disciplines, embrace new ideas and work closely with industry in an environment which fosters open innovation.
- Cross-pollination in an academic setting is made natural through gathering spaces and spaces to collide.
- Classrooms and laboratories are designed around collaborative cores, such as atriums or shared support spaces.
- These design strategies give students and researchers a reason to stay and to linger and to actively ideate with those around them.
- Porous multi-user building that enables active participation between research, community, business and government:

- Design and landscaping to encourage and facilitate community participation.
- Connecting STEM educated students with the employers that need them (eg. engineering graduates with engineering firms).
- Creating effective networks of people and organisations (job clusters in the knowledge economy).

A porous building that embeds STEM in the community

The Hobart Science and Technology building is embedded in society – both as a building and in its research and curriculum. The building:

- Brings together end users, industries, professions and the community / public. The building promotes new understandings of science, communication and public access to discovery, creativity and innovation.
- Is a fulcrum and catalyst which brings together disciplines across the Hobart CBD.
- Shares infrastructure with other University buildings in the city, including immersive technologies performance and visualisation facilities, integrated science and human user experience laboratories; animal and human science laboratories; maritime and hydrological research laboratories; fluid learning spaces, rich communication spaces, flexible open social hubs and a new library.
- Facilitates student mobility (walking, ebikes, free circuit bus route) between facilities and infrastructure, encouraging a distributed model of the University which facilitates students and staff to engage with the city. Walking and cycling routes between facilities will be an attraction of support businesses which increases economic viability.
- Will have multiple entries and an activated ground floor level, and uses spaces such as green courtyards, atria and routes through that maintain permeability of the urban and building fabric.

Public exhibition, demonstration and communication

- The building will have interactive public science and creativity spaces. It will inspire new interest and engagement in science connecting people at the interface of science, art and innovation, by bringing science and technology out of the lab and into open community spaces.
- Exhibition spaces, galleries, studios, and perhaps a science café and some mobile pop up spaces to foster new opportunities for scientists, students and industry to innovate, create and collaborate.

PART 2: ECONOMIC, SOCIAL and ENVIRONMENT APPRAISAL

4 DEMAND

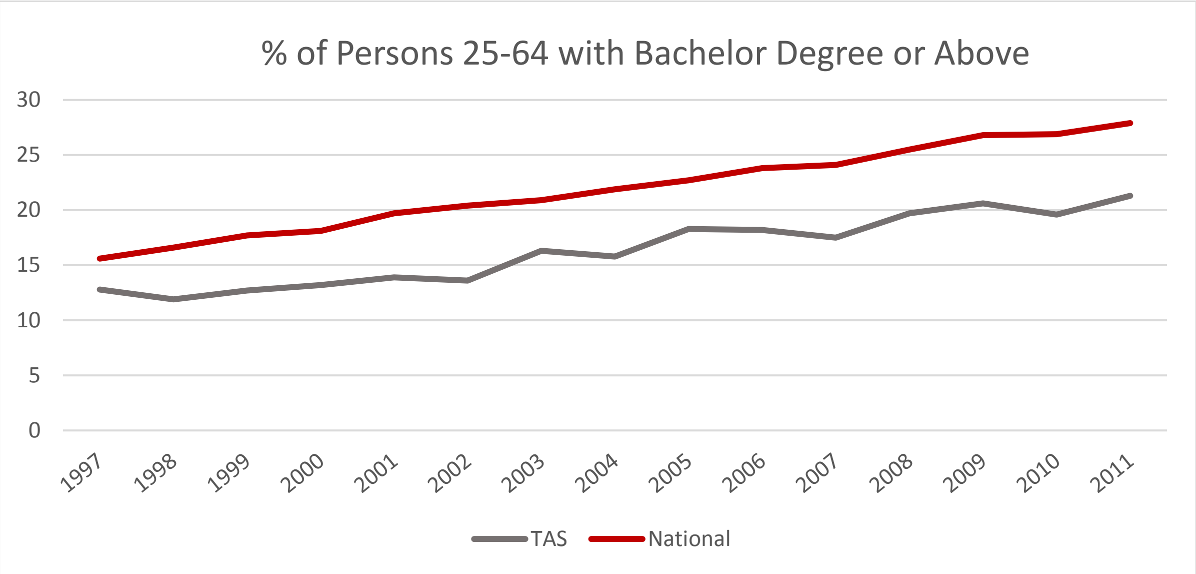
4.1 Latent demand

Currently Tasmania's educational attainment is the lowest in the country. Of Tasmanians aged 20-64 only 20.1% of the population holds a bachelor degree or higher, compared to the national average of 28.5%[41]. This 8% differential equates to a further 23,000 Tasmanians who would need to hold a bachelor degree to reach the national average.

For current school leavers, Tasmania is again well below the national average when it comes to educational attainment. Latest census data puts the percentage of 20 year olds attending a tertiary institution at 27%, almost 10% below the national average[42]. Without rectification, this gap equates to a further 12,000 Tasmanians that will miss out on higher education compared to the national average.

There is also nothing limiting the demand at the current national average, with prior trends indicating strong growth over a prolonged time frame.

FIGURE 4.1: GROWTH IN EDUCATIONAL ATTAINMENT RATES IN AUSTRALIA



The USA and UK have higher rates of tertiary education than Australia. When including short-cycle tertiary (equivalent to an associate degree), Canada has over 50% of the population who have successfully completed a course.[43]

It is clear from this evidence that large latent demand exists in Australia and Tasmania for higher education, which presents upside potential over the life of the Hobart Science and Technology Precinct.

[41] ABS Education and Work, Australia, May 2014

[42] ABS Census of Population and Housing, 2011

[43] OECD, 2016 Figure A1.4

4.2 Demand Analysis

For the purposes of the cost benefit analysis, demand has been separated into three categories to allow marginal benefit contribution to be effectively measured against the marginal costs of the project:

- Existing demand;
- Newly generated demand; and
- Diverted demand.

The existing demand is defined in the base case as stabilising after multiple years of decline (see *Current Trends* section 4.5), and as such is not discussed in detail in this section.

4.2.1 Newly Generated Demand

Newly generated demand is defined as *students who will commence studies at the Hobart Science and Technology Precinct as a result of the project and would not have otherwise attended university in Australia at all.*

It is clear from the evidence outlined in Part 1 of this document and the latent demand discussion, that barriers to entry exist to Tasmanians' participation in higher education, thus holding the average educational attainment rate at the worst in the country. The Hobart Science and Technology Precinct mitigates these barriers to participation in multiple ways, subsequently generating new demand.

Barriers to participation

Analysis of public colleges (Year 11 and 12 providers) in the greater Hobart area, shows a significant variance between application rates for the University of Tasmania in 2015 between the public colleges based in central and southern suburbs, compared to those in the northern and eastern suburbs.

TABLE 4.1: APPLICATIONS RECEIVED 2015 BY PUBLIC SCHOOL IN HOBART REGION

City and Southern	Apps	Total	% Apply	North and East	Apps	Total	% Apply
Hobart College	169	463	36.5%	Claremont College	46	353	13.0%
Elizabeth College	143	415	34.5%	Rosny College	141	580	24.3%
Average Public	**312**	**878**	**35.5%**		**187**	**933**	**20.0%**

This 75% increase (an additional 15% of the cohort), in applications from those in the central and southern suburbs is a significant variance and supports the anecdotal view that students from northern and eastern suburbs do not attend University in Sandy Bay.

Data from independent schools is skewed due to some schools offering boarding on site or nearby, the majority being based in the central region, and there is a national trend that students attending non-government schools are more likely to attend university[44]. However one particular data set for Guildford Young College is pertinent to review, as it is two campuses of the same school, based in separate catchment areas as defined above.

[44] ABS Australian Social Trends, Sep 2011

Table 4.2: Applications received 2015 by Guilford Young College campuses

City and Southern	Apps	Total	% Apps	North and East	Apps	Total	% Apps
Guilford Young (Hobart)	132	205	64.4%	Guilford Young (Glenorchy)	99	192	51.6%

This repetition of a significant application difference between two sites is reflective of the significant barriers to participation that exist in different catchment areas around the Greater Hobart Region.

Table 4.3: Population and participation in tertiary education by local government area in Greater Hobart

Greater Hobart Population by Local Government Area	Population	% of Greater Hobart Population	Participation in Higher Education by 20 year olds[45]
Northern Districts			
Brighton	10,050		12.10%
Derwent Valley	4,286		7.40%
Glenorchy	28,715		15.10%
	43,051	**31%**	
Eastern Districts			
Clarence	33,297		29.60%
Sorell	8,673		11.10%
	41,970	**30%**	
Southern			
Kingborough	19,985		33.90%
	19,985	**14%**	
Central			
Hobart	34,360		61.00%
	34,360	**25%**	
Total Greater Hobart	**139,366**		

This difference in school leaver participation correlates with ABS census data, which further demonstrates these differences. Whilst this analysis is specific to Hobart, it is systemic of the broader Tasmania situation of reduced educational participation in regional areas.

45 2011 Census of Population and Housing. Caution needs to be taken of small population areas due to sample size.

Overcoming Barriers to Entry

1) Access
As demonstrated by the geographical disparities above, location is a barrier to entry to studying at the University of Tasmania for school leavers. Access to the Sandy Bay site significantly increases travel times, requiring all students based in the northern and eastern suburbs to cross the CBD and interchange buses to reach the Sandy Bay campuses. These two districts hold the majority of the population and have the lowest university participation rates.

TABLE 4.4: COMPARATIVE TRAVEL TIME SAVINGS BY REGION OF CBD LOCATION OVER SANDY BAY

Suburbs	Northern	City	Southern	Eastern
Site	**Guilford Young Glenorchy**	**Guilford Young Hobart**	**Kingston GPO**	**Rosny College**
Weekly Time Savings (Minutes)				
Car	95	26	(57)	43
Bus	127	140	55	62
Time Savings over academic year (Hours)				
Car	41	11	(25)	19
Bus	55	61	24	27

Estimates using google maps and traffic data, and the above studied college sites, show that over the academic year (two 13 week semester periods), a move from the Sandy Bay campus to the Hobart CBD site would save students from northern and eastern suburbs significant amounts of time commuting. This will reduce the time commitment required for study and open up for time for activities such as employment. These annual savings increase with provision for orientation weeks, swot vac and exam periods.

2) Visibility
The current campus location is not visible to a broad range of the population; it is not located or visible from a main arterial route, or a business district. It is surrounded by relatively low density residential areas, and bypassed by a major road, therefore is visible to little through traffic except those residents that surround it. A key consideration out of a recent market survey commissioned by the University identified familiarity as a barrier to study. It found some people who had not gone to university saw it as unattainable and daunting.

Moving the University to the CBD will increase its visibility, and will have an impact on education aspirations and expectations. It has been recently shown that parents that have discussions with children in high school regarding university have higher levels of aspiration and expectations for university[46]. This is particularly salient for students from low socio-economic status areas, where the link was shown to be stronger.

[46] Watson, Vernon, Seddon, Andrews, & Wang, 2016

3) Ability to work part time
The time savings outlined above in regards to access are particularly pertinent when it comes to low SES and mature age students, as it effects the ability to work part-time whilst attending university. The top five student jobs while studying at university are: sales assistants, waiters, check out operators or cashiers, bar attendants and baristas. [47] A CBD location allows not only increased work hours, it also locates the students around these types of jobs, out of a residential zone.

4) Academic Pathway
The combination of the effect of removing other barriers as described above opens access to a large proportion of the population that did not attend university as a school leaver, providing a further barrier to people unfamiliar with university. To counter this, the University is currently developing new associate degrees, which are shorter and more industry focused aimed at engaging more people in higher education. As outlined in the visibility section, this engagement and presence of the University in people's lives will raise educational aspiration and expectations. Whilst the Associate Degree program is not dependant on the Hobart Science and Technology Precinct, the additional benefits derived through synergy with greater access and visibility are still real, and forecast to be material.

Experience from the USA college model shows conversion to bachelor's degrees from this short cycle tertiary education (associate degrees) is around 40%, thus has been shown as an effective pathway into higher education[48].

Creating a world class facility

The development of a world class facility will generate demand by attracting international students and industry, and by offering new programs not feasible before colocation.

New inter-disciplinary programs facilitated by co-location could result in such fields as biotechnology, medical engineering, biosecurity, and climate science. Whilst development of future research breakthroughs and technological advancements which are likely to shape these new programs are extremely hard to predict, the ability to respond to these changes will be greatly enhanced in a modern, purpose built facility, co-located with other key disciplines.

The ability to access cutting edge facilities will attract research investment and development in key industries as outlined in section 2. This will drive demand for graduates by increasing industry profitability, allowing more employment and investment in R&D for new industries, especially in the interdisciplinary fields incorporating health, ICT, engineering and environmental management.

The location of the Precinct also builds on the University's new purpose built student accommodation adjacent to the proposed site. This synergy will increase attractiveness to international students, and domestic students who might otherwise move to an interstate or international university.

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[47] Parr, 2015

[48] National Student Clearinghouse Research Centre, 2015

4.2.2 Higher Education Funding Council for England Report

In July 2015, the Higher Education Funding Council for England (HEFCE) published a report on the correlation between investment in higher education infrastructure and increase in student load. Its in-depth analysis accounted for location, research intensity, postgraduate proportion and subject mix, monitored over a seven year timeframe from 2006-7 to 2013-14. Amongst its key findings it concluded:

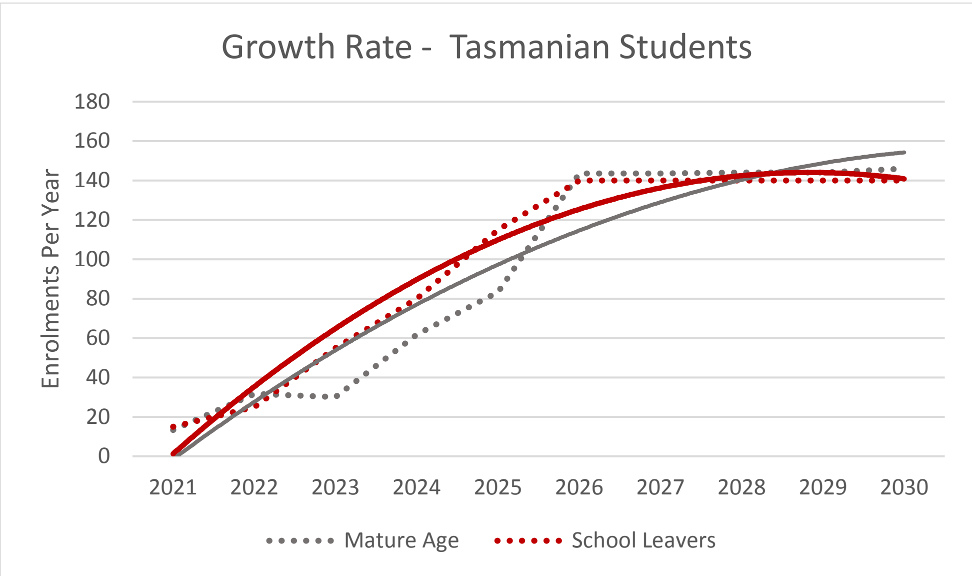
"*There is clear evidence that capital is associated with significant positive changes in a number of outcomes at higher education institutions, including student numbers, numbers of researchers and contract and consultancy research income*."[49]

Other findings of the report included

- An increased investment of £5m (~$8m AUD currently) over five years would on average correlated to increase in 100 Equivalent Full-Time Student Load (EFTSL)
- Investment in institutions with high proportion of Science, Engineering and Technology students would increase this correlation to 120 EFTSL

4.2.3 Tasmanian Students

FIGURE 4.2: GROWTH ASSUMPTIONS IN ENROLMENTS FORM TASMANIAN STUDENTS



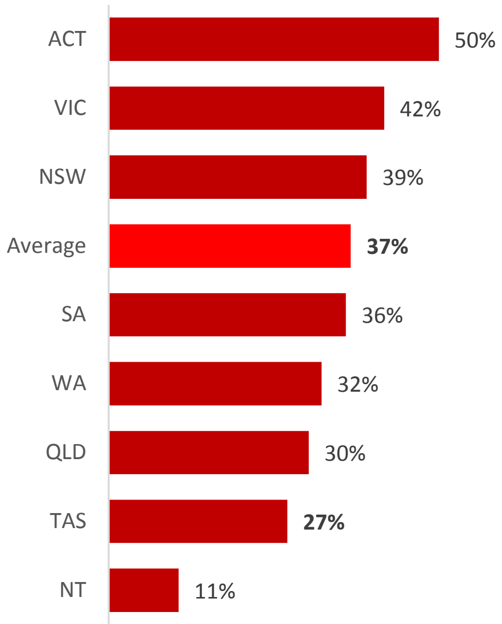
Using the educational attendance of 20-year olds from census data as a proxy for school leaver outcomes (allows for gap years and differentials in age of finishing high school education), Tasmania is approximately 10% under the national average for university attendance.

If the University of Tasmania was to reach the national average of students participating in STEM courses, it would see an additional 140 students per annum studying STEM in Tasmania (using 2014 national averages for STEM subjects as a percentage of total commencements in Australian universities). The traditionally low levels of educational

[49] Higher Education Funding Council for England, 2015

attainment, disruption of traditional industries, together with the reduced barriers to entry, the Hobart Science and Technology Precinct will result in more non-school leavers entering higher education.

FIGURE 4.3: PARTICIPATION RATES IN TERTIARY EDUCATION BY STATE



Using a similar methodology for non-school leavers, as outlined in the latent demand section, there would need to be an increase of approximately 23,000 Tasmanians aged 25-64 to reach the current national average attainment rates. Assuming the same demand for STEM as the national participation rates, would see an additional 5,500 STEM graduates. This trend has been forecast over 40 years, which is at the reverse of the rate of decline over the 14 year period 1997-2011. Census data showed that the national average of bachelor level attainment increased over the Tasmanian level at an average of 0.27% per year[50], allowing for an incremental ramping up over the first 10 years.

4.2.4 Interstate Students

It is expected that a state-of-the-art facility will attract the students from all over the country, and indeed around the world. The 2015 enrolment figures for Australian student's shows that approximately 10% of STEM students originate from mainland states, who have come for a range of reasons, including excellence in specific disciplines.

The 2015 Excellence in Research Australia (ERA) rankings puts the research rankings of many STEM disciplines above world standard, including the following which rated at "well above world standard" (highest rating possible):

[50],ABS Australian Social Trends, Data Cube - Education and training cat. no. 4102.0

- Agricultural Land and Farm Management
- Analytical Chemistry
- Ecology
- Horticultural Production
- Geology
- Geophysics
- Inorganic Chemistry
- Plant Biology
- Zoology

In addition to these current strengths, the colocation of the Hobart Science and Technology Precinct will allow new, cutting edge programs, as outlined in Section 2.

These discipline strengths, together with a world class facility and new programs will attract high performing students from around the country, representing a truly competitive offering on the world stage, retaining students who would have otherwise studied abroad.

Based on current enrolments trends and the impact of the Precinct, interstate growth has been estimated at 15% of total domestic growth, to reflect increase in attractiveness.

4.2.5 International Students

As outlined in the above section of assumptions on interstate students, it is assumed demand will continue to grow from the offer of world class programs, in a world class facility. Based on current enrolments an initial increase of approximately 50% has been modelled, increasing over a five year period, with recognition of an improved, broader offering, building on the synergy of brand new student accommodation directly adjacent to the Hobart Science and Technology Precinct. Whilst this appears on face value to be a large increase, is it reasonable when compared to a range of factors including current trend growth rates, opportunities from current and future partner universities, and the State Government policy on increasing international education and supporting pathways to jobs for international graduates.

4.3 Diverted Demand

Diverted Demand is defined as *students who will commence studies at the Hobart Science and Technology Precinct as a result of the project, but would have otherwise still attended other universities in Australia*.

4.3.1 Tasmanian Students

The current status quo in current student enrolments for STEM courses are in decline. Tasmanian students are modelled to have minimal diverted demand. As outlined in the newly generated demand section, the current barriers to entry will not be overcome without increased access, visibility, and new programs facilitated by the project. 10% has been assumed for this category of student as allowance for the retention of some students in Tasmania, who would have otherwise have gone to mainland universities.

4.3.2 Interstate Students

Interstate students have been modelled to have moderate demand, as there will be some students would have otherwise gone to a mainland university. However, the proportion of students willing to move to an interstate campus to study in a specialised field of STEM will likely be high achieving students. There will be a proportion who would have otherwise moved overseas who will now be retained in Australia. Due to the conservatively small demand modelled, a baseline of 50% diverted, 50% newly generated demand has been used.

4.3.3 International Students

International students have many more considerations when selecting a university compared to domestic students and as such have been modelled with a moderate to high diverted demand. Whilst some graduates will have decided on Australia as a study destination before deciding on a specific university, in a globally competitive market, the Hobart Science and Technology Precinct will compete on a world scale, and as such will be directly compared to other world class STEM facilities across the globe, especially in post graduate studies. Due to an absence of evidence in this space a conservative estimate of 66% has been used an estimate of diverted demand.

4.4 Future Estimates

Forecasting demand over a thirty year period is challenging when accounting for the impact of new construction activity and when operating in a changing higher education sector. Further to this, to then split newly generated and diverted demand adds another level of uncertainty.

The demand estimates generated as part of the business case are based on the demand analysis above, the recent extensive experience of the University's building projects in the Hobart CBD and subsequent relocations from the Sandy Bay campus, together with historical growth rates and research showing the impact of investment on tertiary education facilities[51].

TABLE 4.5: DETAILS OF DEMAND ASSUMPTION BY LOCATION AND NEWLY GENERATED/DIVERTED SPLIT

New Students By Origin	2021	2022	2023	2024	2025	2026	2027
Commencing Students							
Tasmanian	28	57	85	142	198	284	284
Mainland	5	10	15	25	35	50	50
International	17	33	50	83	117	167	167
	50	100	150	250	350	500	500
Newly Generated Demand							
Tasmanian 90%	26	51	77	128	179	255	255
Mainland 50%	3	5	8	13	18	25	25
International 34%	6	11	17	28	40	57	57
	34	67	101	168	236	337	337
Diverted Demand							
Tasmanian 10%	3	6	9	14	20	28	28
Mainland 50%	3	5	8	13	18	25	25
International 66%	11	22	33	55	77	110	110
	16	33	49	82	114	163	163

[51] Higher Education Funding Council for England, 2015

As a result of this analysis the forecast rates for the growth in student numbers of approximately 7% per annum are conservative estimates when compared to the overall University of Tasmania trend over the preceding five years. They are also well below the growth experienced by the Faculty of Health of 18% per annum in commencing students in Hobart after the construction and implementation of the Medical and Health Sciences Precinct in the Hobart CBD.

TABLE 4.6: FUTURE GROWTH ESTIMATES – SCIENCE ENGINEERING AND TECHNOLOGY FACULTY (INCORPORATING HOBART SCIENCE AND TECHNOLOGY PRECINCT) HOBART COMMENCING STUDENTS

Commencing Students (EFTSL) Forecast	2017 Budget	2021	2022	2023	2024	2025	2026	CAGR 2021-26
Operating Grant	601	630	658	686	743	800	885	7.0%
Full Fee Paying Overseas	321	335	349	363	392	420	463	6.7%

Post this growth phase, in 2029 a growth rate of 1% per annum has been factored in to reflect the incremental increased growth over the base case that a new build in the CBD is expected to achieve.

Due to the complexities and range of driving assumptions, the load growth and split between newly generated demand and diverted demand is stressed in the sensitivity analysis in Section 7.2.

4.5 Current Trends

4.5.1 Science, Engineering and Technology Faculty

Current demand for the Faculty of Science, Engineering and Technology (SET) in Hobart has shown minimal growth over the previous five years in domestic load (shown as Operating Grant below) but solid growth in international load (Full Fee Paying Overseas Student or FFPOS) in the last few years after a slow start. Growth in FFPOS has been derived from an increased investment in international partnership and marketing, together with recovery from a record high Australian Dollar.

TABLE 4.7: HISTORICAL GROWTH RATE – SET FACULTY, HOBART COMMENCING STUDENTS

Commencing Students (EFTSL) SET Faculty - Hobart	2012	2013	2014 Actual	2015	2016 Forecast	CAGR
Operating Grant	598	618	646	597	591	(0.3%)
Full Fee Paying Overseas	142	137	157	245	262	16.5%
Other	2	4	6	7	10	
Total	742	759	808	849	863	

4.5.2 Historical Demand (All Faculties)

Despite the SET Faculty's slow growth rate, the University of Tasmania overall has shown consistent growth in commencing students as a result of successful initiatives in both domestic and international recruitment.

TABLE 4.8: HISTORICAL GROWTH RATE – ALL FACULTY, COMMENCING STUDENTS

Commencing Students (EFTSL)	2012	2013	2014	2015	2016	CAGR
			Actual		Forecast	
Hobart	4,117	4,550	5,299	5,663	5,982	9.8%
Other	2,783	3,020	3,611	3,720	3,789	8.0%
Total	6,900	7,570	8,909	9,384	9,771	9.1%

4.5.3 Historical Demand (All Faculties, Allocations)

Analysis of the longer term trends for undergraduate load at the University and the SET faculty level, highlights the consistent growth of the university, and SET faculties reversal in recent years.

TABLE 4.9: HISTORICAL UNDERGRADUATE GROWTH RATE – ALL FACULTY, AND SET FACULTY

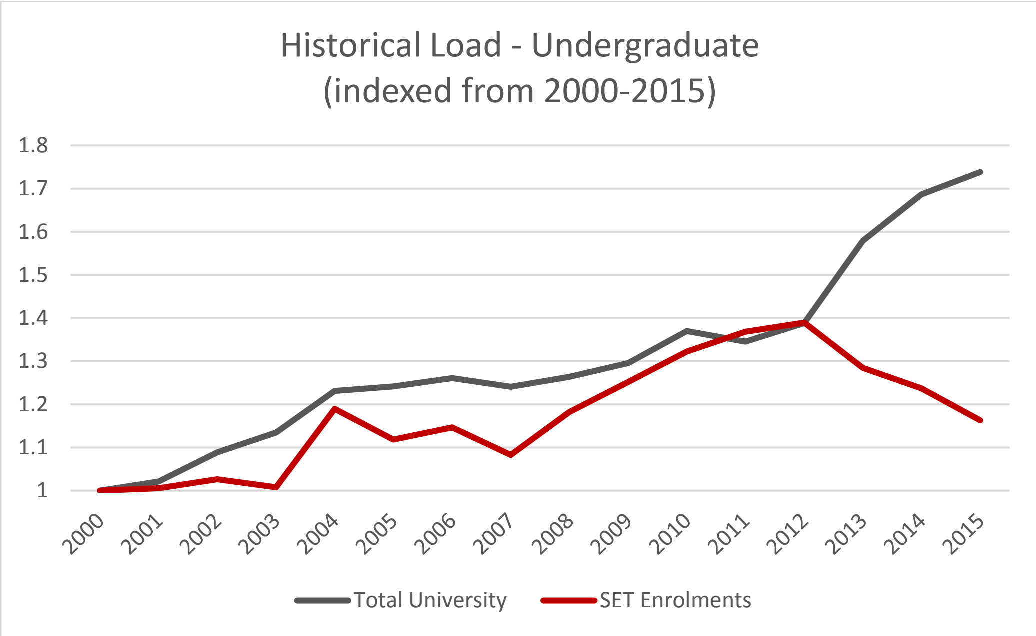
Total University Load	2000	2001	2002	2003	2004	2005	2006	2007
Domestic	8,006	8,202	8,715	8,809	8,987	8,629	8,692	8,536
International	761	747	830	1,136	1,809	2,254	2,361	2,340
Total	**8,767**	**8,950**	**9,545**	**9,945**	**10,796**	**10,883**	**11,053**	**10,876**

SET Faculty Load	2000	2001	2002	2003	2004	2005	2006	2007
Domestic	1,727	1,652	1,689	1,619	1,634	1,509	1,568	1,522
International	225	309	314	347	687	673	669	591
Total	**1,952**	**1,962**	**2,003**	**1,966**	**2,321**	**2,182**	**2,238**	**2,113**

Total University Load	2008	2009	2010	2011	2012	2013	2014	2015
Domestic	8,626	8,791	9,238	8,926	9,522	11,259	12,416	12,758
International	2,450	2,570	2,770	2,867	2,649	2,586	2,372	2,482
Total	**11,077**	**11,361**	**12,009**	**11,793**	**12,172**	**13,845**	**14,789**	**15,241**

SET Faculty Load	2008	2009	2010	2011	2012	2013	2014	2015
Domestic	1,363	1,404	1,502	1,601	1,783	1,590	1,576	1,490
International	944	1,040	1,080	1,069	929	917	838	780
Total	**2,307**	**2,444**	**2,581**	**2,670**	**2,712**	**2,507**	**2,414**	**2,269**

FIGURE 4.4: HISTORICAL UNDERGRADUATE LOAD ALL FACULTY, SET FACULTY



4.5.4 *Example 1: Medical Science Precinct*

The most relevant example of growth is that of the move of the Faculty of Health from poor facilities on the Sandy Bay to a new purpose-built facility in the Hobart CBD creating the Medical and Health Sciences Precinct.

It was constructed and commissioned in a two staged approach, with Stage 1 completed in November 2009 and Stage 2 in May 2013. The Faculty of Health experienced strong growth after this move into the world class precinct in the CBD, showing a Compound Annual Growth Rate (CAGR) of 18% in commencement in Hobart for the five year period 2011-2015 as illustrated in the below chart.

TABLE 4.10: HISTORICAL GROWTH RATE – HEALTH FACULTY, HOBART COMMENCING STUDENTS

Commencing Students (EFTSL)	2011	2012	2013	2014	2015	CAGR
Health Faculty Hobart			Actual			
Operating Grant	594	850	963	1281	1184	19%
Full Fee Paying Overseas	71	71	59	51	84	4%
Other	1	2	32	31	24	
Total	666	923	1054	1363	1292	18%

4.5.5 Example 2: Marine and Antarctic Precinct

The University of Tasmania moved the Institute for Marine and Antarctic Studies (IMAS) from its Sandy Bay location to a new purpose-built facility in the Hobart CBD, colocated with CSIRO, in 2014. The move to this state-of-the-art building combined with investment in enhancing its global reputation, has brought with it a large increase in research income, and international student applications, further evidence that the forecasted outcomes are repeatable.

TABLE 4.11: HISTORICAL GROWTH RATE – IMAS RESEARCH INCOME, INDEXED TO 2011 VALUES.

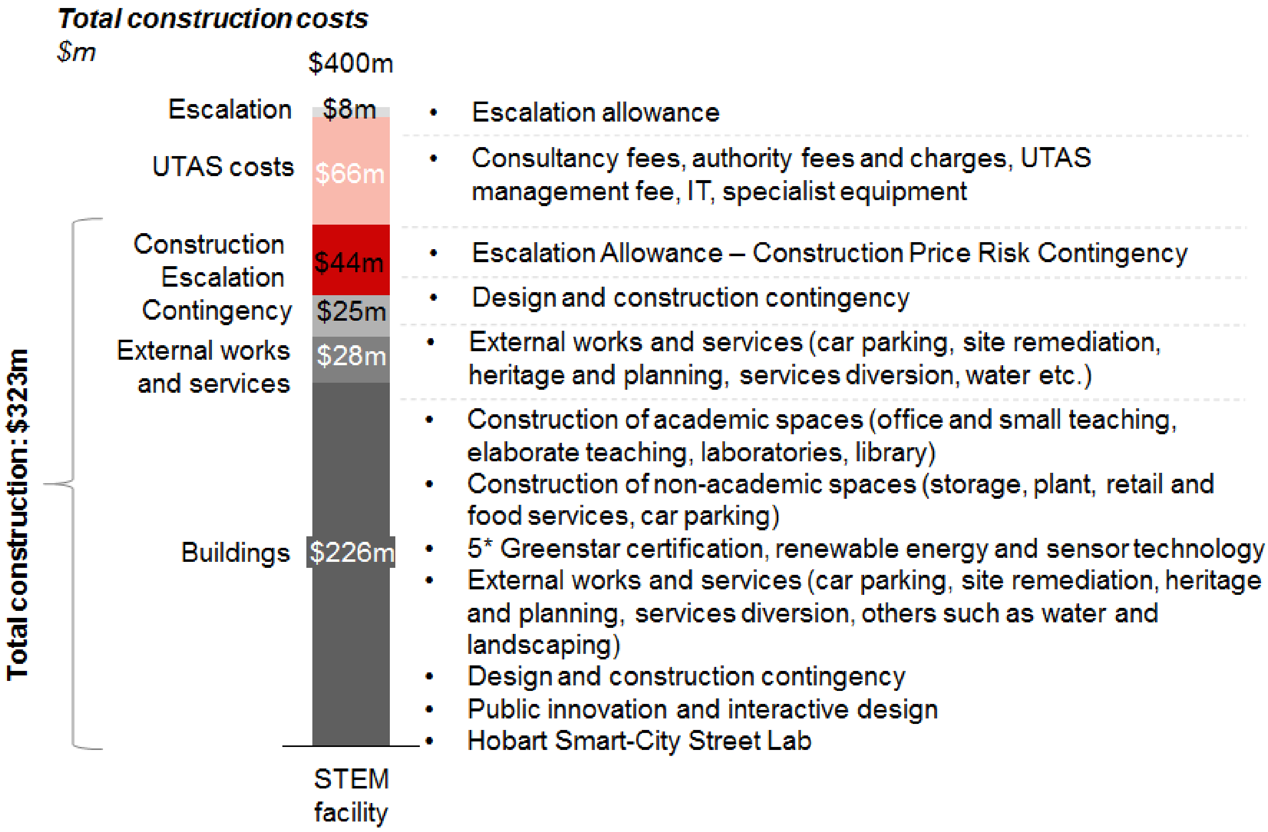
IMAS Research Income - $M	2011	2012	2013	2014	2015	2016	Increase
Indexed to 2011 Values			Actual			Forecast	
Sandy Bay	20.6	17.8	17.0				
CBD Co-Location				22.2	26.3	26.7	
Total	20.6	17.8	17.0	22.2	26.3	26.7	
		Pre Move			**Post Move**		**% Increase**
Average		18.5			25.1		35.7

5 ECONOMIC MODEL – COSTS

5.1 Approach to cost development

5.1.1 Capital Costs

FIGURE 5.1: ESTIMATED CONSTRUCTION COSTS[52]



Construct costs based on analysis by a Quantity Surveyor (QS) and this is provided at Appendix C.

The escalation allowance is a provision based on assessment of the pricing risk over the development duration. This estimate is based on a set of factors including amongst others the anticipated market demand and resourcing constraints.

Avoided capital costs from the base case have been netted off against the total capital incurred, to provide a net capital cost for the project.

[52] Estimate provided by QS (EXSTO Management) and only includes costs for Webster Site (STEM)

5.1.2 Operating Costs

Teaching Costs

Teaching costs are based on historical costs of salary and other expenses as incurred by the SET Faculty of the University in 2015. A percentage of revenue approach has then been adopted, with costs increasing proportionally with student fee income. This proportional increase factors in a high level of conservatism by incorporating an economy of scale that would reasonably be expected by an increase in students, especially in the administration of a faculty.

Overheads

The variable component of University overheads has been applied proportionally over increase in student numbers. These variable costs include IT infrastructure and support, student management and operations, and marketing.

Utilities

Utilities costs have been included on square metre basis incrementally to the base case. No efficiency has been factored in for the likely benefits achieved through a 5* Greenstar certified building, incorporating renewable energy initiatives. This could be considered as a further 'upside'.

5.1.3 Maintenance

Maintenance has been included on an incremental basis, based on university averages reported to the Tertiary Education Facilities Management Association (TEFMA).

Maintenance expenditure has been assumed flat over the life of building, but due to the nature of a new build it is likely to be below average initially, increasing towards the end of the period. This factors in a level of conservatism with amounts discounted back to present values.

5.1.4 Loss of potential Income whilst studying

The opportunity cost of income generated has been included as a user cost of project. This is calculated based on a high school educated worker (using adjusted AWOTE), weighted between estimated school leavers and average earners (as outlined in section 4, Demand), considering participation rate, and originating location of student. International students are not considered as loss of potential income, as it is assumed that they would not of otherwise have come to Australia.

This loss of earnings is in part offset by the lesser amount earned by students as reported in University Australia's survey data[53], to generate a net reduction in earnings per student.

[53] Universities Australia, 2013

5.1.5 Cost of Education

Costs for the students and Commonwealth support for domestic students are included as a user cost.

International Students

International student costs are included when the fees are payable, i.e. annually as incurred studying.

Costs of education are only included for international students who have remained in Australia post-graduation, to align with benefit realisations.

Domestic Students

Commonwealth Grant Scheme amounts are included in the year of study, as paid from the Federal Government to universities.

HECS repayments are factored to be paid post-graduation, as a % of total income (at ATO published 2017 repayment rates). This gives an average repayment timeframe of 6 years.

FIGURE 5.2: COSTS PROFILE (REAL, UNDISCOUNTED $2017)

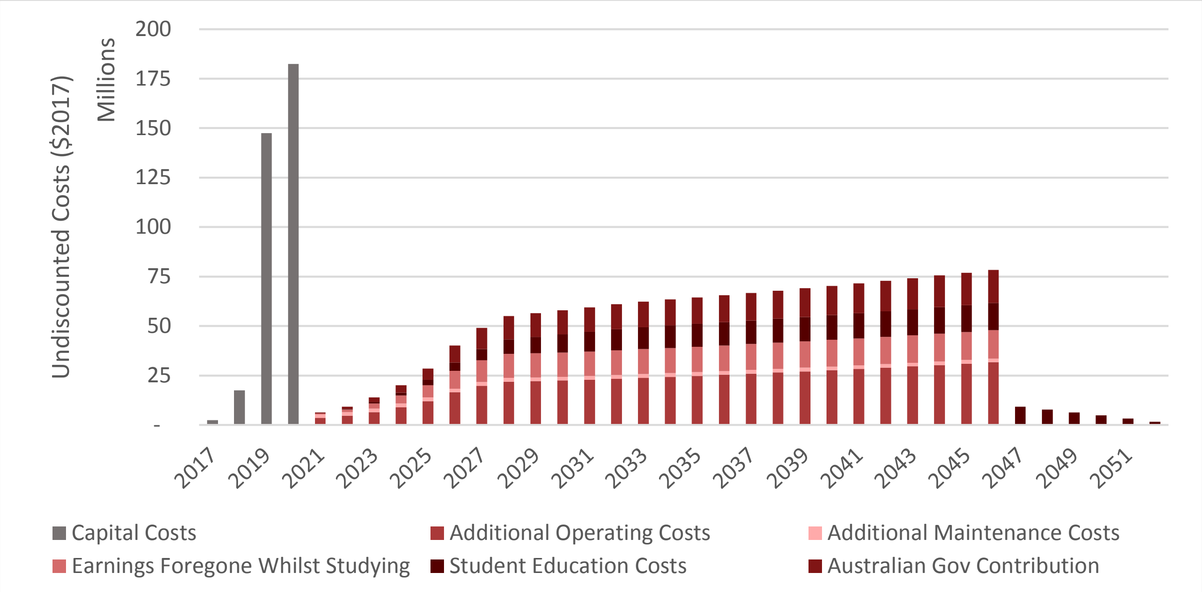


TABLE 5.1: SUMMARY, DISCOUNTED COSTS BY CATEGORY

NPV - $M	Real discount rate		
	4%	7%	10%
Costs			
Capital Costs	297	269	244
Additional Operating Costs	181	110	69
Additional Maintenance Costs	1	1	
Earnings Foregone Whilst Studying	104	63	40
Student Education Costs	63	35	20
Australian Gov Contribution	121	73	46
Total Costs	**767**	**550**	**420**

6 ECONOMIC MODEL – BENEFITS

6.1 Approach to Benefits

6.1.1 Conventional economic benefits

To allow equitable comparison against broad investment opportunities, the cost benefit analysis has been undertaken using conventional economic benefits and costs. Measuring the value of the research and educational output of such a project is difficult given the broad range of economic, social and environmental impacts, and the interdependence of these, that are derived in aggregate as a result of higher education and research. For this reason it is pertinent to consider a conventional cost benefit analysis in conjunction with the economic impact analysis and broader benefits as outlined throughout the business case.

All benefits are realised incrementally from the base case and are driven only from newly generated demand as defined in Section 4 Demand.

6.1.2 Benefits – Monetised

Further details about assumptions and the calculation of monetised benefits are listed in Appendix B.

Student Educational Outcome

One of the two core outcomes of an investment in higher education is the educational attainment achieved by students. The value of this has been calculated by measuring the future increase in earnings over an average working life of graduates, as a factor of the Tasmanian average wage. It includes the lifetime earnings of all graduates in the thirty year analysis period, as all benefits for the students have accrued inside the measurement period. An unemployment figure for workers with a bachelor level education has been allowed for in the value, and it does not include the benefits of international students who return overseas after graduation. Increase in percentage earnings has been calculated from OECD[54] reporting and is profiled to increase of the working life of the graduates. This figure is supported by the 2012 report by the National Centre for Social and Economic Modelling (NATSEM)[55].

It does not include value attribution for any social or welfare outcomes as outlined in the non-quantified benefits below.

Research Outcomes

The other core outcome is research output by the institution. The incremental output is valued on a cost basis, and driven by the increase in the number of academics employed as a function of student growth, proportional to the current earnings per academic in the University's SET Faculty. This cost basis valuation methodology is used for research output due to the extreme difficulty in placing a commercial value on the implementation of research. The impact of research is explored further in the economic impact assessment, where its impact on gross product for the state and nation is estimated.

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[54] OECD, Education at a Glance 2016, Indicator A6, Table A6.1.

[55] Modelling, 2012

Increased Student Revenues

Increased student revenues have been included to account for the teaching surplus of the University, in conjunction with the incremental increase in operating costs. This operational teaching surplus will be redirected into the universities strategic priorities, usually further investment infrastructure, equipment and research.

Car Parking

There are 50 car parks included in indicative building design with value recorded at market rate.

Residual Building Value

The capital construction of the building has been depreciated in a straight line over 60 years, to arrive at a depreciated value at the end of the 30 year evaluation period. This life was determined in reference to the current STEM infrastructure on the Sandy Bay campus which is reaching the end of its useful life. This value only includes construction costs and escalation allowance relating to this amount. All equipment has been assumed to have been fully depreciated, and consulting and management fees have been excluded.

Benefit of vacated Sandy Bay land

The University is currently assessing the potential benefit from land that would be vacated with this move of STEM to the Hobart Science and Technology Precinct. The large area of building space to be vacated would allow a condensing of remaining faculties into a relatively small footprint on the existing Sandy Bay site. It will also unlock value in previously vacated or underutilised areas of the Sandy Bay site, which because of reasons such as vicinity to other buildings or shared services and infrastructure, to date has not been able to realise. Because of the preliminary nature of the investigations, no plans have been formalised into strategy or policy, and hence have not been approved by University Council.

However, for the purposes of the conventional cost benefit analysis, a value needs to be determined. As the method of realising value is yet to be determined, with potential options to be explored including disposals, development, lease arrangements and land swaps, a valuation has been conducted at a high level. A recent valuation of the Sandy Bay site placed total realisable value at approx. $120M, and the SET buildings account for approximately 50% of the teaching space on site. Allowing for uplift to the 2017 base year, decanting the remaining staff and students into a smaller footprint, including reduction in need for shared spaces, a value of $80M has been estimated for the benefit.

Due to the unique nature of the valuation, and the uncertainty of future strategy, this value has been stressed in the sensitivity analysis to determine impact of movement on the BCR.

FIGURE 6.1: BENEFITS PROFILE (REAL, UNDISCOUNTED $2017)

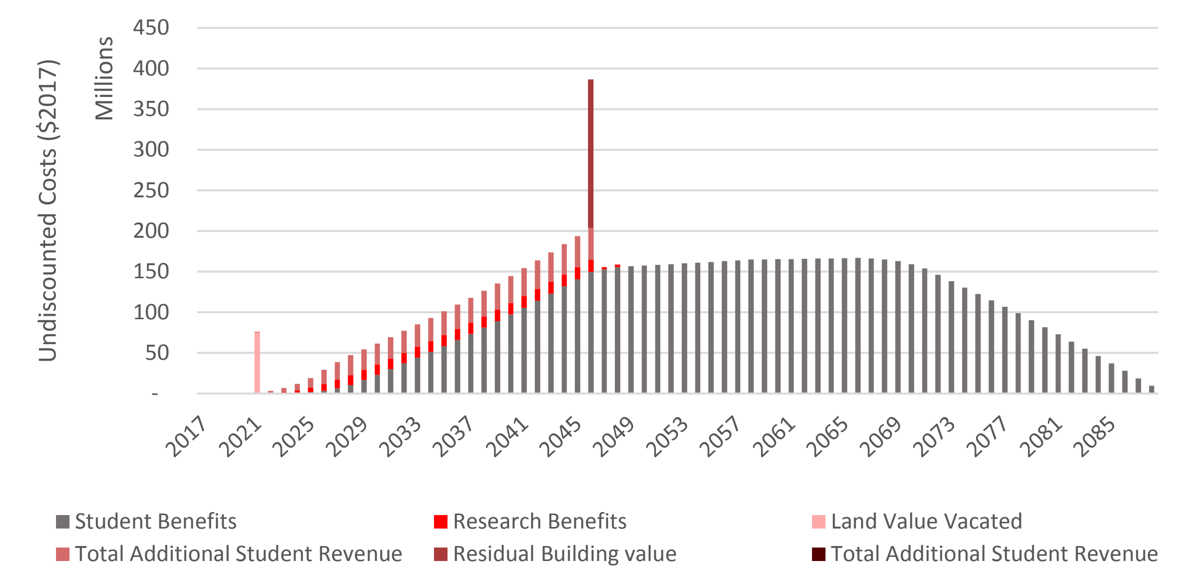


TABLE 6.1: SUMMARY, DISCOUNT COSTS BY TYPE

NPV - $M	Real discount rate		
	4%	7%	10%
Benefits			
Student Benefits	1,566	605	268
Research Benefits	144	86	54
Car Parking Benefit	2	1	1
Residual Building value	46	19	8
Land Value Vacated	66	57	50
Total Additional Student Revenue	223	135	85
Total Benefits	**2,047**	**905**	**467**

6.2 Non-Monetised Benefits

Increase in educational attainment has a broad range of external benefits which have not been monetised for the purposes of this cost benefits analysis, they include but are not limited to:

TABLE 6.2: NONMARKET AND EXTERNAL BENEFITS OF EDUCATION[56]

Non-wage Remuneration	Better educated people receive higher fringe benefits and better working conditions
Crime	Education reduces criminal activity
Child Education	Parental education affects children's education level and achievement
Child Health	Children's health is positively related to parental education
Own health	More education increases life expectancy

[56] Psacharopoulos, 2006 and Jimenez & Patrinos, 2008

Spouse's health	More schooling improves spouse's health & lowers mortality
Job search efficiency	More schooling reduces cost of search, increases mobility
Technological change	Schooling helps R&D, diffusion
Income Transfers	More schooling reduces dependence on transfers
Consumption Efficiency	More schooling improves consumer choice

Wider economic benefits

Analysis of the conventional economic benefits, specifically those monetised and included in the modelling measure direct impact of the proposed Precinct, but do not cover some efficiencies of location and expansionary impact on labour markets. These wider economic benefits (WEB) whilst not measured in this business case are likely to deliver 'up-side' benefits in conjunction with conventional benefits.

Agglomeration economies

The colocation of the University campuses will create increased efficiencies in resource utilisation, savings of time for students and staff and will contribute to the population and workforce density of the CBD. This will lead to increased efficiencies in public transport networks for the city, and subsequent flow on effects to the broader population.

Increased Labour Supply

The conventional economic benefits do not take into account the change in labour market from an increasingly skilled workforce. This will have wider economic benefits of moving labour to more highly productive and newly created jobs, allowing for broader workforce participation. The impact of this will be particularly positive in Tasmania, which has the lowest productivity in the country[57].

[57] Eslake, 2015

7 COST BENEFIT ANALYSIS

7.1 Cost Benefit Analysis Result

A conventional economic CBA methodology has been applied to the costs and benefits as outlined in the previous sections that can be monetised. The nature of the benefits of an investment in higher education are difficult monetise and hence, this CBA should be considered in conjunction with the broader social, environment and economic impacts of the precinct. Due to the variability of some costs and benefits, detailed scenario analysis modelling has been undertaken, with due regard to the risks (both upside and downside) of forecasts.

A pivotal element of the modelling is the assumption around inducement of additional students into higher education in Australia, as opposed to simply transposing the benefit that would have otherwise been experienced elsewhere. This has been discussed and tested in the scenario modelling, however from experiences evidenced in the demand section of student growth, together with international attractiveness of the world class facility of IMAS and the low participation rate in Tasmania, an assumption of an incremental increase of 90% for Tasmanian students, 50% for interstate students and 34% for International students of those who would have not otherwise attended university has been used for the model. These numbers are generated through the Demand analysis detailed in Section 4 above. Wider economic benefits have not been monetised, and therefore have not been included in this modelling.

Key Assumptions

- **Evaluation Period –** 30 Years. All benefits accrued in this period are measured for their useful life.
- **Base Year** – 2017. All costs and benefits are measured in real 2017 dollars.
- **Construction Period –** 4 years, 2017-2020.
- **First Year of Operations –** 2021
- **Inducement of Additional Students –** Tasmanian Students 90%, Interstate Students 50%, International Students 34%
- **Residual Building Value –** depreciated useful life

Key Findings

Table 7.1 outlines the benefits and costs by type for the real discount rates of 4%, 5%, 6%, 7% and 10%. Figure 7.1 and 7.2 clearly demonstrates the major drivers of benefits as the student outcomes and the research output of the additional induced students, who would have otherwise not attended university.

7.1.1 Net Present Value

The present value of costs and benefits are summarised in the table below, as is the relevant BCR. These benefits and costs are future scrutinised in the scenario analysis section (Section 7.2).

The two discount rates highlighted below:

4% - Closest to current indicative TASCORP long term indicative lending rate available to the university.[58]

7% - Infrastructure Australia's base case

TABLE 7.1: COST BENEFIT ANALYSIS RESULTS BY BENEFIT TYPE (INCREMENTAL TO BASE CASE, DISCOUNTED, $2017, MILLIONS)

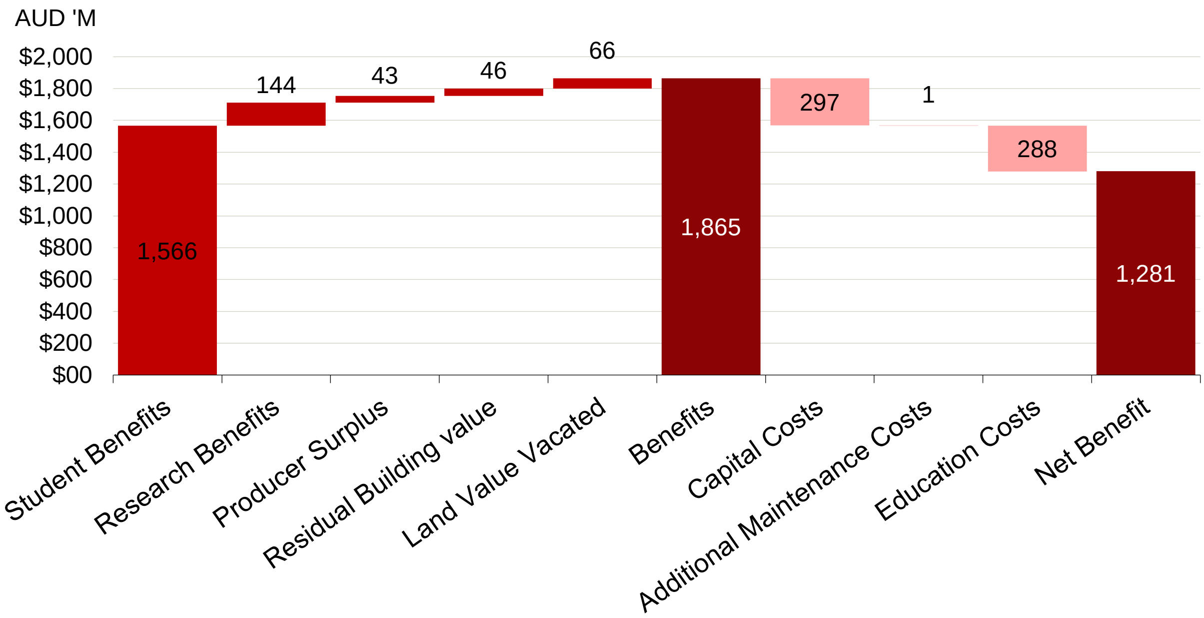
NPV $M (2017)	TASCORP 4%	Discount Rate 5%	Discount Rate 6%	IA BASE 7%	10%
Costs					
Capital Costs	297	287	278	269	244
Additional Operating Costs	180	152	129	110	69
Additional Maintenance Costs	1	1	1	1	
Earnings Foregone Whilst Studying	104	88	74	63	40
Student Education Costs	63	51	42	35	20
Australian Gov Contribution	121	102	86	73	46
Total Costs	**767**	**681**	**610**	**550**	**420**
Benefits					
Student Benefits	1,556	1,122	817	605	268
Research Benefits	144	121	101	86	54
Car Parking Benefit	2	2	1	1	1
Residual Building value	46	34	26	19	8
Land Value Vacated	66	63	60	57	50
Total Additional Student Revenue	223	186	159	135	85
Total Benefits	**2,047**	**1,529**	**1,165**	**905**	**467**
NPV	1,281	848	556	355	46
BCR	**2.67**	2.25	1.91	**1.65**	1.11

Based on the $400M capital plan as outlined through the implementation section Benefit Cost Ratio (BCR) modelling demonstrates a positive return on investment for the project overall.

[58] As Of Oct 2016, TASCORP indicative 30 year lending rate was a 4.4-4.6%. When considered with RBA target range for inflation of 2-3%, equates to a real range of 1.4-2.6%

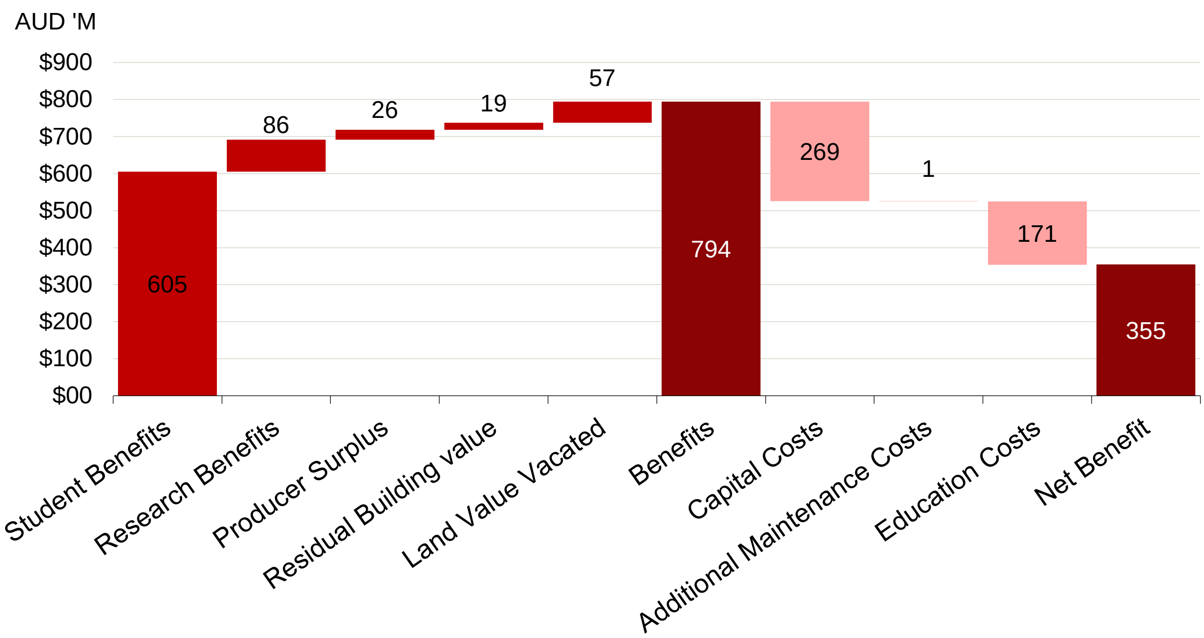
7.1.2 NPV by benefit and cost type – 4% discount rate

FIGURE 7.1: PRESENT VALUES BY BENEFIT AND COST TYPE (DISCOUNTED 4%, INCREMENTAL TO BASE CASE, $2017, MILLIONS)



7.1.3 NPV by benefit and cost type – 7% discount rate

FIGURE 7.2: PRESENT VALUES BY BENEFIT AND COST TYPE (DISCOUNTED 7%, INCREMENTAL TO BASE CASE, $2017, MILLIONS)



7.2 Cost Benefit Sensitivities

Forecast modelling over an extended period brings with it inherent risk of uncertainty across the measurement period, and as such input assumptions should be tested to provide an outcome range. It is pertinent to also acknowledge that non-quantified benefits are likely to vary over the life of the project, and consideration of the cost benefit analysis should be considered in conjunction with further economic analysis and social and environmental benefits. Key quantified parameters tested are listed below with rationale.

7.2.1 Student Inducement (% Newly Generated Demand)

Variation of the percentage of total students attending the precinct that would have not otherwise attended university in Australia, has been modelled by fluctuating the % of students within a range of +/- 20%. As majority of Tasmanian students are already included as newly generated demand, this sensitivity analysis produced a maximum of 100% inducement in the 20% increase scenario.

TABLE 7.2: STUDENT INDUCEMENT SCENARIOS TESTED

Scenario	BCR
20% Reduction in Demand being Newly Generated	1.50
10% Reduction in Demand being Newly Generated	1.57
Base case	1.65
10% Increase in Demand being Newly Generated	1.71
20% Increase in Demand being Newly Generated	1.72

7.2.2 Total Increase in Number of Students

Varying the total head count of students attracted to the Hobart Science and Technology Precinct. Has a similar impact to the percentage newly generated demand, however does not have the same capping effect on additional Tasmanian students in the upside variation.

TABLE 7.3: STUDENT INCREASE SCENARIOS TESTED

Scenario	BCR
20% Reduction in student numbers	1.50
10% Reduction in student numbers	1.57
Base case	1.65
10% Increase in student numbers	1.71
20% Increase in student numbers	1.77

7.2.3 Research Value

The valuation of research is inherently hard to value due to the unknown nature of results, and as such is currently valued at cost, that is the income generated, fully expended on research activities. Income has been increased proportionally with increase in academic FTE, allowing for no law of diminishing return which arise given future funding sources are variable, but on the contrary, no impact of reaching a critical mass of attracting a dedicated research facility.

There are multiple examples from around the world where co-location of researchers and industry in a precinct has delivered substantial increases in research output.

TABLE 7.4: INDUSTRY UNIVERSITY RESEARCH COLLABORATION EXAMPLES

Institution	Precinct
University of Sheffield (UK) and Boeing	Advanced Manufacturing Research Centre
Denmark Technical University	Copenhagen Bio Science Park
University of Warwick	Warwick Manufacturing Group
University of Swansea and Rolls Royce	Materials Research Centre

Whilst targeted industry research, and high quality track records of results should be treated as a predictor of future value, the possibility of large breakthroughs in innovation suggest a broad range of values should be tested for this parameter and a range of -50% to +100% has been modelled.

TABLE 7.5: RESEARCH VALUE SCENARIOS TESTED

Scenario	BCR
50% Reduction Research Income	1.57
Base case	1.65
50% Increase Research Income	1.72
100% Increase Research Income	1.80

7.2.4 Teaching Costs

The current teaching costs of a university precinct are well understood, and modelling incorporates a consistent % of teaching revenue as a base line. This incorporates a high level of conservatism as no economy of scale has been factored in, despite increasing student teaching load to approximately 50%. Given this conservatism, operating costs have been tested in a range of +/- 20%

TABLE 7.6: TEACHING COSTS SCENARIOS TESTED

Scenario	BCR
20% Reduction in Teaching Costs	1.70
10% Reduction in Teaching Costs	1.67
Base case	1.65
10% Increase in Teaching Costs	1.62
20% Increase in Teaching Costs	1.60

7.2.5 Wage Rates – Educational Benefit, and foregone wages.

OECD benchmarks have been used for the increase in value of future earnings, and conservatism have been included in the modelling. By calculating all students have been modelled to graduate bachelor degree level, not accounting for a percentage who will go on to post graduate study, which has been shown to additionally increase wage levels[59].. As a result of the extremely highly studied and understood area of economic analysis and high level of conservatism factored in, wages rates have been tested in a range of +/- 10%.

TABLE 7.7: WAGE RATE SCENARIOS TESTED

Scenario	BCR
10% Reduction in wage rates	1.55
Base case	1.65
10% Increase in wage rates	1.74

7.2.6 Construction Costs

Both a contingency for additional scope and cost escalation provision have been included in the construction cost estimate, however, as the major component on the economic costs of the project, it has been tested to +/-20%

TABLE 7.8: CONSTRUCTION COSTS SCENARIOS TESTED

Scenario	BCR
20% Reduction in Construction Costs	1.86
10% Reduction in Construction Costs	1.75
Base case	1.65
10% Increase in Construction Costs	1.55
20% Increase in Construction Costs	1.47

7.2.7 Vacated Land

Being a unique parcel of land, with minimal direct comparisons available for valuation purposes, the value of the vacated land has been tested at +/-25%

TABLE 7.9: CONSTRUCTION COSTS SCENARIOS TESTED

Scenario	BCR
25% Reduction in vacated land value	1.62
Base case	1.65
25% Increase in vacated land value	1.67

7.2.8 Package

The uncertainty highlighted the in aforementioned key variables leaves a significant possibility that more that one of the variables will be diverge away from base case forecasts simultaneously. To account for this, a package of the lower and upper range variables listed here (discount rate 7%) has been simultaneously inputted in the model to determine the impact of multiple effects.

[59] OECD. (2016). Education at a Glance. OECD.

Figure 7.3 summarises the above analysis at 7% discount rate against base case, and highlights the relatively stable returns from scenario analysis. The inclusion of both downside on students and percentage newly generated effectively drops the student load to less that 65% of the base case, along with downside of all other risks, this still shows a BCR of 1.00.

TABLE 7.10: PACKAGE OF MULTIPLE SCENARIOS TESTED

Scenario	BCR
Package of all downside scenarios	1.01
Base case	1.65
Package of all upside scenarios	2.47

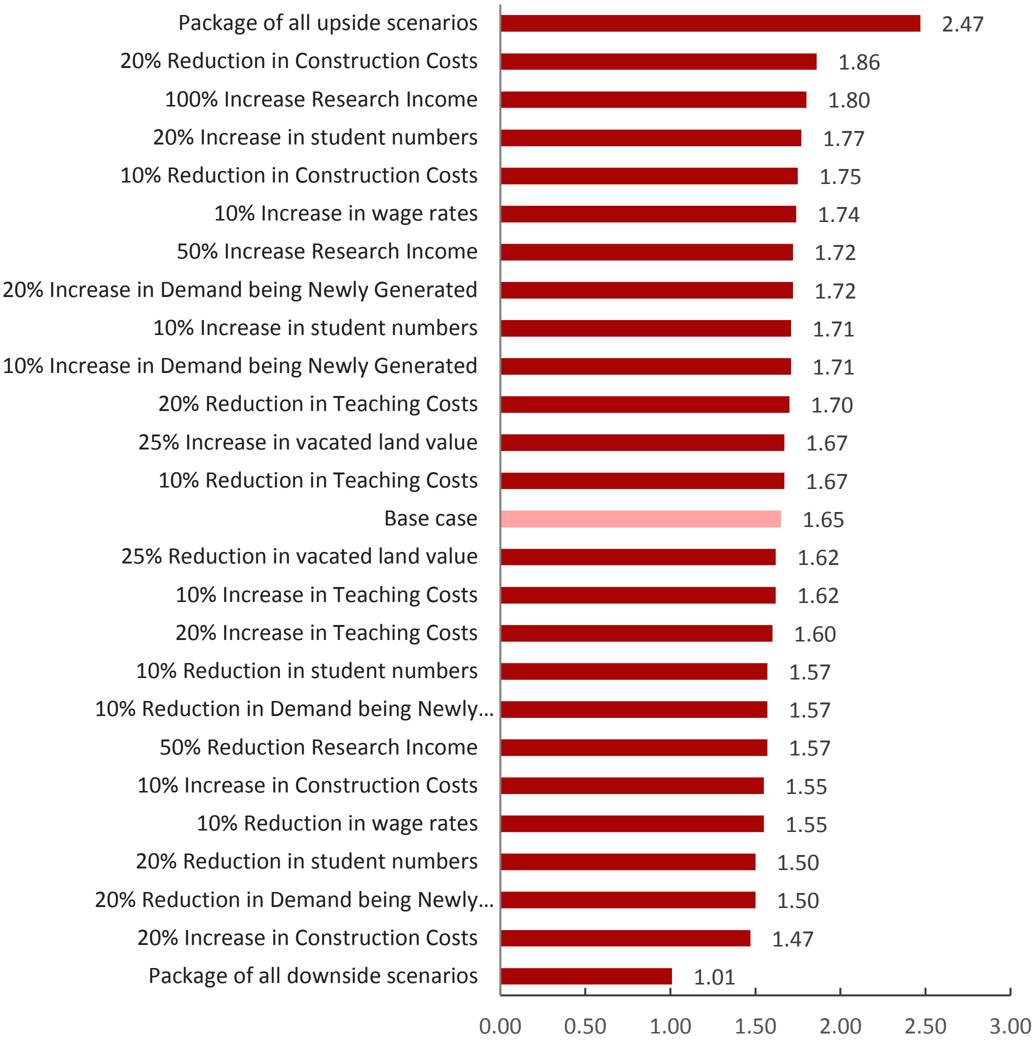
7.2.9 Discount Rate

Base case of modelling has valued future benefits and costs at a 7% discount rate as per Infrastructure Australia guidelines. Additional rates tested are standard 4% and 10%, along with the long term TASCPRP indicative lending rate (10 year) 3.39%.

TABLE 7.11: DISCOUNT RATE SCENARIOS TESTED

Scenario	BCR
Discount Rate 3.39% TASCORP	2.97
Discount Rate 4%	2.67
Discount Rate 7% - Base	1.65
Discount Rate 10%	1.11

FIGURE 7.3: SENSITIVITY ANALYSIS AT 7% DISCOUNT RATE AGAINST BASE CASE



8 ECONOMIC IMPACT ANALYSIS

In addition to a conventional cost benefit analysis, an economic impact analysis was carried out. This demonstrates that the Hobart Science and Technology Precinct will achieve a high level return on investment for Government and for the University, as well as ongoing, strategic economic, environmental and social benefits for the broader Tasmanian community. It should be noted that this modelling excludes the value of any new industries created as explored in Part 1.

TABLE 8.1: IMPACT SUMMARY

Project Impact Summary	
Tasmanian Construction Jobs	775
Ongoing Tasmanian Jobs (Year 10)	190
National Economic Output	$3,322 m
Increase to GDP	$2,336 m

8.1 *The Precinct will generate $3.3b for the Australian economy, including $2.7b in Tasmania.*

Modelling at 4% (closest to TASCORP long-term borrowing rate) indicates a total economic output of $3.3 billion for Australia, including $2.7 billion for Tasmania, based on increasing student numbers, a boost to research income and construction of the precinct (see Appendix D for methodology). This calculation does not include the predicted benefits from increases in productivity and innovation.

TABLE 8.2: ECONOMIC OUTPUT SUMMARY

Source of Benefit	Increase in Tasmanian Expenditure		Total Economic Output Tasmania		Total Economic Output Australia	
Discount Rate	4%	7%	4%	7%	4%	7%
Increase in consumption by students and visitors	$131 m	$80 m	$270 m	$164 m	$151 m	$92 m
Increase in student fees	$318 m	$192 m	$744 m	$450 m	$839 m	$508 m
Increase in research income	$210 m	$126 m	$487 m	$293 m	$561 m	$337 m
Construction of Precinct	$351 m	$320 m	$1,198 m	$1,091 m	$1,771 m	$1,612 m
Total Benefit	$1,010 m	$718 m	$2,699 m	$1,998 m	$3,322 m	$2,549 m

8.2 The precinct will generate not only economic output, but increase real Gross State and Domestic Product.

This increase in GSP and GDP is driven not only by the construction and operation of the precinct, by but the educational and research outputs, and the impact they will have as a net increase to the economy.

TABLE 8.3: GROSS PRODUCT SUMMARY

Source of Benefit	Increase in Tasmanian Expenditure		Increase in Gross State Product Tasmania		Increase in Gross Domestic Product Australia	
Discount Rate	4%	7%	4%	7%	4%	7%
Increase in consumption by students and visitors	$131 m	$80 m	$129 m	$78 m	$65 m	$39 m
Increase in student fees	$318 m	$192 m	$490 m	$682 m	$597 m	$339 m
Increase in research income	$210 m	$126 m	$516 m	$293 m	$1,125 m	$615 m
Construction of Precinct	$351 m	$320 m	$367 m	$334 m	$549 m	$499 m
Total Benefit	$1,010 m	$718 m	$1,502 m	$1,387 m	$2,336 m	$1,492 m

8.3 Further economic benefits include:

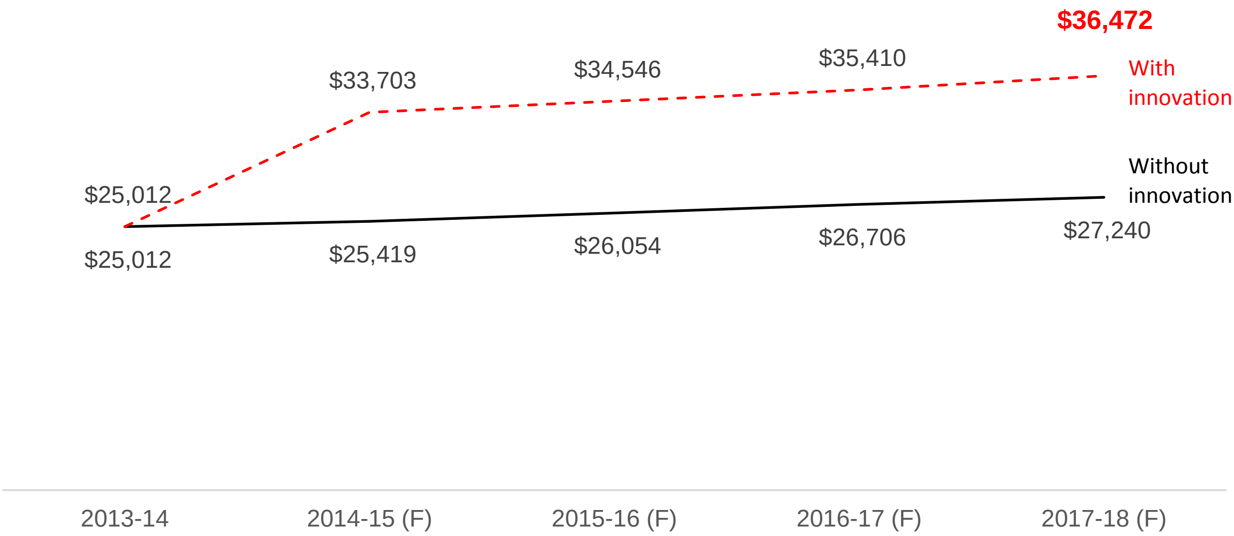
- 775 jobs during construction, reducing Tasmania's unemployment rate by 0.3%.
- 1,500 new students to the University, including 500 international students and 150 interstate students generating $160M in economic output and adding an additional $78m to the GSP.
- 100 new ongoing academic and support jobs.
- Additional research funding per new academic position of $245,000 per annum.
- An additional $436m to GSP through an increase in STEM skills and educational attainment in the Tasmanian workforce.
- Greater research output to help future-proof existing and emerging Tasmanian industries.
- Increased collaboration with industry will help drive productivity and performance.
- New industries emerge at the interface of STEM with other disciplines, such as biotechnology, medical devices, ambient and ubiquitous technologies, additive manufacturing, logistics and biosecurity.
- Creating commercial opportunities for local businesses, such as those in retail, accommodation and hospitality, building on benefits already realised from major university developments in the CBD in the past five years.
- Boost to tourism through increased international student numbers – for every 10 international students at the University, five friends or family visit Tasmania, spending around $2,000 each.[60]

[60] University of Tasmania, 2015

8.4 The Economic Benefits of Investing in Innovation

We have used research from the International Monetary Fund (IMF) to assess the impact innovation has on economic growth[61]. The research demonstrates that every extra 1% a region invests in R&D will result in a 0.05% increase of GDP. Since GDPs are vastly bigger than R&D spending, this will always mean a significant multiplier of two or three times. For Tasmania, a 2% increase in R&D will significantly increase Tasmanian GSP over a four year period (Figure 8.1).

FIGURE 8.1: INCREASED TASMANIAN GSP AS A RESULT OF A 2% INCREASE IN R&D NATIONALLY (IN $M) *



*Figures are based on assumption that every 1% increase R&D results in an additional 0.05% increase in GDP
Source: R&D, Innovation, and Economic Growth: An empirical analysis by IMF

[61] International Monetary Fund, 2014

9 SOCIAL AND ENVIRONMENTAL IMPACT

9.1 Social Impact

The social impacts of the new Precinct are significant through both civic and urban rejuvenation, increased participation in higher education, population growth and greater cultural diversity. The colocation of the Science and Technology Precinct alongside the Peter Underwood Centre for Educational Attainment and the associated Children's University Tasmania will create a lively throughput of children and ignite their interest in STEM and appreciation of its possibilities. This is an investment in the future social capital of Tasmania.

It will attract more people to the Hobart CBD for both the short and long-term, encourage and assist low-SES students to undertake STEM courses at the University, enable city life to flourish around the Precinct, and contribute to strengthening Hobart's international reputation as a university city. The social impacts are interrelated and together will revitalise the Hobart CBD, and this will create broader benefits for Tasmania.

City life will flourish around iconic university buildings, which are porous and permeable spaces that seamlessly integrate community, business and education. The University envisages city life going on in and around university buildings, supporting students to better balance study, work and social lives. Hobart is already experiencing the benefits of the University's inner-city developments, which have drawn thousands more people to the CBD and created new community spaces. Previously stagnant parts of the CBD are becoming vibrant hubs for students. The new student accommodation on Melville St, due to open in 2017, is already creating a dynamic “mid-town” district in what was a traditionally quiet part of the CBD. With more than 4,700 staff and students working and studying a Science and Technology Precinct, this development would be the largest university precinct in the city.

FIGURE 9.1: UNIVERSITY FOOTPRINT IN HOBART CBD

Improved visibility and access will increase participation, particularly for those from non-traditional backgrounds. The new Precinct will facilitate access to public transport, significantly improving commutes from lower socio-economic suburbs, many of which require at least two bus connections to reach the current campus at Sandy Bay. The highly visible buildings would celebrate the STEM disciplines, promoting them as an attractive career pathway, and promoting university as a realistic life choice for the tens of thousands of Tasmanians for whom it has never been on the radar.

Increasing diversity in Hobart's population. Universities contribute in major ways to their urban context and more than ever before, are linked to the vitality of their surrounding neighbourhoods and communities. The Precinct will attract new residents and visitors to the Hobart CBD, and encourage locals who would have otherwise left Hobart to remain. The Precinct is expected to enrol up to 1,500 additional students once fully operational, including 500 international students from a range of cultural backgrounds. The OECD (2007) concluded that higher education can be a major player in internationalising regions and make them more diverse and multicultural. A proportion of academics and their families attracted to Hobart by the quality of facilities and the opportunity to work with high quality staff and students are likely to stay. More broadly, new opportunities for work and study further enhance Hobart's attractiveness as a liveable city and will help offset Tasmania's rapidly ageing population.

9.2 Environmental impact

The University has a clear commitment to reducing the impact of its operations on the local environment and beyond. This is reflected in requirement for Green Star certifications for new builds and application of Green Star principles in all other building works including application of innovative approaches to building and promotion of sustainable transport and waste minimisation strategies. The development of the Hobart Science and Technology Precinct is consistent with this commitment and will enable the University to further reduce its environmental footprint in Hobart.

9.2.1 Innovative design will enable more sustainable use of natural resources

The new Hobart Science and Technology Precinct will be built to a 6 Star Green Star rating. This is the highest possible rating for buildings in Australia and reflects world leadership in sustainable building design. Analysis conducted by the Green Building Council of Australia[62] found that on average these buildings:

- Use 66% less electricity than average Australian buildings and 50% less than if built to meet minimum industry requirements.
- Produce 62% fewer greenhouse emissions than average Australian buildings and 45% fewer than if built to meet minimum industry requirements.
- Use 51% less potable water than average buildings.
- Recycle 96% of their waste, compared with 58% for the average new construction project.

These savings have been proven at recent University of Tasmania building projects built with Green Star ratings including the 120 bed student apartment buildings in Launceston as shown by actual meter readings or measurements:

- Approximately 50% of the energy use (kWh per bed) as some of the University's older accommodation (vintage 1970s) and even using 22% less energy than other University apartments completed in early 2015 that were designed to only focus on a high thermal efficiency rating.
- The project's Life Cycle Analysis (LCA) demonstrated the following reductions in environmental impacts when compared to a conventional reference building:
  - 60% reduction in global warming potential;
  - 38% reduction in acidification potential;
  - 27% reduction in eutrophication;
  - 42% reduction in tropospheric ozone formation potential; and
  - 61% abiotic resource depletion.

With Green Star certification commitments, it is reasonable to project that the proposed Hobart Science and Technology project would deliver similar relative savings considering the very poorly performing buildings the project would replace. In addition, innovative approaches to building materials and design would be pursued, including: green roofs/walls, integrated photovoltaic systems and other renewable energy systems, locally-sourced products wherever possible including use of recycled or sustainably sourced timber and smart building components to collect data that is accessible to students and academics for use in teaching and learning and research.

[62] Green Building Council of Australia,, 2013

9.2.2 The precinct will drive changes in staff and student transport behaviour

The new precinct will also significantly contribute to delivery of the University's sustainable transport strategy and the transport elements of Green Star ratings. Transport contributes a large portion of Tasmania's environmental impact, including carbon emissions, localised pollution and congestion, but transport choices can also have positive economic and social impacts. For these reasons, the University through its Sustainable Transport Strategy seeks to minimise environmental impacts while contributing to positive outcomes by encouraging uptake of active, public and more efficient transport modes.

The University's successful implementation of the transport strategy and leadership in sustainable practice has been recognised through a number of awards, including a 2013 Australian Bicycling Achievement Award, 2014 Green Gown Award Australasia and a 2015 Planning Institute Award.

The relocation of courses and research activity from the Sandy Bay campus to CBD locations is a core enabler to further improvement. Firstly, it enables staff and students to benefit from local and state government initiatives and investment to improve sustainable access to the Hobart CBD. Secondly, it will deliver immediate benefits on its own. Evaluation of University Travel Behaviour Surveys (2013 and 2015) indicated significant changes in student and staff travel mode choices from the shift of Marine and Antarctic Precinct and the Medical and Health Science Precinct from the Sandy Bay campus to the Hobart CBD. The identified changes to travel behaviour for staff and for students are outlined below.

TABLE 9.1: CHANGE IN TRAVEL BEHAVIOUR FOLLOWING MOVES TO CBD

	Change in behaviour
Staff	∘ A decrease in the percentage of staff travelling via single occupant vehicle (SOV) from 50% to 32% ∘ An increase in bus use from 2% to 12% ∘ An increase in walking/cycling from 23% to 32%
Students	∘ A decrease in the percentage of students travelling via single occupant vehicle (SOV) from 28% to 10% ∘ An increase in bus use from 18% to 22% ∘ An increase in walking/cycling 31% to 41% ∘ Parked bike counts from 2011-2015 show that since Marine & Antarctic Precinct and Medical & Health Sciences were completed there has been a 300% increase overall for the south in bike use

Shifts to more sustainable transport modes have resulted from a number of targeted approaches to deliver more equitable and sustainable outcomes with a special focus on the university student and staff cohorts, but have also influenced travel options and choices of the surrounding community. These approaches include positive provisioning of carpool parking, public transport services and infrastructure, motorcycle/scooter parking as well as for active transport modes such as bicycling end-of-trip facilities including showers, lockers, repair and water stations. These approaches will also be applied for the proposed precinct. Further, the new precinct will include:

- Facilities centrally located with transport hubs that encourage the use of public transport (e.g., on public transport high-frequency routes, local council free bus services in the CBD);
- Real-time public transport information at bus stops (especially at stops near our facilities)
- Provision of car sharing vehicles (e.g., GoGet, GreenShareCar, Flexicar); and,
- Availability of electric vehicle charging for bicycles, motorcycles/scooters, and cars (preferably with on-site renewable energy installations).

The result will be a significant reduction in the transport footprint of staff and students as well as visitors to the facility.

The University of Tasmania's commitment to Green Star buildings and developments has also delivered a broader community benefit given that building contractors and tradespeople have been required to familiarise themselves and up skill to these higher order approaches, which is then taken to other projects in Tasmania. Thus, the University's efforts serve as a model for future sustainable urban renewal in Tasmania.

PART 3: DELIVERABILITY

10 FUNDING STRATEGY

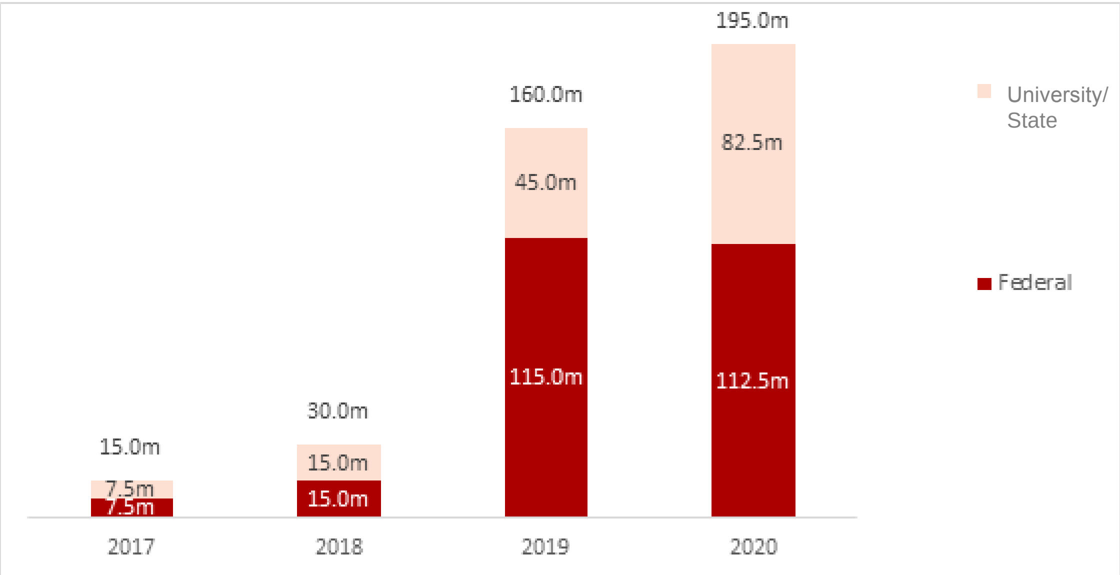
10.1 The project requires $400m in Commonwealth, State and University partnership investment to proceed

The University has engaged quantity surveyors to develop detailed costing of the proposed CBD precinct. This together with a provision for the relocation of specialist equipment from existing Sandy Bay facilities, have formed the basis of the $400m project costing (see Appendix C). The University owns the site on which the facility would be built.

10.2 The University seeks to partner with Government to fund the project

The University is seeking a Commonwealth investment of $250m in Federal Government funding, with further funding to be met by contributions from the University and State Government. The University is working closely with the State Government to identify the nature of its support. An indicative timing for funding is outlined below, aligned to current construction estimates.

FIGURE 10.1: SUMMARY OF PROPOSED FUNDING STRATEGY



10.3 University funding strategy and other contributions

The University is currently implementing a strategic asset management framework to ensure the sustainability of investments in infrastructure, and efficiency in utilisation of investment funds. Multiple options have been explored to fund the University's contribution, and sources will likely include borrowings and realisation of existing assets.

Internal funding opportunities have been explored by the University, however it faces constraints and minimal options are available to raise large amounts for capital infrastructure of this nature.

The University's current funding arrangements are set according to national policy which ties the increased revenue generation from domestic students directly to the attraction of additional students. This results in long lag periods and would require significant growth to result in revenues of the magnitude required to fully fund such a project.

The flexibility of pricing options for International students provides a further funding opportunity. Whilst this growth in fees provides economic benefit and stimulus to the region as a result of this project, it also faces the same challenges in scale and timeliness to contribute meaningfully to a capital investment of this magnitude.

The State Government has committed to strongly supporting this initiative in principal, and are working closely with the University through the practicalities of this support. However the scale of the Precinct and magnitude of investment involved is significant on a state level, and will require funding from a combination of sources.

10.4 Alignment with Government and University strategy is clear

The Hobart Science and Technology Precinct proposal was endorsed by Infrastructure Australia as a priority initiative under the National Priority Infrastructure List in early 2016 and was listed as a priority project for Tasmania by Regional Development Australia. The Precinct aligns with policy objectives at federal, state and local levels. This includes the Prime Minister's Smart Cities Plan, the National Science and Innovation Agenda, Infrastructure Australia, the Tasmanian Population Growth Strategy, Tasmanian Priorities for Training and Workforce Development 2016, Infrastructure Tasmania and Hobart 2025 Strategic Outcomes. Table below provides a high level summary of the relevant Government policies which the Precinct satisfies in terms of the benefits in meeting policy objectives.

TABLE 10.1: SUMMARY OF RELEVANT GOVERNMENT POLICIES THAT THE PRECINCT SATISFIES

Level	Policy	Assessment
Federal	Smart City plan	✓
	National Innovation & Science Agenda	✓
	Infrastructure Australia	✓
State	Population Growth Strategy	✓
	Ministerial Priorities for Training and Workforce Development 2016	✓
	Infrastructure Tasmania	✓
Local	Hobart 2025 Strategic Outcomes	✓

This strong alignment facilitates potential investment from within these federal policies, along with other potential sources of Commonwealth funding such as the National Collaborative Research Infrastructure Scheme (NCRIS).

The Precinct also contributes to the following strategic outcomes which the University is working towards, namely:

- **Strategically increasing its footprint in the Hobart CBD**. As outlined in the University's 2007 Masterplan, the University will gradually consolidate its Hobart City properties into a Hobart City campus so that the campus will be of State significance.
- **Support incubator and start-up businesses in the Hobart CBD.** The University intends for the Science and Technology Precinct to support incubator and start-up businesses through direct collaboration. The University has recently partnered with the State Government and the local start-up business community for the opening of the Enterprize Tasmania Innovation Hub in the Hobart CBD to foster and support for graduate start-ups. The new CBD facility for STEM disciplines will enable the running of an innovation incubator to encourage and support staff, students and alumni to commercialise their ideas and allow the Precinct more generally to be an integral part of a wider enterprise community.
- **Alignment of University activity with socio-economic outcomes through city-based renewal projects**. As the only higher education institution on the island, the University believes that lifting educational attainment is key to a more skilled, productive and prosperous Tasmanian community. The University is committed to ensuring that as many Tasmanians as possible are able to acquire the knowledge and qualification they need for the jobs of today and the future. This means attracting more students into higher education and providing high quality, relevant and affordable University courses in modern, fit-for-purpose facilities that are accessible and connected to work and social activities.
- **Leveraging long-term private sector investment**. The collaboration between STEM research and business will lead to greater private sector investment in Tasmania.
- **Striving to enhance efficiency and sustainability.** The University is committed to initiatives that will enhance the efficiency of our operations and generate a sustainable base for the future.

11 IMPLEMENTATION STRATEGY

11.1 Implementation is planned to occur over four years

The implementation approach has been designed to address the key activities required to develop and transition to the Hobart Science and Technology Precinct and to achieve the qualitative and financial impacts and benefits outlined above. Three phases make up the core of the recommended implementation approach:

1. **Phase 1: Plan -** conducting the remaining feasibility studies, securing funding, engaging consultants and contractors, developing the design and achieving council approval.
2. **Phase 2: Build –** undertake actual construction, with several milestones in place through the 3-year period.
3. **Phase 3: Transition –** incorporating all activities required to get the new Hobart Science and Technology Precinct facility up and running, from fit-out to student recruitment.

TABLE 11.1: IMPLEMENTATION STRATEGY

Phase 1 - Planning	
1. Secure sites	
1.1 Amalgamate property titles	The main STEM site in Hobart city owned by University exists on two property titles – requires amalgamation to single title and lodgment with Tasmanian Titles Office
1.2 Transfer title of subsidiary site	Negotiate with City of Hobart transfer of subsidiary site on Domain. Required for some biological and agricultural research and teaching
1.3 Establish biological and agricultural precinct on Domain	Develop partnership with State, State Herbarium and Royal Tasmanian Botanical Garden to create Tasmanian Land and Environment Teaching & Research Precinct
2. Secure Funding	
2.1 Commonwealth funding	Identify source of Commonwealth funding and secure through appropriate application process
2.2 State funding	Negotiate agreement with State on funding and/or in-kind support
2.3 University of Tasmania funding	Identify and activate University resources – funding, property and personnel
3. Stakeholder Engagement	
3.1 Develop communications plan	Develop and implement stakeholder management/communications plan for internal and external stakeholders
4. Finalise feasibility studies	
4.1 Research and teaching requirements	Structured consultations with University staff and students to determine needs and requirements for teaching & research space and facilities
4.2 Student experience	Determine student needs for learning spaces, library, social and catering spaces

4.3 Infrastructure testing	Complete architectural, engineering and heritage testing and modelling at both sites
4.4 Benchmarking	Undertake benchmarking investigations of existing Australian exemplars
4.5 Cost estimates	Confirm cost estimates through Quantity Surveyor analysis and establish envelope for budget
4.6 Urban design principles	Investigate and develop urban design principles for both sites to set parameters for development
5. Governance	
5.1 Decision making	Establish and determine responsibilities of Project Steering Committee and clarify reporting and decision making through University Council and its Committees
5.2 Project management	Recruit or deploy University Project Manager and support staff
5.3 Reporting to Commonwealth	Finalise agreement for funding arrangements and milestone reporting with Commonwealth
6. Design	
6.1 Shortlist Principal Consultant	Undertake Expression of Interest process to shortlist likely Principal Consultants (architects)
6.2 Select Principal Consultant	Finalise selection process, engage and finalise contract with Principal Consultant
6.3 Establish University development committees	Establish University Project User Group (PUG). PUG works with Principal Consultant in development of designs continuing through construction phase.
6.4 Technical input to design	Establish University Technical Working Groups (TWGs) to input to PUG on specific technical issues eg specialist laboratory set-up
6.5 Design development	Develop preliminary building designs for both sites
7. Site Investigation	
7.1 Technical investigations of site	Engage consultants to undertake statutory technical investigations of site: archaeological; geotechnical and contamination studies
7.2 Technical reports	Review technical reports – reports a requirement for lodging a Development Application
8. Planning Permit	
8.1 Prepare Development Application (DA)	Principal Consultant to prepare required documentation Development Application for submission to City of Hobart (CoH) Planning Department for both sites. Required to achieve Planning Permit for site.
8.2 DA determination and issue	DA assessment by CoH. Assumes any planning objections can be addressed during assessment and does not proceed to Tasmanian Resource Management and Planning Tribunal (RMPT). Responsible for making determinations on planning issue disputes.
9. Procurement Model and Engagement	
9.1 Confirm procurement model	Assess possible models of procurement. Managing Contractor (MC) model likely outcome, allowing

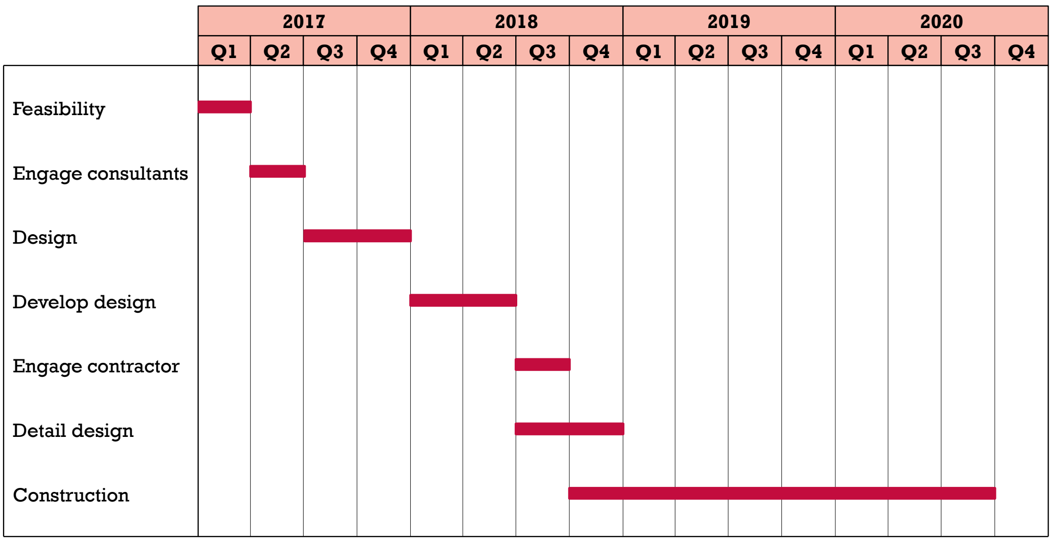
	increased flexibility in delivery of such a large complex project. Gain internal approval for procurement model.
9.2 Shortlist potential contractors	Issue and assess Expressions of Interest for construction contractor
9.3 University approvals	Project Steering Committee consideration and approval of shortlisted contractors
9.4 RFT Development	Develop Request for Tender (RFT) for construction contractor including legal advice on process and contract issues. Assumes and includes successful DA.
9.5 Issue and assess RFT	Issue RFT to shortlisted tenderers. Assess and evaluate responses. Recommend preferred tenderer and seek Project Steering Committee approval
9.6 Engage Managing Contractor	Negotiate and finalise contract and induct contractor
Phase 2 - Construction	
1. Construction Stage 1 – early works	
1.1 Early works	Establish site – safety fencing, entrances, site offices, amenities etc. Undertake demolition of existing buildings.
1.2 Site remediation	Undertake any remediation as required under conditions of Planning Permit
1.3 Complete site preparation	Complete: archaeological excavations, site remediation and service diversions.
1.5 Submit Guaranteed Maximum Price (GMP)	Finalise design development and review. MC to submit bid for GMP on basis of design parameters.
1.6 Assessment of GMP	University to assess and seek approval for GMP submission
2. Construction Stage 2 – construction of major facilities	
2.1 MC engagement	MC engaged and contracted to commence main construction of facilities.
2.2 Prepare Building Application	Principal Consultant to develop and submit documentation for Building Applications (BA) to CoH.
2.3 Building Permit issued	CoH assessment of BA and Building Permits issued
2.4 Construction documentation	Prepare construction documentation
2.5 Construction - Domain site	Construction of facilities at Domain site, any necessary landscaping of site, coordination with CoH initiating elements of Domain Masterplan
2.7 Commence construction - city site	Site excavations and construction of car park
2.8 Construction of main facilities	Construction of main facilities on site
Phase 3 – Transition	
3.1 Fit-out Domain	Complete fit-out of Domain site, FFE, IT and AV, installation and testing and calibration of specialised equipment

3.2 Activation of Domain	Transfer of current research projects from Sandy Bay where possible, commencement of new projects, move of staff
3.3 Fit-out city	Complete fit-out of City site, FFE, IT and AV, installation and testing and calibration of specialised equipment
3.3 Activation of City	Transfer of current SET functions from Sandy Bay – includes establishing learning, social and support service hub, move staff and students, commence activities Semester 1 2021
3.4 De-activation of SET Sandy Bay	Staged wind down of SET operations at Sandy Bay commencing with functions moved to Domain and then introduce care and maintenance status for rest of site.
3.5 Other operations SB	Unless parallel project to move other functions retain operations of remaining Faculty of Arts, sporting functions (fields, sports clubs etc)
3.6 Disposal of property	Potential for disposal of remaining excess land/buildings on Sandy Bay Campus
3.7 Student recruitment	Develop marketing plans around new facilities, advertise and take applications
3.8 Staff recruitment	Undertake recruitment as required

This phased approach is in line with the University's approach on previous large infrastructure projects and has been shown to be effective. The sequencing ensures that the necessary building blocks are created, providing a suitable starting point for the next phase. Additionally, the identification of key milestones within the individual phases enables for effective monitoring and communication of project progress to all relevant stakeholders.

Implementation is planned to take place from 2017 to 2020 ready for commencement in Semester 1 2021. A high level implementation timeline is provided below with a more detailed schedule provided in Appendix D.

FIGURE 11.1: HIGH LEVEL IMPLEMENTATION PLAN



11.2 The University is well positioned to meet this schedule

The University is well positioned to successfully execute and manage the project, with a strong track record in delivering large infrastructure projects in Hobart. This means that the University has the necessary capability and experience to deliver on both the construction of the precinct, and management of it once fully operational.

The University has in recent years successfully undertaken a number of large infrastructure projects and delivered them on time and within budget. Selected examples of recent large infrastructure projects, including relevant information on budget and timing have been included below.

FIGURE 11.2: SELECTED CASE STUDIES OF RECENT LARGE INFRASTRUCTURE PROJECTS

		Medical Science 1	*Medical Science 2*	*Institute for Marine & Antarctic Studies*
Budget	Proposed	$58m	$90m	$49m
	Actual	$58m	$90m	$49m
	Assessment	✓	✓	✓
Timing	Proposed	November 2009	March 2013	December 2013
	Actual	November 2009	April 2013	November 2013
	Assessment	✓	✓	✓

The University's substantial capability and experience can be leveraged to successfully deliver on the construction of the Hobart Science and Technology Precinct. In particular, existing project management and implementation expertise, robust internal project management processes and strong relationships with relevant stakeholders can be leveraged to ensure implementation success.

Additionally, the University is well positioned to ensure that intended benefits from the Precinct will materialise once it is fully operational. Having successfully managed other precincts, and given the proven ability to manage all aspects of university operations, the University has the right capabilities and resources across critical operational areas such as demand management, industry and community engagement, asset maintenance, finances etc.

11.3 Governance and project management procedures are in place

Effective governance arrangements are critical to successful delivery. The project will be governed and managed in accordance with established procedures. Key elements of the governance structure are outlined below.

Project Steering Committee:

The primary function of the Steering Committee is to ensure that the approval, development and support of the Hobart Science and Technology Precinct reflect the University's' strategic objectives.

The Steering Committee will be established at the beginning of the project and will have the following principal functions:

- monitor the project to ensure that it meets the University's requirements and expectations;
- facilitate the resolution of Project conflicts;
- approve the final consultancy report;
- review and approve Project Plans and any subsequent variations;
- allocate project funding, when provided; and
- make recommendations to the Built Environment and Infrastructure Committee (BEIC) of University Council.

The Steering Committee will be comprised of members of the University's Senior Management Team, representing both the supplier (CSD) and the end-users (Faculties) and chaired by the nominated Project Executive.

The Steering Committee will meet monthly and/or as required throughout the course of the Project.

Project Reference Group:

Project operations will be guided by a Project Reference Group (PRG), the primary functions of which are to:

- monitor project execution and progress;
- be the principal forum for communication with project consultants;
- address matters arising from the Project User Group/s or escalate to the Steering Committee, as required; and
- provide regular progress reports and advice to the Steering Committee.

The PRG will be comprised of senior staff engaged in the delivery of the Project and senior representatives of the principal project consultants.

The PRG will meet fortnightly and/or or as required throughout the course of the Project.

Project User Group

In order to ensure appropriate end-user consultation and engagement, the project governance structure will include one or more Project User Group/s (PUG/s).

The PUG/s constitute the principal forum for liaison between the project delivery team and end-users and stakeholders. PUG/s perform an advisory role, with each PUG providing regular reports to the PRG.

The PUG/s will be comprised of principal project delivery staff, key end-user representatives and senior staff of operational stakeholder areas, including Information Technology Services, Commercial Services and Development, Student Services, etc.

Project Reporting

For each project governance body, meetings will be minuted and an Action List maintained.

Project management reports from the PRG to the Steering Committee will include:

- an overview of project status and progress against the agreed schedule;
- advice on any project variations, including the rationale for same and any impacts on project budget and/or schedule;
- a report on any significant project issues and related actions undertaken to address same;
- notification of items requiring action by the Steering Committee;
- a report on progress against budget;
- a report on any actual change or potential threat to the project risk profile; and
- other matters as required.

The Steering Committee will report to BEIC, Finance Committee and Council on a regular basis.

Project Management

Operational management of the project will comply with the University's established project management requirements for major building works, which entails comprehensive procedures and documentation for all project stages as follows:

- Project Identification and Assessment
- Project Start-up
- Feasibility Stage
    - project scoping and programming
    - design consultant selection
    - feasibility Study
- Procurement Stage
    - schematic design (sketch planning)
    - detailed design (and tender documentation development)
    - tendering
    - construction
    - practical completion and project hand-over
- Post Construction Stage
    - defects liability
    - post-implementation review

Senior University Governance

Beyond the scope of project-level governance, the University also has established governance arrangements for high-level organisational strategic and operational decisions.

The Vice-Chancellor's Executive (VCE) is the University's collegial forum for senior academic and professional leaders to engage with strategy and discuss emerging issues that underpin the delivery of strategy. Matters requiring approval are directed to the Senior Management Team.

The Senior Management Team (SMT) is the University's management decision-making and performance monitoring body. SMT is responsible for overseeing the development of University plans, budgets, policies in strategic areas, and considering and providing advice on a range of major matters affecting the University's mission. SMT membership comprises senior executives, Deans and heads of institutes. Matters requiring higher-level approval are submitted to University Council through its sub-committees.

University Council is the governing authority for the University, and concentrates on mission, vision, strategy and general oversight of overall University performance, for which it is ultimately accountable. Council is supported by a group of specialist sub-committees, including:

- Built Environment & Infrastructure Committee (BEIC) - University Council delegates responsibility for the oversight of strategy and high-level policy related to the built environment and infrastructure to BEIC.
- Finance Committee - Finance Committee provides strategic advice to Council on the University's financial performance and sustainability and on the financial implications of future plans, including amongst other matters:
    - the University's capital management plans and associated budget
    - business cases for major developments or strategic projects.
- Audit & Risk Committee - amongst other matters, the committee is responsible for overseeing the risk management framework and ensuring that it effectively facilitates the identification, assessment and mitigation of key higher level risks across the University (including all entities and activities).

12 PROJECT RISK MANAGEMENT

The implementation of the Hobart Science and Technology Precinct involves a number of risks which will need to be attentively managed by the University. These are detailed in Table below, with an assessment of the likelihood of the risk materialising, and relevant mitigation strategies. Note that risks have been categorised based on implementation phase.

TABLE 12.1: SUMMARY OF KEY RISKS AND MITIGATION STRATEGIES RISKS RELATING TO PLANNING AND CONSTRUCTION PHASES

Key risk	Likelihood / severity	Mitigation strategies
STEM facility not delivered within agreed budget	**Moderate risk**: • There will be robust project management which leverages established University processes • Costs assessed and provided by QS • Experience and capability to deliver project within budget	• Budget to include adequate allowance for contingency and escalation costs • Selection of suitably qualified and resourced architects and construction company • Ensure timed delivery of agreed milestones
STEM facility not delivered within agreed timeframe	**Moderate risk**: • There will be robust project management which leverages established University processes • Detailed implementation planning has been undertaken • Internal experience and capability to deliver project within timeframe	• Selection of suitably qualified and resourced architects and construction company • Ensure timed delivery of agreed milestones • Creation of a contingency plan for potential delay to the establishment of new facilities
DA not approved by local council or there are appeals	**Moderate risk:** Time delays associated with any significant appeals have not been factored into Gantt chart.	• Develop and implement robust stakeholder management strategy, including community consultation and engagement with Alderman. • Develop design with input from CoH planning team and Heritage Tasmania.

Key risk	Likelihood / severity	Mitigation strategies
Delay in fit-out of STEM facility resulting in the facility being fully operational later than expected	**Moderate risk**: Costs associated with facility equipment fit-out have not been included as part of the investment amount in the business case and will need to be absorbed accordingly	• Detailed implementation planning undertaken includes planning for critical equipment and other fit-out costs to ensure they are accounted for and can be funded • The business case assumes that transition and ramp up will take place across a number of years
Transition costs and efforts are underestimated	**Moderate risk**: Transition costs (and benefits) and time have been estimated based on analysis of historical data and past projects	• Detailed implementation planning undertaken includes planning for transition activities • A project manager will be appointed to oversee transition
Construction causes significant disruption to Hobart CBD and local residents	**Low risk:** Standard construction practices will be followed, and all regulations will be adhered to.	• Communications to emphasise the broader benefits of the precinct to the local community
Insufficient funding resulting in STEM facility not delivering required capabilities	**Low risk**: • Costs assessed and provided by qualified quantity surveyor • Sufficient funding to be secured before project commencement	• Undertake feasibility study to assess total costs and achievability, leveraging extensive project experience • Ensure external funding delivered as per agreed project milestones

TABLE 12.2: RISKS RELATING TO OPERATIONS PHASE

Key risk	Likelihood / severity	Mitigation strategies
Forecast student numbers not met, leading to lower than forecast revenues	**Low risk**: • Continuous increase in University profile will greatly assist in the attraction of additional students • Market research and demand analysis undertaken to ensure forecasts are reasonable	• Marketing to leverage the University's positive trajectory in international rankings across ranking systems • Partnerships with overseas institutions will provide a sustainable flow of international students to Tasmania • Potential to increase international student fees to offset any reductions in international student numbers • The business case includes sensitivity analysis tested sensitivity of the project to number of new students
Difficulty in hiring sufficient staff to ensure smooth operations during initial period	**Low risk**: • Prior projects demonstrate that the creation of precincts will attract high quality staff • Existing staff can be leveraged to identify potential hires	• Detailed implementation planning undertaken includes a capability review to identify recruitment needs • Recruitment to commence ahead of completion of construction
Interdependencies with University and Government strategy, and risk that required initiatives are not implemented (by other parties)	**Low risk**: • The University is able to control its own strategic actions and is likely to continue with its strategy to expand its footprint in the Hobart CBD • Government across levels have clearly articulated intentions and plans, and will likely follow through on agreements made with the University	• Identify major interdependencies and make contingency plans for those that will have significant negative impact on the precinct. For example, a major interdependency is the development of a high tech incubator in the Hobart CBD with the State Government which the University should create a contingency plan for.

Key risk	Likelihood / severity	Mitigation strategies
Students who need to move campuses midway through their courses may find it difficult to adjust to the change	**Low risk:** New facilities will be significantly better, and the Hobart CBD location means that it will be more accessible for the majority of students	• All students to be provided with sufficient information about the precinct, including the many benefits it offers to facilitate change management.

Additionally, major risks with significant financial implications have been factored into the financial model created to support the business case. The method and implications of this are detailed below:

- **Sensitivity analysis was conducted** to assess the sensitivity of the project's NPV to key variables, including the risk of actual student numbers being lower than forecast. Whilst the NPV was found to be most sensitive to student numbers, there is a sufficient buffer in place to ensure the project will create value even if actual student numbers are 10% lower than forecast student numbers.
- **A conservative ramp up period** (which is the period from completion of construction to the achievement of target growth) was assumed to factor in potential delays due to potential problems with fit-out and transition more generally.

13 BENEFITS REALISATION

Benefits realisation will be carefully managed to ensure that anticipated benefits, both direct and indirect materialise. The University has substantial experience in the area of benefits realisation and will leverage existing expertise and processes to ensure prior successes can be replicated.

The University will focus on measuring and monitoring direct benefits in particular, given that these are within its control. Measures will be put in place, specifically those relating to key direct benefits over which they have more control. Figure 22 below is an example of a benefits scorecard containing the relevant metrics that will be measured and monitored.

FIGURE 13.1: EXAMPLE OF BENEFITS SCORECARD THAT WILL BE USED FOR BENEFITS MANAGEMENT AND REALISATION

Goal of investment	Metric	Assessment	Baseline	Target	Current performance
Build Hobart's human capital	• Number of students	○			
	• Number of HDR students	○			
	• Number of academic staff	○			
	• Number of professional staff	○			
Enable Hobart to respond to a changing economy	• Research income	○			
	• Number of publications	○			
Revitalise and increase the attractiveness of Hobart	• Number of graduates who secured employment in the Hobart CBD	○			
Stimulate the local economy	• Number of collaborations with industry	○			
	• Number of start-ups supported	○			

● Above target ● On target ● Below target

For these metrics, information will be collected as part of existing governance processes, and is expected to be accurate and cost-effective similar to existing arrangements. The "current performance" of the existing STEM facility in Sandy Bay will act as a baseline to enable comparisons, and the appropriate year for gathering this baseline information will need to be determined. Based on the data collected and analysed, action is taken to either strengthen the benefits that are created, or to address issues that are negatively impacting on benefits. Active monitoring of benefits as they are realised, and taking follow-up action where required both help to ensure that benefits are realised and maximised.

The following metrics in Table 14 provides an example of the metrics that have been used as part of benefits realisation management for the Marine and Antarctic Science Precinct building.

TABLE 13.1: SELECTED METRICS USED FOR MONITORING AND MANAGING BENEFITS – MARINE AND ANTARCTIC PRECINCT IN HOBART CBD

Metric	Baseline performance (2013)	Current year performance (2016)
Research Grant Income	$19.6M	$24.3M
Student EFTSL	181	280
RHD Heads	103	178
Staff EFT	50	68

APPENDIX A. Statements of Government support

State/territory government impacted:	Tasmanian Government
Outline level of support:	Supported in-principle with a commitment to work in partnership to identify funding and contributions
State/territory government official:	Mr Greg Johannes, Secretary Department of Premier and Cabinet Phone: 03 6270 5487 Email: greg.johannes@dpac.tas.gov.au

State/territory government impacted:	City of Hobart – Local Government
Outline level of support:	Supported with a commitment to work together on the plans for a 'Smart City' plan for Hobart.
State/territory government official:	Alderman Sue Hickey Mayor, City of Hobart Phone: 03 6238 2705 Email: lord.mayor@hobartcity.com.au

APPENDIX B. ECONOMIC MODEL PARAMETER ASSUMPTIONS

Demand

See Section 4 Demand for detailed discussion.

Costs

Construction Costs

QS Estimate – see Appendix C for copy of QS Report.

Teaching Costs

Salary and Other Expenses as a % teaching salary, based on 2015 final result reporting by the SET Faculty

Teaching Salary Costs - % Teaching Revenue	**54.5%**
Teaching Other Costs - % Teaching Revenue	**8.7%**

Overhead Costs

Cost per EFTSL attributed to the SET faculty in 2016 budgeted overhead model in relation to Student Administration, Experience, IT services and Support, Marketing.

Variable Overheads	4,031	$/EFTSL

Utilities Costs

Based on reported 2014 University of Tasmania actual average utilities cost per square metre to the Tertiary Education Facilities Management Association, including cleaning, utilities, energy, security, waste disposal. 2017 amount uplifted on CPI figures to estimate base year ($2017)

	2014	2017 CPI Uplift	
Utilities	56.90	59.79	$/m2

Maintenance

Based on reported 2014 average maintenance cost per square metre to Tertiary Education Facilities Management Association. Also allows provision for rolling lifecycle minor refurbishment works.

Building Costs	2014	2017	
Maintenance & Refurbishment	36.50	38.36	$/m2

Earnings foregone whilst studying

The reduced earnings capacity was calculated by finding the difference in average earnings that could be expected to be earned in absence of study, and the average earnings of university students.

The average weekly ordinary time earnings (AWOTE) was adjusted to account for age, education level, and participation and multiplied by the newly generated domestic students (those who otherwise would have been earning in Australia). Origin of student and location whilst studying was factored into earnings potentials.

This was partially offset by earnings by students, calculated by the same number of students, multiplied by average earnings of university students.

Assumption (Average)	**Value**	**Source**
National Average wage	$80,409	ABS AWOTE – May 2016
Tasmanian Average Wage	$70,792	ABS AWOTE – May 2016
High school educated - National	$71,187	Weighted average of OECD Education Stats
High school educated – Tasmanian	$62,674	Proportional decrease of national figure in line with AWOTE difference
High school leaver wage - National	$48,593	High School Educated weighted for Age earnings ABS Census 2011
High school leaver wage – Tasmanian	$42,782	Proportional decrease of national figure in line with AWOTE difference
Participation rate – National	64.7%	National Average Sep 2016
Participation rate – Tasmania	59.9%	Tasmanian Average Sep 2016
University full time student earnings – Tasmania	$20,375	2012 National Average per University Australia Study, indexed to base year, reduced proportionally to AWOTE TAS
% School leavers in Tasmanian commencements	50%	Estimate on demand – see Demand Section
% School leavers in interstate commencements	100%	

Student Education Costs

International Fees and Government Contribution Scheme are recorded in the year that they are earned. HECS repayments are calculated in line with estimated earnings of graduates on 2017 repayment levels, once graduated.

2017 published amounts have been used for HECS and CGS contributions for domestic students. Due to slight variances between courses, a weighted average has been used split by HECS band and CGS clusters in line with 2015 actuals.

International student fee is now in line with published rates for 2017. Due variation of fees between courses, a weighted average has been used in line with the top 10 courses in 2015. This results in;

2017 Average Domestic Student Fee $24,231

2017 Average International Student Fee $27,878

In line with current rates, a small percentage of fee income is "waived". This can be in the form of scholarship to students, discounts offered to alumni or incentive to articulate from foundation studies to a bachelor degree. The domestic proportion is only applied to the HECS component of the student fees.

Waiver Rate Domestic 11.6%

Waiver Rate International 11.7%

Monetised Benefits

Student Educational Outcomes

Increase in future earnings over life time of graduates.

Assumption (Average)	Value	Source
Age at Graduation	22 Years	OECD, 2014
Age of Retirement	65 Years	ABS Retirement and Retirement Intentions 6238.0 -2016
Length of course	3 Years	
Unemployment	**2.80%**	Bachelor Degree Level of workforce, Education and Work, ABS, Cat 6227 May 2015 (latest available, national average has decrease from 6.0 to 5.6% in this time)
Annual Earnings average	$80,409	Average Weekly Time Earnings – ABS Cat 6302.0 May 16

Annual Earnings for High school educated worker	$71,187	Weighted average of OECD stats on AWOTE
Increased Earning capacity of Bachelor Degree holders above high school educated worker	39%	OECD Education Stats
% International Students remaining in country post study	30%	OECD Education Stats[63]

Increase in future potential earnings is used to value the output of education for students as a user benefit. As the destination of graduates varies across the nation, (increase in education leads to an increase in geographic mobility[64][65]) the national average weekly ordinary times earning (AWOTE) is used. This is used in combination of OECD stats[66] of index of earnings difference by educational level to create an AWOTE of a worker who has completed secondary school. This post-secondary level is then multiplied by the average increase to a bachelor level education to determine the average annual earnings increase.

The profile of earnings increase is weighted in line with the reported profile in the 2011 census data.

Only newly generated demand from international students who remain in Australia after graduation are counted towards the increase in student educational outcomes benefit.

Research Outcomes

Due to the difficulty and subjective nature of valuation, Research output is valued as the income sourced to fund. In this model research income is driven ultimately by student load, and the academics that are employed to teach this load.

Assumption (Average)	**Value**	**Source**
Staff Student Ratio	20:1	
Annual Income per research	$246,418	Uplifted (CPI) 2014 Value of reportable (HERDC) research income per SET Faculty academic.
Research Block Grant Income	0.25c /$1 Income	2015 SET Faculty average

Increased Student Revenues

[63] OECD, 2011

[64] Bonin, 2008

[65] Andrienko, 2009

[66] OECD, 2016

Increased student revenues from newly generated demand are used to calculate the producer surplus when considered with the incremental increase in teaching costs.

Enrolment Growth Profile from teaching start year

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Students – Head count	**50**	**100**	**150**	**250**	**350**	**500**
New Students By Origin						
Commencing Students						
Tasmanian	28	57	85	142	198	284
Mainland	5	10	15	25	35	50
International	17	33	50	83	117	167
	50	**100**	**150**	**250**	**350**	**500**
Newly Generated Demand						
Tasmanian 90%	26	51	77	128	179	255
Mainland 50%	3	5	8	13	18	25
International 34%	6	11	17	28	40	57
	34	**67**	**101**	**168**	**236**	**337**
Diverted Demand						
Tasmanian 10%	2	6	9	14	20	28
Mainland 50%	3	5	8	13	18	25
International 66%	11	22	33	55	77	110
	16	**33**	**49**	**82**	**114**	**163**

Other Assumptions	Value	Source
Teaching Start Year	2021	4 Year construction period from base year
Growth rate post expansion	1%	After defined growth period as stated in profile above, new facility will attract 1% more than base case.
Heads to EFTSL Ratio	85%	Average SET Faculty Teaching ratio 2015
Domestic to International Commencements	2:1	Estimate based on 2015 actual ratio (2.25:1), with allowance one year of current growth at current trend rates (outlined in demand section).

Car parking

STEM Precinct design currently includes 50 car spaces. Benefit is valued at current market rate of $2,880 per annum which the university pays in arm's lengths transaction.

Residual Building Value

Building value is measured through a depreciated life method, with an assumption of a useful life of 60, in line current end of life STEM buildings at the University's Sandy Bay Campus

Close to end of Life Buildings	Date Built
Engineering	1/07/1958
Engineering Workshop	1/07/1960
Chemistry	1/08/1961
Geography-Geology & CODES	1/08/1963
Mathematics	1/11/1962
Average	**25/05/1961**

This life has been applied to total construction costs and escalation attributable to that construction element of the total costs, and depreciated on a straight line basis. Specialist and IT equipment is assumed to have reached the end of its useful life by this stage, and consulting and management fees have been excluded.

Building Value used for Depreciated Value (From QS Appendix C)

Building Value	$,000
Construction Costs	279,485
Escalation	41,923
Total Value	321,408

Sandy Bay Land Value

The university is currently assessing the potential benefit from land that would be vacated with this move of STEM to the Hobart science and technology precinct. The large area of building space to be vacated would allow a condensing of remaining faculties into a relatively small footprint on the existing Sandy Bay site. It will also unlock value in previously vacated or underutilised areas of the Sandy Bay site, which because of reasons such as vicinity to other buildings or shared services and infrastructure, to date has not been able to realise. Because of the preliminary nature of the investigations, no plans have been formalised into strategy or policy, and hence have not been approved by University Council

However, for the purposes of the conventional cost benefit analysis, a value needs to be determined. As the method of realising value is yet to be determined, with potential options to be explored including disposals, development, lease arrangements and land swaps, a valuation has been conducted at a high level. A recent valuation of the Sandy Bay site placed total realisable value at approx. $120M, and the SET buildings account for approximately 50% of the teaching space on site. Allowing for uplift to the 2017 base year, decanting the remaining staff and students into a smaller footprint, including reduction in need for shared spaces, a value of $80M has been estimated for the benefit.

Due to the unique nature of the valuation, and the uncertainty of future strategy, this value has been stressed in the sensitivity analysis to determine impact of movement on the BCR.

APPENDIX C. QUANTITY SURVEYOR REPORT

SANDY BAY CAMPUS MASTERPLAN
(2-NOV-16)

UTAS SANDY BAY CAMPUS REDEVELOPMENT

Building / Program		AREA GFA (m2)	Development Sequence ID	PROGRAM Demolish / Refurb / New Build Start Year	Occupy (Feb)	Refurbishment	Decant	Demolition	Sub-total	New Build	Greenstar (+3%)	Sub-total	Ext. Services / Works (+5%)
Redevelopment													
Engineering	SET	5,435	2	3	4	N/A	$ 150,000	$ 543,500	**$ 693,500**	$ 35,327,500	$ 1,060,000	**$ 37,081,000**	$ 1,819,380
Chemistry	SET	10,127	3	4	6	N/A	$ 200,000	$ 1,012,700	**$ 1,212,700**	$ 65,825,500	$ 1,975,000	**$ 69,013,200**	$ 3,390,030
Mathematics	SET	892	4	6	8	N/A	$ 50,000	$ 89,200	**$ 139,200**	$ 4,460,000	$ 134,000	**$ 4,733,200**	$ 229,700
Physics	SET	5,426	4	6	8	N/A	$ 100,000	$ 542,600	**$ 642,600**	$ 27,130,000	$ 814,000	**$ 28,586,600**	$ 1,397,200
Life Sciences	SET	9,732	5	8	10	N/A	$ 150,000	$ 973,200	**$ 1,123,200**	$ 53,526,000	$ 1,606,000	**$ 56,255,200**	$ 2,756,600
Life Sciences Annexe - TIAR	SET	1,187	6	10	11	N/A	Incl.	$ 118,700	**$ 118,700**	$ 6,528,500	$ 196,000	**$ 6,843,200**	$ 336,230
Horticultural Research Centre	SET	1,216	6	10	11	N/A	Incl.	$ 121,600	**$ 121,600**	$ 6,688,000	$ 201,000	**$ 7,010,600**	$ 344,450
sub-total		**34,015**				**N/A**	**$ 650,000**	**$ 3,401,500**	**$ 4,051,500**	**$ 199,485,500**	**$ 5,986,000**	**$ 209,523,000**	**$ 10,273,590**
Temporary / Decant													
Admin - City (150 FTE @ 15m2		2,250	1	2	3	$ 4,050,000	$ 100,000	N/A	**$ 4,150,000**	$ -	$ -	**$ 4,150,000**	N/A
Medical Sciences		5,091	1	2	3	$ 12,727,500	Incl. above	N/A - refer note	**$ 12,727,500**	$ -	$ -	**$ 12,727,500**	N/A
TOTAL		**41,356**				**$ 16,777,500**	**$ 750,000**	**$ 3,401,500**	**$ 20,929,000**	**$ 199,485,500**	**$ 5,986,000**	**$ 226,400,500**	**$ 10,273,590**

Building / Program	Total Construction	Design & Construction Contingency (+10%)	Design & Management Fees (+12%)	IT / AV / FF&E / SPECIAL (+10%)	UTAS Costs (+3%)	Sub-Total	Escalation (+5% p.a.)	TOTAL
Redevelopment								
Engineering	**$ 38,900,380**	$ 3,890,038	$ 5,134,850	$ 4,792,527	$ 1,581,534	**$ 54,299,329**	$8,559,000.00	$ 62,858,329
Chemistry	**$ 72,403,230**	$ 7,240,323	$ 9,557,226	$ 8,920,078	$ 2,943,626	**$ 101,064,483**	$21,780,000.00	$ 122,844,483
Mathematics	**$ 4,962,900**	$ 496,290	$ 655,103	$ 611,429	$ 201,772	**$ 6,927,494**	$2,356,000.00	$ 9,283,494
Physics	**$ 29,983,800**	$ 2,998,380	$ 3,957,862	$ 3,694,004	$ 1,219,021	**$ 41,853,067**	$14,234,000.00	$ 56,087,067
Life Sciences	**$ 59,011,800**	$ 5,901,180	$ 7,789,558	$ 7,270,254	$ 2,399,184	**$ 82,371,975**	$39,329,000.00	$ 121,700,975
Life Sciences Annexe - TIAR	**$ 7,179,430**	$ 717,943	$ 947,685	$ 884,506	$ 291,887	**$ 10,021,450**	$6,302,000.00	$ 16,323,450
Horticultural Research Centre	**$ 7,355,050**	$ 735,505	$ 970,867	$ 906,142	$ 299,027	**$ 10,266,591**	$6,457,000.00	$ 16,723,591
sub-total	**$ 219,796,590**	**$ 21,979,659**	**$ 29,013,150**	**$ 27,078,940**	**$ 8,936,050**	**$ 306,804,389**	**$ 99,017,000**	**$ 405,821,389**
Temporary / Decant								
Admin - City (150 FTE @ 15m2	**$ 4,150,000**	$ 415,000	$ 547,800	$ 511,280	$ 168,722	**$ 5,792,802**	Incl rates	$ 5,792,802
Medical Sciences	**$ 12,727,500**	$ 1,272,750	$ 1,680,030	$ 1,568,028	$ 517,449	**$ 17,765,757**	Incl rates	$ 17,765,757
TOTAL	**$ 236,674,090**	**$ 23,667,409**	**$ 31,240,980**	**$ 29,158,248**	**$ 9,622,222**	**$ 330,362,949**	**$ 99,017,000**	**$ 429,379,949**

STEM MASTERPLAN REV 3 (1-NOV-16)

Classification	GFA (m2)	Buildings	Ext. Works & Services	Contingency	Total Construction	UTAS Costs	Escalation	TOTAL DEVELOPMENT COST	DEVELOPMENT RATE / M2
STEM - Webster Site	48,500	$217,243,000	$27,424,000	$24,467,000	**$269,134,000**	$63,444,000	$52,000,000	**$ 384,578,000**	**$ 7,900**
STEM - Ancillary Buildings	5,024	$ 8,373,000	$ 1,037,000	$ 941,000	**$ 10,351,000**	$ 2,364,000	$ 2,000,000	**$ 14,715,000**	**$ 2,900**
TOTAL	**53,524**	**$225,616,000**	**$28,461,000**	**$25,408,000**	**$279,485,000**	**$65,808,000**	**Excl.**	**$ 399,293,000**	**$ 7,500**

STEM MASTERPLAN REV 3 (1-NOV-16)

		% GFA	GFA	Rate/m2 $		TOTAL $
A	**CONSTRUCTION**					
1.0	**ACADEMIC**					
1.1	Academic - Office & Small Teaching	50%	18,680	$ 3,500	$	65,380,000
1.2	Academic - Elaborate Teaching / Assembly	17%	6,351	$ 3,400	$	21,594,000
1.3	Academic - Laboratories (general)	28%	10,458	$ 8,500	$	88,893,000
1.4	Academic - Laboratories (PC2)	2%	600	$ 10,000	$	6,000,000
1.5	Academic - Laboratories (PC3)	0.4%	150	$ 15,000	$	2,250,000
1.6	Academic - Library Learning Space	3%	1,121	$ 3,200	$	3,587,000
	Total (1) Academic	**100%**	**37,360**	**$ 5,024**	**$**	**187,704,000**
		80%				
2.0	**NON-ACADEMIC**					
2.1	Non-academic - Storage					
2.2	Non-academic - Plant	85%	7,939	$ 1,800	$	14,290,000
2.3	Non-academic - Retail / Food Services	15%	1,401	$ 3,500	$	4,904,000
2.4	Non-academic - Carparking		Included in item 5.01 below			
	Total (2) Non-Academic	**100%**	**9,340**	**$ 2,055**	**$**	**19,194,000**
		20%				
3.0	**BUILDING COST (Academic / Non-academic)**		**46,700**	**$ 4,430**	**$**	**206,898,000**
4.0	**ADD 5* GREENSTAR (3%)**	**5%**			**$**	**10,345,000**
	Total Building Cost		**46,700**	**$ 4,652**	**$**	**217,243,000**
5.0	**EXTERNAL WORKS & SERVICES**					
5.1	Carparking		1,800	$ 1,500	$	2,700,000
5.2	Site remediation (contaminated material)				$	500,000
5.3	Heritage & planning considerations				$	2,000,000
5.4	Services diversion				$	500,000
5.5	External Services (water / sewer / stormwater / electrical / comms)	7%			$	15,207,000
5.6	External works incldg landscaping, access roads etc.	3%			$	6,517,000
	Total Ext Works & Services		**1,800**		**$**	**27,424,000**

STEM MASTERPLAN REV 3 (1-NOV-16)

6.0	**LOCATION FACTOR & CONTINGENCY**					
6.1	Site location factor	0%			$	-
6.2	Design & Construction Contingency	10%			$	24,467,000
	Total Contingency				**$**	**24,467,000**
	TOTAL CONSTRUCTION COST		**48,500**	**$ 5,549**	**$**	**269,134,000**
B	**FEES & OTHER DIRECT DEVELOPER COSTS**					
7.0	Consutancy Fees - Design / Management	10%			$	26,913,000
8.0	Authority fees and charges	2%			$	5,383,000
9.0	UTAS management fee	3%			$	8,074,000
10.0	Headworks charges - Excluded					Excl.
11.0	Relocation and decanting		Refer item 13.0 below			
12.0	IT & FF&E	3%			$	8,074,000
13.0	Specialist Equipment				$	15,000,000
14.0	Land Purchase - Excluded					Excl.
	TOTAL FEES				**$**	**63,444,000**
C	**ESCALATION (36 months @ 5% per annum)**	5%			$	52,000,000
	TOTAL ESCALATION				**$**	**52,000,000**
	TOTAL ESTIMATED DEVELOPMENT BUDGET				**$**	**384,578,000**
	RATE / m2 (GFA)				**$**	**7,929**

STEM MASTERPLAN REV 3 (1-NOV-16)

			GFA		Rate/m2		TOTAL
A	**CONSTRUCTION**				**$**		**$**
1.0	**RESEARCH FACILITIES**						
1.1	Glass House		1,830	$	1,000	$	1,830,000
1.2	Animal Holding		213	$	800	$	170,000
1.3	Ancillary Areas		1,510	$	1,200	$	1,812,000
1.4	Loading / Storage		400	$	1,000	$	400,000
	TOTAL RESEARCH FACILITIES (1)		**3,953**	**$**	**1,066**	**$**	**4,212,000**
2.0	**OUTREACH & EDUCATION CENTRE**						
2.1	**STAFF ACCOMMODATION**						
2.1.1	Office Staff / Researchers (20 seats)		168	$	3,000	$	504,000
2.1.2	Meeting Room (10 seats)		20	$	4,000	$	80,000
2.1.3	Kitchenette / Lounge		20	$	3,500	$	70,000
2.1.4	Storage / Utility / Planning		15	$	1,800	$	27,000
	Total Staff Accommodation (2)		**223**	**$**	**3,054**	**$**	**681,000**
2.2	**GALLERY & EDUCATION**						
2.2.1	Learning Foyer / Gallery		270	$	3,200	$	864,000
2.2.2	Finishing Kitchen / Catering		36	$	4,500	$	162,000
2.2.3	90 Seat Theatre		378	$	5,000	$	1,890,000
	Total Gallery & Education (3)		**684**	**$**	**4,263**	**$**	**2,916,000**
2.3	**NON-USEABLE AREAS**						
2.3.1	Visitor Toilets		40	$	3,200	$	128,000
2.3.2	Access Toilets		11	$	3,200	$	35,000
2.3.3	Storage / Plant / Other		113	$	1,800	$	203,000
	Total Non-useable (4)		**164**	**$**	**2,232**	**$**	**366,000**
	TOTAL OUTREACH & EDUCATION CENTRE (5=2+3+4)		**1,071**	**$**	**3,700**	**$**	**3,963,000**
3.0	**BUILDING COST (1+5)**		**5,024**	**$**	**1,627**	**$**	**8,175,000**
4.0	**ADD 5* GREENSTAR (5% on Outreach & Education Centre)**	**5%**				**$**	**198,000**
	TOTAL BUILDING COST		**5,024**	**$**	**1,667**	**$**	**8,373,000**

STEM MASTERPLAN REV 3 (1-NOV-16)

5.0	**EXTERNAL WORKS & SERVICES**					
5.1	Site remediation (contaminated material)				$	100,000
5.2	Services diversion				$	100,000
5.3	External Services (water / sewer / stormwater / electrical / comms)	7%			$	586,000
5.4	External works incldg landscaping, access roads etc.	3%			$	251,000
	TOTAL EXTERNAL WORKS & SERVICES				**$**	**1,037,000**
6.0	**LOCATION FACTOR & CONTINGENCY**					
6.1	Site location factor	0%			$	-
6.2	Design & Construction Contingency	10%			$	941,000
	Total Contingency				**$**	**941,000**
	TOTAL CONSTRUCTION COST		**5,024**	**$ 2,060**	**$**	**10,351,000**
B	**FEES & OTHER DIRECT DEVELOPER COSTS**					
7.0	Consutancy Fees - Design / Management	10%			$	1,035,000
8.0	Authority fees and charges	2%			$	207,000
9.0	UTAS management fee	3%			$	311,000
10.0	Headworks charges - Excluded					Excl.
11.0	Relocation and decanting		Refer item 13.0 below			
12.0	IT & FF&E	3%			$	311,000
13.0	Specialist Equipment				$	500,000
14.0	Land Purchase - Excluded					Excl.
	TOTAL FEES				**$**	**2,364,000**
C	**ESCALATION (36 months @ 5% per annum)**	5%			$	2,000,000
	TOTAL ESCALATION				**$**	**2,000,000**
	TOTAL ESTIMATED DEVELOPMENT BUDGET				**$**	**14,715,000**
	RATE / m2 (GFA)				**$**	**2,929**

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To	Jacinta Young, UTAS	Pages	1
CC	Neal Denning, UTAS		
Subject	STEM Masterplan Stage Estimating Methodology		
From	Peter O'Donoghue		
File/Ref No.	61164	Date	1st November 2016

With reference to the current Cost Planning services Exsto Management is providing to the University of Tasmania for the proposed STEM Development in Hobart, we confirm that the rates and allowances that we have used have been informed from national benchmark data of comparable facilities. This cost data is available to us based on Exsto Management having previously been part of AECOM. These database rates are adjusted by our qualified Quantity Surveyors to take into account the following:

- Design complexity including best practise developments as well as adaptability to local practise
- Site constraints including latent conditions, access, adjoining properties et al
- Local planning requirements both on a council and state level
- Delivery framework including timeframe and procurement methodology
- Local market constraints from a design, management and construction perspective

The types of projects used include, but are not limited to:

- KBRB Ecosciences, Brisbane
  47,000m2 CSIRO Food & Nutritional Sciences Precinct, inner city
- Florey Neurosciences, Melbourne
  20,000m2 Research & Education Facility, inner city
- TRI Building, University of Queensland
  34,000m2 Medical Research & Education Facility, inner city
- University of Melbourne School of Chemistry
  1,200m2 Refurbishment of Heritage Building

The cost data used by Exsto Management in preparing our estimates is Private & Confidential and cannot be provided to the University of Tasmania or any other body.

Our estimates and cost plans are developed in accordance with standards and guidelines set by the Australian Institute of Quantity Surveyors.

Should you have any queries in this regard or require any additional information, please do not hesitate to contact me.

Regards

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Director

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APPENDIX D. ECONOMIC IMPACT ANALYSIS METHODOLOGY

Economic Impact Analysis

Methodology

Cost Benefit Analysis was undertaken on the basis of the student growth that will be achieved through the Hobart Science and Technology Precinct. Additional teaching resources required, research income generated by these academics engaged, and consumption by additional students and their families were developed in the model, over a 30 year timeframe.

The benefits included are driven by multipliers (provided by ACIL Allen economic analysis) of the infrastructure investment and direct operating of the precinct. Further to this direct expenditure, the model also quantifies the benefit associated with the educational output that the Hobart Science and Technology Precinct will deliver. These include increase in human capital, productivity improvements from an increase skilled workforce, benefits from increased employment or wages of graduates and the productivity benefits from research outcomes to existing industries. Due to the complexity and challenges of forecasting, there is no attempt to quantify the development of new industries from research nor the agglomeration benefits or co-location of the new Precinct within the CBD of Hobart.

Costs are measured as an impact to the state of Tasmania and the nation as a whole, however as this Precinct is based in Hobart, the vast majority of benefit will be realised in the greater Hobart area. No additional consumption is recognised for Tasmanian students, as it assumed they will be residing and consuming at a constant rate.

Key Assumptions

- Enrolments – Growth to 1500 additional students over 8 years, resulting in 500 International Students and 1000 Domestic students represents a compound annual growth rate of 6.8% of international students and 5.2% for domestic students.
- All students who are new to Tasmanian study are included in the Tasmanian figures. Only the marginal contribution from induced study, that otherwise would have not studied in Australia are included in the national figures.
- Salary On costs – 24.8% University of Tasmania's current full time on costs made up for superannuation (17%), Payroll Tax (7.14%) and workers compensation insurance (0.7%)
- Heads to EFTSL Ratio 1:0.85 – weighted average of student numbers to total unit enrollments of the five largest SET courses form 2015 in Semester 1 and 2.
- Operating Salary % - 70% Salary, 30% Other expenses - University of Tasmania's 2015 Result
- Research Salary % - 65% Salary 35% Other expenses - University of Tasmania's 2015 Result
- Weeks in residence – Length of a full academic year contract at the University of Tasmania's residential accommodation.
- Research Block Grant Income - $0.25 per $1 of reportable research earned – in line with 2015 SET faculty actuals.

Calculation of Direct Benefits

- Construction

Construction costs are estimated over a 4 year development and construction time frame as outlined in the implementation plan. Cost split in line with prior university major capital projects.

- Consumption

Consumption is calculated by the two drivers of attracting additional interstate and international students to Tasmania, and the consumption of the increase in visitors that these students will attract.

- Consumption by Students includes
  - Housing
  - Groceries
  - Transport
  - Fuel
  - Medical
  - Personal Care
  - Miscellaneous

- Travel Costs include
  - Transport
  - Accommodation
  - Other

- Benefits from student fees

Student fees are calculated on a steady EFTSL to student heads ratio, and grow as a product of student number growth and increasing domestic and international fees. As a not-for-profit entity, it is assumed all income generated, is subsequently expended, in line with the current university expenditure profile.

- Benefits from research income

Research income is based on an average research income attracted per academic staff in the SET faculty (as per Higher Education Research Data Collection reporting), and the additional research block grant income that this research income generates.

Calculation of indirect benefits

- Economic Output

Output is calculated using multipliers of direct spend specifically calculated for the above categories of direct expenditure. In addition to this, separate multipliers for where used for salary and non-salary expenses for research and student fee income, generated in line with the expenditure profile of the university.

- Economic Value Add

Similarly to output, increase in economic value is calculated by multipliers of direct costs. However in addition to the impact of direct expenditure, computer generated equilibrium (CGE) modeling has been used to include

- The impact of increasing human capital on productivity resulting from a higher level of educational attainment
- The impact resulting from innovations and practical applications of additional STEM related research done at the precinct.

The later extrapolates the current profile of STEM research income to estimate the industries themes in which research will be undertaken, and then industry specific modelling to show the impact.

APPENDIX E. ACIL ALLEN REPORT

ACIL ALLEN CONSULTING

REPORT TO
THE UNIVERSITY OF TASMANIA

1 NOVEMBER 2016

UNIVERSITY OF TASMANIA:

ECONOMIC IMPACT ASSOCIATED WITH THE UNIVERSITY OF TASMANIA'S HOBART SCIENCE AND TECHNOLOGY PRECINCT

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TABLES

1 ABOUT THIS STUDY

1.1 Project scope

The University of Tasmania (UTas or the University) was founded in 1880. It is the fourth oldest university in Australia and the only university in the state of Tasmania.

Unwearied by age, UTas seeks to extend its capabilities in providing quality education and research in the area of science and technology. Already a significant economic and social institution in Tasmania, the University is setting out to retain its relevance in a changing educational environment.

The University commissioned ACIL Allen Consulting (ACIL Allen) to assist the University in its submission to Infrastructure Australia regarding its Hobart Science and Technology Precinct.

1.2 Background to the analysis

In October 2015, ACIL Allen produced a report for the University entitled "University of Tasmania: Economic Contribution to Tasmania in 2014" (ACIL Allen Consulting, 2015). That report, and the calculations behind it, form the basis of the input-output multipliers derived here for the University for use in their economic assessment for Investment Australia.

In the 2015 report, ACIL Allen estimated the economic contribution of University related expenditure on the Tasmanian and regional Tasmanian economies. For this work, Australian impacts have been added to the analysis while also considering the impacts on the whole of Tasmanian and the region of Hobart & South East.

In the 2015 report, the economic contribution of UTas arising from its research and education programs was also analysed. This analysis is also used for the outcomes presented in this report.

1.3 The components of economic contribution

For this work we have focussed on six areas of contribution to the economies of Tasmania and Australia:

1. Construction expenditure
2. Student and associated visitor spend
3. Wages and salaries paid
4. Other operating costs
5. Research program impacts
6. Education impacts.

The economic contribution of the first four areas have also been estimated for the region of Hobart & South East.

These economic contributions are analysed using a combination of input-output tables and the associated multipliers for Tasmanian and the region of Hobart & South East or computable general equilibrium (CGE) modelling of Tasmania and Australia developed by ACIL Allen for the 2015 analysis.

For the 2015 analysis input-output tables and multipliers for Australia were developed but not applied in that analysis. These Australian tables and multipliers are applied in this analysis.

1.4 The types of multipliers provided

Four categories of multipliers have been provided in this report:

– Output multipliers — which measure the impact on production (or sales) from all industries within the economy.
– Income multipliers — which measure the impact on payments to workers (compensation of employees) throughout the economy.
– Value added at market prices multipliers — which measure the income effect described above plus economy wide profits plus indirect taxes. Value added at market prices in the Australian economy are a measure of Gross Domestic Product (GDP). At the state level they measure Gross State Product (GSP) and at the regional level, Gross Regional Product (GRP).
– Employment multipliers — which measure employment creation throughout the economy.

For each multiplier category two types of multiplier have been provided: the simple multiplier and the total multiplier.

Simple multipliers capture the summation of all inter-industry purchases throughout the economy. Therefore, any stimulus is transmitted through the economy as businesses within the economy make purchases from each other. However, simple multipliers assume no stimulus from the wages paid by businesses that stimulate additional personal consumption. Total multipliers include all of the inter-industry purchases contained within simple multiplier and also the stimulus provided by wages and the associated private consumption. Thus total multipliers are always larger than the corresponding simple multiplier.

Additional information on input-output multipliers and input-output analysis can be found in Appendix A and Appendix B.

2 CONSTRUCTION MULTIPLIERS

UTas have provided initial cost estimates for the construction of the Hobart Science and Technology Precinct. The Precinct will be constructed over two sites in Hobart: the Webster Site and at an ancillary building. Most of the construction cost is associated with the Webster Site.

The cost estimates provided by UTas for construction contain broad details of the major cost elements of the construction phase. These estimates were used to produce a construction cost profile that when combined with the Australian, Tasmanian and Hobart & South East input-output multipliers produced the construction multiplier estimates contained in Table 2.1.

TABLE 2.1 – **INPUT-OUTPUT MULTIPLIERS FOR PROJECT CONSTRUCTION**

	Output		Income		Value added at market prices		Employment	
	Simple	Total	Simple	Total	Simple	Total	Simple	Total
	A$m	A$m	A$m	A$m	A$m	A$m	FTE	FTE
Australia	2.91	5.04	0.45	0.73	0.92	1.56	7.25	11.91
Tasmania	2.30	3.41	0.35	0.49	0.73	1.05	7.16	9.70
Hobart & South East	2.08	2.96	0.31	0.42	0.65	0.90	6.52	8.50

SOURCE: ACIL ALLEN CONSULTING.

To appropriately apply the multipliers in Table 2.1, they must be multiplied by total construction spend in any given year to give an annual impact. It is understood that the project will have a construction length of five years.

3 STUDENT AND VISITOR MULTIPLIERS

For the 2015 report, UTas provided data on average student spend and its key components:

- Housing
- Groceries
- Transport
- Fuel
- Medical
- Personal care
- Miscellaneous.

Spending profiles for Australian and international students were separately provided.

Similarly, UTas provided data for spending by visitors (i.e. parents, relatives and/or friends visiting students). The data provided for visitors included components of this spending but with fewer categories:

- Transport
- Accommodation
- Other.

Spending profiles for Australian and international visitors were separately provided.

By combining these data for student and visitor spend with the information contained within the Private Consumption Expenditure for Households (from the Australian, Tasmanian and Hobart & South East input-output tables), an expenditure profile for Students and Visitors was estimated.

These individual spending profiles have been used to estimate the average multiplier for students and visitors to UTas and are shown in Table 3.1. These multipliers can be applied to estimates of student and visitor spend to calculate the estimated impact of that spend on the Australian, Tasmanian and Hobart & South East economies.

Note that no multipliers are produced that estimate the impact of Australian students on the Australian economy. These students are assumed to study at other Australian universities if they did not attend UTas. Therefore, the net effect of their attendance at UTas is zero.

TABLE 3.1 – **INPUT-OUTPUT MULTIPLIERS FOR STUDENTS AND VISITORS**

	Output		Income		Value added at market prices		Employment	
	Simple	Total	Simple	Total	Simple	Total	Simple	Total
	A$m	A$m	A$m	A$m	A$m	A$m	FTE	FTE
Australia								
Overseas students	1.71	3.03	0.28	0.45	0.91	1.31	4.78	7.68
Overseas visitors	1.70	3.30	0.34	0.55	0.83	1.31	5.58	9.08
Tasmania								
Interstate students	1.31	2.07	0.24	0.34	0.75	0.97	4.59	6.33
Overseas students	1.34	2.05	0.22	0.31	0.78	0.98	4.35	5.97
Interstate visitors	1.30	2.22	0.29	0.41	0.68	0.95	5.52	7.62
Overseas visitors	1.30	2.22	0.29	0.41	0.69	0.95	5.42	7.53
Hobart & South East								
Interstate students	1.16	1.78	0.22	0.29	0.69	0.87	4.11	5.50
Overseas students	1.19	1.76	0.20	0.27	0.72	0.88	3.88	5.17
Interstate visitors	1.16	1.92	0.27	0.36	0.63	0.84	5.07	6.78
Overseas visitors	1.16	1.92	0.27	0.36	0.63	0.85	4.97	6.68

SOURCE: ACIL ALLEN CONSULTING.

4 WAGES AND SALARIES

For the 2015 report, the impact of spending by UTas staff was estimated—where staff included teaching, research and administrative personnel.

Three key assumptions underpin the analysis of the impact of spending by UTas staff:

1. UTas staff spend all of their after-tax income
2. UTas staff are taxed (income tax) at an average rate of 30 per cent
3. UTas staff spend, on average, as per the input-output table Private Consumption Expenditure for Households.

Combining these three assumptions allows the average input-output multipliers associated with staff spending to be estimated, as shown in Table 4.1. These multipliers can be applied to estimates of pre-tax wages and salaries in order to calculate the estimated impact of that spend on the Australian, Tasmanian and Hobart & South East economies.

TABLE 4.1 – **INPUT-OUTPUT MULTIPLIERS FOR STAFF WAGES AND SALARIES**

	Output		Income		Value added at market prices		Employment	
	Simple	Total	Simple	Total	Simple	Total	Simple	Total
	A$m	A$m	A$m	A$m	A$m	A$m	FTE	FTE
Australia	1.14	2.21	1.18	1.32	1.59	1.91	11.01	13.35
Tasmania	0.85	1.45	1.14	1.22	1.49	1.66	10.80	12.17
Hobart & South East	0.75	1.25	1.13	1.19	1.45	1.59	10.49	11.60

SOURCE: ACIL ALLEN CONSULTING.

5 OPERATING EXPENSES

For the 2015 report, a detailed expenditure profile for each campus was provided by UTas. This profile covered all operational costs associated with existing campuses.

The operating cost data provided by UTas was coded against input-output categories to provide a detailed expenditure profile. Using this profile, input-output multipliers for standard operating expenditure (non-labour) have been calculated and are provided in Table 5.1.

It is noticeable that the multipliers for Tasmania and Hobart & South East are quite small. These relatively low values are to be expected because over half of operating expenses are met through out-of-state purchases.

The multipliers in Table 5.1 can be applied to estimates of non-labour operating expenditure to calculate the estimated impact of that spend on the Australian, Tasmanian and Hobart & South East economies.

TABLE 5.1 – **INPUT-OUTPUT MULTIPLIERS FOR UTAS OPERATING EXPENSES**

	Output		Income		Value added at market prices		Employment	
	Simple	Total	Simple	Total	Simple	Total	Simple	Total
	A$m	A$m	A$m	A$m	A$m	A$m	FTE	FTE
Australia	2.31	4.39	0.44	0.71	0.88	1.50	7.37	11.91
Tasmania	0.68	1.08	0.13	0.18	0.26	0.37	2.62	3.53
Hobart & South East	0.61	0.94	0.12	0.16	0.24	0.33	2.35	3.09

SOURCE: ACIL ALLEN CONSULTING.

6 DIRECT EFFECT OF OPERATIONS ON OUTPUT

To this point, the multipliers provided can be used to calculate an estimate of the economic impacts of the Hobart Science and Technology Precinct. However, in doing so one effect will not be calculated—the direct effect of the operation of the Hobart Science and Technology Precinct on **output** within Tasmania and the Hobart & South East region.

While the direct effects of wages have been included in the calculation of wages and salaries multipliers, there was no appropriate point at which to include the direct impact of the Precincts' operation.

It is therefore required, as one final calculation step, to add in the direct impacts of the Precinct's operations, where the direct impacts on output is total revenues (teaching and research).

7 IMPACT OF RESEARCH ACTIVITIES

7.1 Research contributions

Universities can undertake research and development (R&D) that is targeted in a way that addresses real regional issues (and/or have commercial applications). The outcomes from this research contribute to regional productivity improvements and act as a catalyst for the development of industry in the region.

Research (and innovation) leads to the development of new and efficient processes, technologies and products which, when deployed across the economy, improve living standards. The 2015 ACIL Allen report contains a discussion of how publicly funded research can lead to enhanced health and living standards, improved economic, social and environmental outcomes and national wealth creation. The 2015 report also discusses ways of quantifying the impact of research. Broadly, the main channels through which the University's research activities produce an economic impact are:

- research funding (investment) that has been attracted to Tasmania from sources outside the state as a result of the research activities undertaken by the University; and
- the returns to Tasmania and the rest of Australia from research undertaken by the University.

These economic benefits each act to boost productivity and output both in Tasmania and nationally.

In developing the modelling inputs for the economic impact of the University's research, the following methodological issues have been addressed, namely, the need to:

- determine the level and source of leveraged investment;
- account for the opportunity cost of investment;
- determine the assumed rate of return on research investment;
- allocate returns to appropriate industry sectors;
- account for time lags involved in accrual of returns on investment;
- account for the useful life of research; and
- determine the geographic boundaries of returns from research.

How each of these matters has been addressed is set out below.

Level and source of leveraged investment

For studies of economic benefit to be credible, it is essential that they are based on a clearly argued case for 'additionality' of the University's economic contribution. To determine the 'net benefit' a necessary condition is to show that certain streams of economic benefit can be identified and associated with the University. However, this by itself is not sufficient. It is also necessary to show that the identified streams of economic benefits (or a substantial part of them) are 'additional' in the sense that without the presence of the University's research, the economic benefits would not have occurred or occurred to the extent they did.

Assessing additionality requires two separate questions to be answered:

– would specific research projects have proceeded in the form they did in the absence of Tasmanian Government funding?
– to what extent would the resources invested by other parties in research projects undertaken by the University have been invested elsewhere within the Tasmanian science and innovation system?

Judgements in relation to these two questions are necessarily subjective. Therefore, assessments of 'additionality' rates should be seen as estimates rather than as definitive figures.

In order to evaluate the economic impact of the University's research activities, we have examined the University's sources of income for research projects to determine the extent to which the University has successfully obtained additional funds for research. These are funds that, in the absence of the University, would not have been spent in Tasmania.

The total funds spent in research activities by the University in 2014 and the funds that were considered as 'additional' (that is, attributed to the existence of the University's research capabilities) and included in the economic impact modelling are outlined in **Error! Reference source not found.**.

Additivity

To ensure that the estimates of the economic contribution of the University's research activities are additive to the contribution of the University's operations expenditure and avoid double counting, the additional investment figures have been used to estimate the productivity benefits from research. However, the contribution from the investment (or expenditure) of research funds is not accounted in the research impacts but in the expenditure contribution (see Section 6).

Additionality and opportunity cost

Investment in the University research projects made by international industry, and national companies headquartered outside Tasmania represents highly mobile investment capital that has come to Tasmania because of particular scientific infrastructure and expertise. Therefore, the 'additionality rate' of such leveraged investment was considered to be high.

The share of research funding from alternative sources (e.g. Tasmanian Government, Tasmanian private sector, Commonwealth Government, International etc.) has been assumed to be the same as that estimated from the 2014 research program as discussed in the 2015 report.

When modelling the economic impact of the additional investment associated with the University's research activities it is necessary to take full account of the 'cost' of such investment. Additional investment made into research activities at the University by definition cannot also be used for other purposes. To account for this opportunity cost of the investment, within the modelling we have assumed a reduction in investment in other activities equivalent to the amount of research funding. It has been assumed that such investment would have occurred in the investor's home region.

Rate of return on investment

In assessing the economic impacts of the University's research a crucial variable is the assumed rate of return (ROR) associated with the additional investment in the University's research activities. The ROR is the increase in output relative to the size of the investment that generated this increase. For instance, if a $1 million investment in research generates a $200,000 increase in output, the rate of return on this investment is 20 per cent. The rate of return explores the economic impacts of research and is a broad measure of return on investment or value creation resulting from research. The higher the rate of return on the investment, the greater the economic benefits associated with the research.

For this study we took the approach and assumed returns used in the 2015 report, which involved mapping the University's 2014 research projects to the types of research considered in the literature.

Industry sectors receiving the benefits

As part of our modelling approach, the University of Tasmania identified the sectors of the economy that are likely to benefit from the University's research associated with the Hobart Science and Technology Precinct.

TABLE 7.1 – **ANZSIC INDUSTRIES USED TO ALLOCATE RESEARCH BENEFITS**

ANZSIC industry	% of research program
Agriculture, Forestry and Fishing	58
Mining	22
Oil, gas	6
Electricity, Gas, Water and Waste Services	6
Information Media and Telecommunications	1
Professional, Scientific and Technical Services	6
Transport, Postal and Warehousing	6

SOURCE: UNIVERSITY OF TASMANIA.

Time lags and useful life of research

For the calculation of benefits, it was assumed that the returns on investment (i.e. the benefits) from the University's research will be achieved on average three years after the investment is made and that these benefits will continue to be accrued annually thereafter. Returns on investment in research occur after a delay for a number of reasons. For example, it may take some time for the beneficiaries of the research to recognise the significance of the outcomes. On the other hand, most of the research undertaken by the University is aimed at addressing issues of current importance. Returns on this type of research are likely to be achieved sooner that for some other types of research (such as those that require significant further investment to achieve commercialisation).

The economic modelling also assumes that the useful economic life of outcomes generated or enabled through the University's research activities is 15 years (i.e. the economic modelling does not include any economic impacts from University's research beyond 15 years after the investment is made). Previous evaluations of research institutes conducted by ACIL Allen Consulting used the 20-year standard of patent life generally recognized in patent legislation as the indicator of the useful economic life of research. However, not all the University's research projects produce commercial outputs so a 15 year period used is considered a reasonable average.

Geographic boundaries of returns from research

To model the impact on Tasmania of the University's research activities, assumptions must be made about the geographic boundaries within which the returns from the University's research activity accrue. Following a similar study conducted by Giesecke and Madden (2006), this study assumes that 25 per cent of the research benefits are enjoyed by Tasmanian agents only (reflecting the propensity of Tasmanian researchers to investigate local issues) and that 75 per cent of the research benefit are enjoyed by all Australians (including Tasmanians). These assumptions were also made in the 2015 report.

7.2 Modelling inputs

Broadly, two sets of shocks have been applied to the *Tasman Global* model. One set of shocks is related to the benefits of the investment in the University's research activities, and the other to its costs.

The opportunity cost of the investment associated with the University's research activities is factored into the modelling in the years it occurs. As a consequence of this shock, the growth in capital stock in each region is lower relative to the reference case.

Three years after the installation of the investment, productivity shocks (i.e. the benefits of the research activities) are applied to Tasmanian and Australian industry sectors that benefit from the University's research activities.

The *Tasman Global* model then simulates the effects of this investment and lagged productivity shocks for Tasmania and for Australia as a whole.

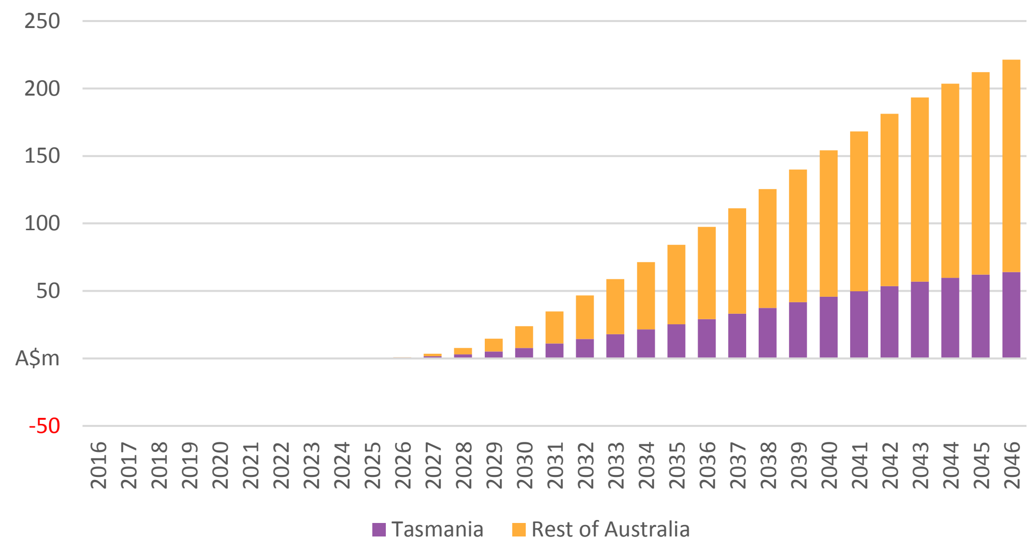
7.3 Impact of research activities

This section provides estimates of the future economic impact that the anticipated research activities in the Hobart Science and Technology Precinct are forecast to have on the Tasmanian and Australian economies. In particular, it provides estimates of the future economic impact of research activity on output, income and employment.

7.3.1 Real economic output

The projected changes in real economic output for Tasmania and Australia associated with the anticipated additional research activities are presented in Figure 7.1 and Table 7.2. Figure 7.1 shows the year on year impacts of research and Table 7.2 shows the cumulative impacts of the research programs undertaken over the period 2021–2046.

FIGURE 7.1 – **PROJECTED CHANGE IN REAL ECONOMIC OUTPUT AS A RESULT OF RESEARCH ACTIVITIES, RELATIVE TO THE REFERENCE CASE (2016 A$M)**



Note: The change in real economic output for Tasmania is equivalent to the change in real GSP while the change for Australia is equivalent to the change in real GDP.
SOURCE: ACIL ALLEN CONSULTING.

Although difficult to see in Figure 7.1, during the early years of the forecast period, the impact of the University on real economic output is slightly negative. This occurs as it takes a few years for the benefits of investing in the University's research programs to be realised. Further, this reflects the opportunity cost of the initial investment in research. In a competitive economy, funding of research activities at the University implies that funds have been redirected from other productive industries that could have provided an immediate benefit to the economy.

However, after the initial ramp-up period, the impact of the University's research on the Tasmanian and Australian economies becomes positive as the benefits of its projects and activities are translated into increased productive capacity. Specifically, the benefits of the University start to pick up from 2026 and remain positive until the end of the simulation period. These economic benefits are realised due to the flow on activity generated by the Precinct's research programs. For example, mining technology and related services companies drawing on results from University research and expertise improve the performance of the minerals and resources sector. This leads to an increase in the demand for resources and generates new jobs, products and profits in the economy.

Overall, as shown in Table 7.2, it is estimated that the research activities of the Hobart Science and Technology Precinct are projected to increase the real economic output (a measure of economic activity) of:

– *Tasmania* (i.e. real GSP) by a total of $642 million over the period 2017-2046 (with an NPV of $140 million using a 7 per cent real discount rate)
– *Australia* (i.e. real GDP) as a whole by a total of $2,153 million over the period 2017-2046 (with an NPV of $465 million using a 7 per cent real discount rate).

TABLE 7.2 – **PROJECTED IMPACT OF THE UNIVERSITY'S 2014 RESEARCH ACTIVITIES ON REAL ECONOMIC OUTPUT**

	Total (2017 to 2046)	NPV 4% discount rate	NPV 4% discount rate	NPV 10% discount rate
	A$m	A$m	A$m	A$m
Tasmania (GSP)	642	263	140	78
Rest of Australia	1,511	613	325	178
Total Australia (GDP)	**2,153**	**875**	**465**	**256**

Note: Net Present Value (NPV). Economic impact estimated using the *Tasman Global* CGE model of the Australian economy.
SOURCE: ACIL ALLEN CONSULTING.

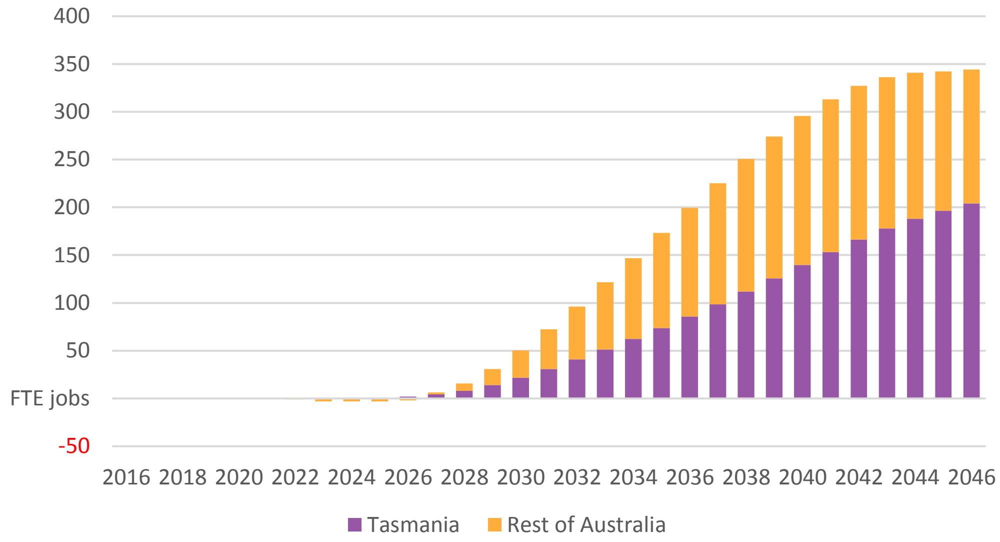
7.3.2 Employment creation

Employment is closely linked with economic activity and investment: as demand for a firm's goods increases, it can expand its operations and levels of capital and, in turn, their requirements for labour change. Hence, changes in employment typically mirror changes in economic output.

Indeed, the simulation results show that the impact of the Precinct's research on employment follows a similar path to economic output (see Figure 7.2). Both Tasmanian and Australia-wide employment during the initial years of the simulation period is slightly lower than the base case. However, the impact on employment turns positive, indicating an increase in the number of jobs stemming from the productivity benefits of the University's research projects.

Overall, as shown in Table 7.3, the Precinct's research activities are projected to increase total employment in Tasmania and the rest of Australia by nearly 2,000 employee years over the period 2017 to 2046. This is equivalent to creating 63 additional FTE jobs per year in Tasmania and 64 additional FTE jobs per year in the rest of Australia.

FIGURE 7.2 – **PROJECTED CHANGE IN TOTAL EMPLOYMENT AS A RESULT OF RESEARCH ACTIVITIES, RELATIVE TO THE REFERENCE CASE (FTE JOBS)**



Note: FTE = full time equivalent.
SOURCE: ACIL ALLEN CONSULTING.

TABLE 7.3 – **PROJECTED EMPLOYMENT IMPACTS OF UNIVERSITY'S 2014 RESEARCH ACTIVITIES**

	Total (2017 to 2046)	Average per annum
	Employee years	**FTE jobs**
Tasmania	1,957	63
Rest of Australia	1,995	64
Total Australia	**3,953**	**128**

Notes: FTE = full time equivalent. Employment impacts estimated using the *Tasman Global* CGE model of the Australian economy. Reflects employment impacts stimulated throughout the economy as a result of the effects of research activities.
SOURCE: ACIL ALLEN CONSULTING.

8 IMPACT OF EDUCATIONAL ACTIVITIES

The teaching and learning activities of the Hobart Science and Technology Precinct will increase the human capital of the labour force. This increased human capital has a material impact on the economy, as each graduate produces more output per hour worked than each non-graduate, on average.

The approach to estimating the effect of the Precinct on the productivity of the workforce via its output of graduates is to estimate the following:

- the number of additional graduates in the future labour force due to the Precinct's existence (i.e. the total number of graduates less those that would have studied elsewhere in the absence of the Precinct or would have studied another course)
- the proportion of graduates that remain in Tasmania after study, those that travel to the mainland to work immediately after graduation, and those that travel to the mainland to work over time
- the wage premium that graduates attract over non-graduates, accounting for ability bias and for differences in wage premium between Tasmania and the rest of Australia

This approach, the data sources and key assumptions are the same as used in the 2015 report with the exception of those described below.

The University of Tasmania provided their forecasts of the number of commencing students at the Precinct in each year of the forecast broken down by origin (Tasmanian, interstate or international). In the absence of a completion rate, all students were assumed to complete with 15 per cent of commencements assumed to undertake post-graduate studies. Undergraduates were assumed to study for 3 years while the average post-graduate student was assumed to study for 2 years.

8.1 Impact of educational activities

This section provides estimates of the future economic impact that the Precinct's education activities are forecast to have on the Tasmania and Australian economies (in particular of students graduating over the forecast period). Estimates are provided for economic output and employment.

8.1.1 Real economic output

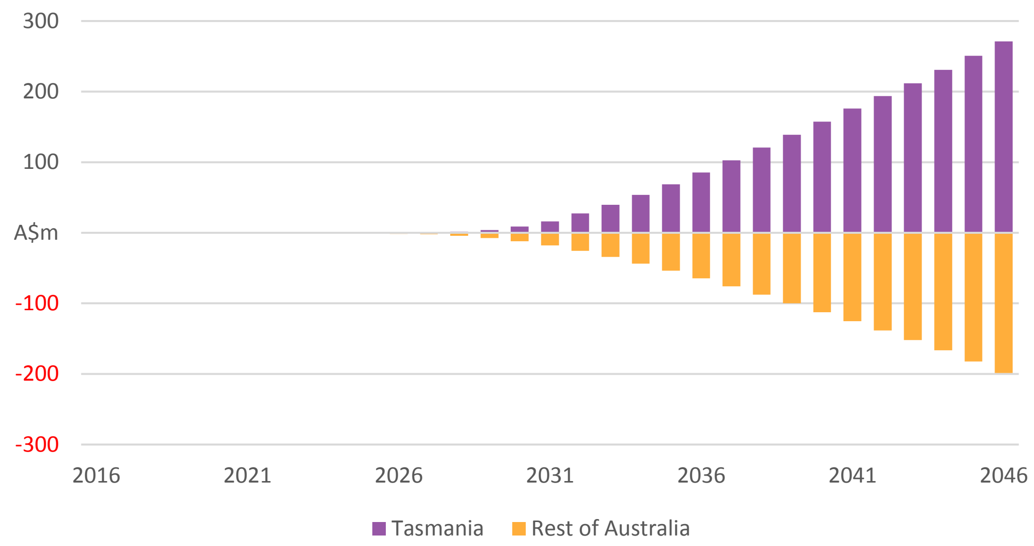
The projected changes in real economic output for Tasmania and Australia associated with the students graduating from the Hobart Science and Technology Precinct are presented in Figure 8.1 and Table 8.1. Figure 8.1 shows the year on year impacts and Table 8.1 shows the cumulative impacts of the future graduates.

Figure 8.1 shows a slightly negative impact of the Precinct on Tasmanian real economic output initially. This reflects the opportunity costs of studying at university and can be thought of as the investment in human capital for obtaining future returns. However, after the initial negative period, the impact of the graduates on the Tasmanian economy becomes positive as the year-on-year wage premium of graduates provides a return on the educational investment. The rest of Australia is projected to experience an offsetting (but lesser) negative impact reflecting the movement of labour (particularly international students) away from the mainland to Tasmania in the initial years after graduation.

Overall, as shown in Table 8.1, the Precinct's graduates are projected to increase the real economic output of:

- *Tasmania* (i.e. real GSP) by a cumulative total of $2,159 million over the period 2017–2046 (with an NPV of $436 million using a 7 per cent discount rate)
- *Australia* (i.e. real GDP) as a whole by a cumulative total of $554 million over the period 2017-2046 (with an NPV of $103 million using a 7 per cent discount rate).

FIGURE 8.1 – **PROJECTED CHANGE IN ECONOMIC OUTPUT AS A RESULT OF THE PRECINCT'S EDUCATIONAL ACTIVITIES, RELATIVE TO THE REFERENCE CASE (2014 A$M)**



Note: The change in real economic output for Tasmania is equivalent to the change in real GSP while the change for Australia is equivalent to the change in real GDP.
SOURCE: ACIL ALLEN CONSULTING.

TABLE 8.1 – **PROJECTED IMPACT OF PRECINCT'S EDUCATIONAL ACTIVITIES ON REAL ECONOMIC OUTPUT**

	Total (2017 to 2046)	NPV 4% discount rate	NPV 4% discount rate	NPV 10% discount rate
	A$m	A$m	A$m	A$m
Tasmania (GSP)	2,159	847	436	232
Rest of Australia	–1,605	–638	–333	–180
Total Australia (GDP)	**554**	**209**	**103**	**52**

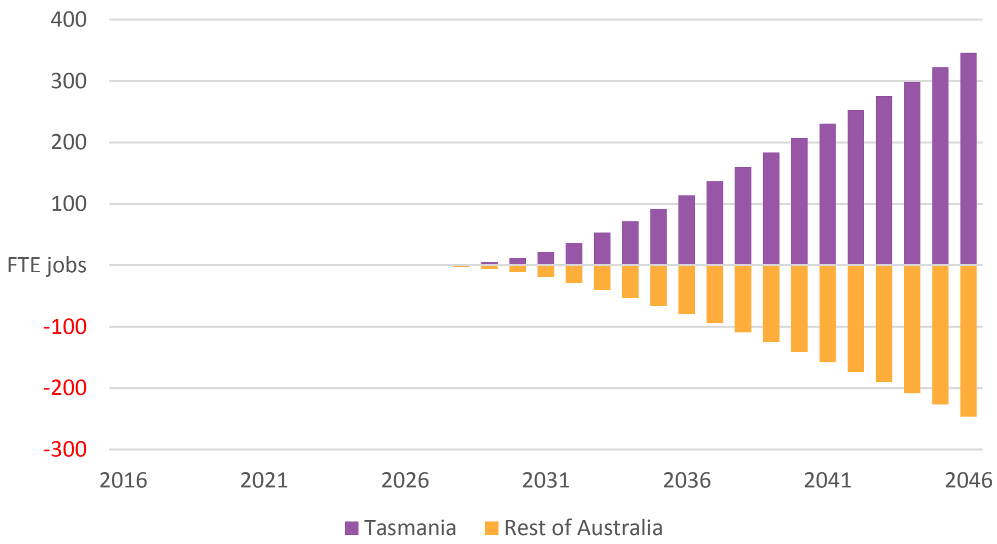
Note: Net Present Value (NPV). Economic impact estimated using the *Tasman Global* CGE model of the Australian economy.
SOURCE: ACIL ALLEN CONSULTING.

8.1.2 Employment creation

As mentioned before, employment is closely linked with economic activity and as such, changes in employment typically mirror changes in economic output. Figure 8.2 shows that the employment impacts of the Precinct's future graduates follow a similar path to economic output, with employment in Tasmania and Australia being slightly lower than the base case in the first year of the simulation. However, the impact on employment turns positive, indicating an increase in the number of jobs stemming from the productivity benefits of the Precinct's educational activities and the increased number of educated overseas students staying in Tasmania after graduation.

Overall, as shown in Table 8.2, the Precinct's graduates are projected to increase total employment in Tasmania by 2,820 employee years over the period 2017 to 2046 and by 837 FTE jobs across Australia in total. This is equivalent to creating 91 additional FTE jobs per year in Tasmania and 27 additional FTE jobs per year across Australia in total.

FIGURE 8.2 – **PROJECTED CHANGE IN TOTAL EMPLOYMENT AS A RESULT OF THE PRECINCT'S EDUCATIONAL ACTIVITIES, RELATIVE TO THE REFERENCE CASE (FTE JOBS)**



Note: FTE = full time equivalent.
SOURCE: ACIL ALLEN CONSULTING.

TABLE 8.2 – **PROJECTED EMPLOYMENT IMPACTS OF PRECINCT'S EDUCATIONAL ACTIVITIES**

	Total (2014 to 2024)	Average per annum
	Employee years	**FTE jobs**
Tasmania	2,820	91
Rest of Australia	–1,982	–64
Total Australia	**837**	**27**

Notes: FTE = full time equivalent. Employment impacts estimated using the *Tasman Global* CGE model of the Australian economy. Reflects employment impacts stimulated throughout the economy as a result of the current and future effects of educational activities.
SOURCE: ACIL ALLEN CONSULTING.

REFERENCES

ACIL Allen Consulting, 2015, *University of Tasmania: Economic Contribution to Tasmania in 2014*, report for the University of Tasmania.

A

OVERVIEW OF INPUT-OUTPUT ANALYSIS

Input-output tables provide a comprehensive picture of the supply and consumption of all commodities within the economy, including detailed information on factor incomes, taxes and the source (domestic or foreign) of every commodity. They are essentially the bottom-up accounting framework that underlies the calculation of aggregate GDP. Unlike the GDP accounts, however, I-O tables retain all intermediate consumption and therefore provide a detailed picture of the structure and interrelationships of industries. An important feature of I-O tables is that they are fully balanced matrices. For example, production costs (including returns to factors of production) equals sales revenue.

I-O multipliers are summary measures generated from input-output tables that can be used for predicting the total impact on all industries in the economy of changes in demand for the output of any one industry. The tables and multipliers can also be used to measure the relative importance of the product chain linkages to different parts of the economy. In most circumstances, the results of I-O multiplier analysis should be treated as upper level impacts.

Limitations of I-O Analysis

The limitations of the I-O analysis relate to four key simplifying assumptions underpinning the model:

- each industry in the I-O table is assumed to produce a single output;
- there can be no substitution between the goods or services of different industry sectors (or their source);
- there are constant returns to scale in production such that the inputs to production of all industry sectors are in fixed proportion to the level of output from that industry; and
- the total effect of production in several sectors is equal to the sum of the separate effects.

Therefore, particular care should be used when interpreting multiplier impacts, as they represent a linear response from the increase in final demand under implicit assumptions that an economy or industry has no spare capacity and that the productivity of that industry is constant.

The I-O approach ignores the opportunity costs associated with diverting resources from other productive activities as the model has no mechanism whereby the prices of factors (land, labour and capital) adjust in response to changes in demand. As such, I-O analysis does not consider the efficiency of an investment and the wider social implications. I-O analyses are not well suited to the analysis of social or population changes that might arise over the life of a project.

B INPUT-OUTPUT ANALYSIS

B.1 Overview

Input-output tables provide a snapshot of an economy at a particular time. The tables used in this analysis were for the 2013-14 financial year.

The 2013-14 input-output tables provide a picture of the region's economy in the 2013-14 financial year. Input-output tables can be used to derive input-output multipliers. These multipliers show how changes to a given part of an economy impact on the economy as a whole. A full set of input-output multipliers for each region were estimated for the purpose of this analysis.

The input-output multipliers allow rigorous and credible analysis of the economic footprint of a particular facility, industry or event for the region of interest. Although input-output multipliers may also be suitable tools for analysing the impact of various types of economic change, caution needs to be adopted in their application for this purpose. Misuse of input-output multipliers for the purpose of impact analysis has led to scepticism of their general use in favour of other tools such as computable general equilibrium (CGE) modelling. Notwithstanding this, they are still eminently suitable for understanding the economic linkages between a given facility or industry to gain an appreciation of the wider interactions of the industry beyond its direct contribution.

B.2 Multiplier types

Input-output multipliers estimate the economic impact on a region's economy from a one dollar change in the final demand for the output of one of the region's industries. Generally, four types of multipliers are used:

1. Output — measures the impact on the output of all industries in the economy
2. Income — measures the effect on the wages and salaries paid to workers within the economy
3. Employment — measures the jobs creation impact
4. Value-added — measures the impact on wages and salaries, profits and indirect taxes.

The sum of wages and salaries, profits and indirect taxes for a given industry provides a measure of its contribution to the size of the local economy – its contribution to gross regional product (GRP). The value added multiplier can therefore also be considered to be the GRP multiplier.

Input-output multipliers are a flexible tool for economic analysis. Their flexibility stems from the different forms of each multiplier type. For each region, multipliers were estimated in the following forms:

1. initial effects
2. first round effects

3. industrial support effects
4. production induced effects
5. consumption induced effects
6. simple multipliers
7. total multipliers
8. type 1A multipliers
9. type 1B multipliers
10. type 2A multipliers
11. type 2B multipliers.

The above multiplier types are defined in full in Johnson (2004)[1] for output, income, employment and value-added multipliers; however, a brief overview of the different types of output multipliers is presented below.

B.2.1 Multiplier effects

When additional sales to final demand are made, for example through increased exports or sales to the public, production increases to meet the increased demand, and this is the initial effect. Since production increases to exactly match the increased final demand, the increase is always equal to one (noting that the multipliers are defined in terms of a one dollar increase in final demand).

The industry producing the additional output makes purchases to enable itself to increase production, these new purchases are met by production increases in other industries and these constitute the first round effect. These first round production increases cause other industries to also increase their purchases, and these purchases cause other industries to increase their production, and so on. These 'flow-on' effects eventually diminish, but when 'added together constitute the industrial support effect.

The industrial support effect added to the first round effect is known as the production induced effect. So far this chain of events has ignored one important factor, the effect on labour and its consumption. When output increases, employment increases, and increased employment translates to increased earnings and consumption by workers, and this translates to increased output to meet the increased consumption. This is the consumption effect.

B.2.2 Multipliers

The simple and total multipliers are derived by summing the effects. The simple multiplier is the sum of the initial and production induced effects. The total multiplier is larger, because it also adds in the consumption effect. So far all the effects and multipliers listed have had one thing in common, they all measure the impact on the economy of the initial increase in final demand.

The remaining multipliers take a different point of view, they are ratios of the above multiplier types to the initial effect. The type 1A multiplier is calculated as the ratio of the initial and first round effects to the initial effect, while the type 1B multiplier is the ratio of the simple multiplier to the initial effect. The type 2A multiplier is the ratio of the total multiplier to the initial effect, while the type 2B multiplier is the ratio of the total multiplier less the initial effect to the initial effect.

Given the large number of multiplier types to choose from, output, income, employment and value added multipliers, and each with numerous variations (simple, total, type 2A, etc.) it is important that the analysis uses the most appropriate multipliers. Usually, the multipliers that include consumption effects (i.e. the added impact that comes from wage and salaries earners spending their income) are used. These are the total and type 2A multipliers. The total and type 2A multipliers will generally provide the biggest projected impact. Simple or type 1B (which omit the consumption effect) may be used to provide a more conservative result.

For this analysis, given that we were kindly provided with access to the key and detailed expenditure items, the Simple and Total multipliers were used to calculate the total contribution that the different campus of the University make to their respective economies.

[1] Johnson, P. (2004), *An Input-Output Table for the Gascoyne Region of Western Australia*, ACIL Tasman report for the Gascoyne Development Commission.

B.3 Limitations of input-output analysis

Although input-output analysis is valid for understanding the contribution a sector makes to the economy, when used for analysing the potential impacts of a change in production of a particular sector, input-output analysis is not without its limitations. Input-output tables are a snapshot of an economy in a given period, the multipliers derived from these tables are therefore based on the structure of the economy at that time, a structure that it is assumed remains fixed over time. When multipliers are applied, the following is assumed:

- prices remain constant
- technology is fixed in all industries
- import shares are fixed.

Therefore, the changes predicted by input-output multipliers proceed along a path consistent with the structure of the economy described by the input-output table. This precludes economies of scale. That is, no efficiency is gained by industries getting larger—rather they continue to consume resources (including labour and capital) at the rate described by the input-output table. Thus, if output doubles, the use of all inputs doubles as well.

One other assumption underpinning input-output analysis which is worth considering is that there are assumed to be unlimited supplies of all resources, including labour and capital. With input-output analysis, resource constraints are not a factor. It is thus assumed that no matter how large a development, all required resources are available, and that there is no competition between industries for these resources.

It is important to understand the limitations of input-output analysis, and to remember that the analysis provides an estimate of economic contribution of a facility or industry, not a measurement of economic impact if the facility or industry shut down or did not exist.

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APPENDIX F. Alignment with Government policies

The table below summarises the relevant policies and in particular specific policy objectives which the precinct will meet.

Level	Relevant policy	Objectives	Assessment
Federal	Smart Cities Plan	▪ Creation of job clusters which are concentrated areas of economic activity that foster access to employees, suppliers and customers while providing economies of scale ▪ High quality public spaces that bring people together to exchange ideas and build a sense of community	✓
	National Innovation and Science Agenda	▪ Building world-class national research infrastructure ▪ Greater collaboration between universities and businesses ▪ Equipping young Australians to create and use digital technologies ▪ Inspiring STEM literacy ▪ Attracting the best and brightest to Australia	✓
	Infrastructure Australia	▪ Infrastructure that will underpin Australia's continued prosperity	✓
	Regional Development Australia	▪ Priority infrastructure that will underpin growth in southern Tasmania	✓

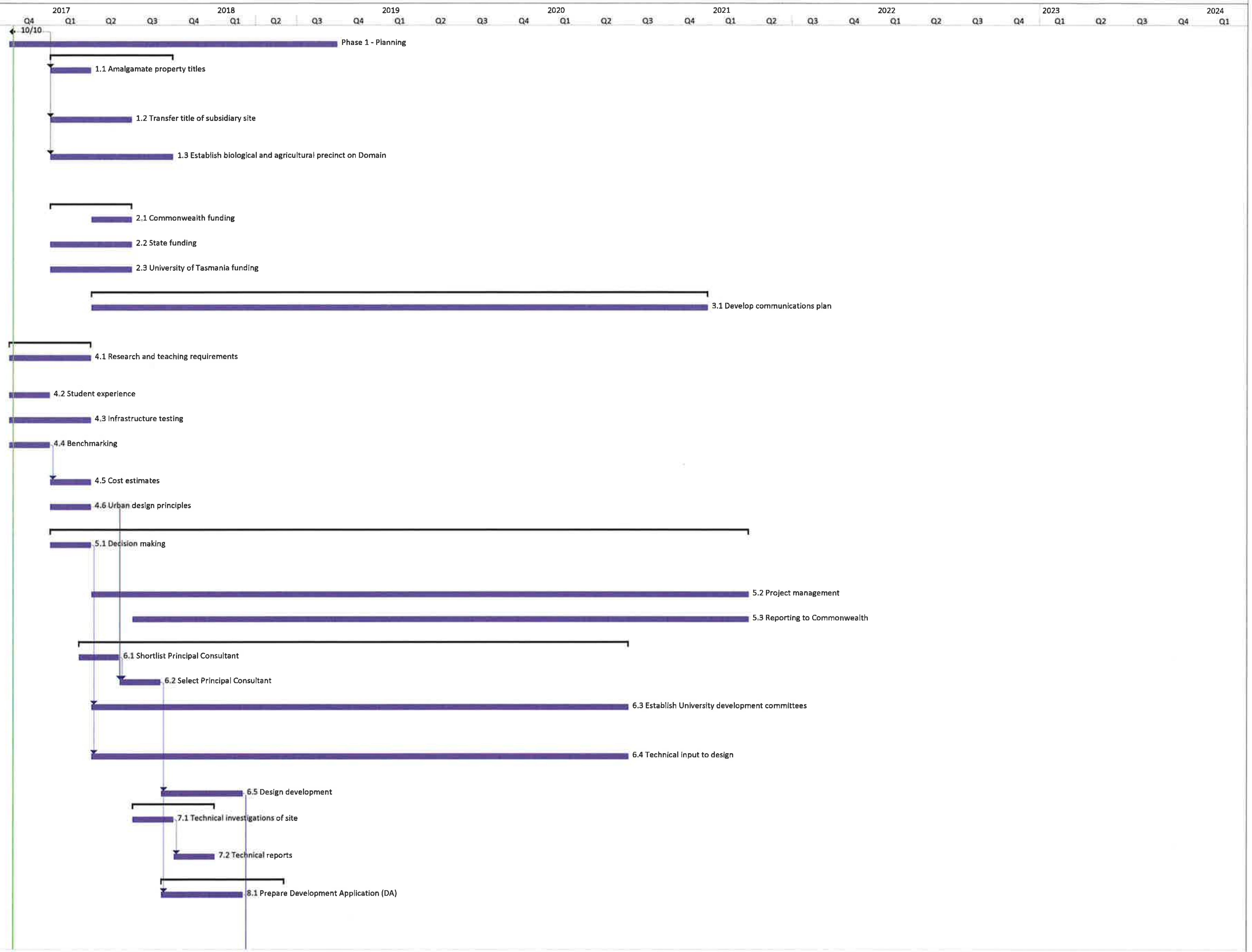
Level	Relevant policy	Objectives	Assessment
State	Population Growth Strategy	▪ Job creation and workforce development: facilitate job creation and identify current and future employment opportunities to inform investment in education and training, and migration attraction strategies ▪ Migration: actively pursue and facilitate overseas and interstate migration to Tasmania and encourage Tasmanians living elsewhere to come home ▪ Liveability: build and promote Tasmania's liveability and foster a culture which is vibrant, inclusive, respectful and supportive	✓
	Ministerial Priorities for Training and Workforce Development 2016	▪ A workforce for a competitive future ▪ Skills for a growing population ▪ Building business capability and entrepreneurial spirit and helping young Tasmanians to succeed at work ▪ Responding to emerging skills needs ▪ Supporting Tasmanians and Tasmanian businesses to adapt and grow	✓
	Infrastructure Tasmania	▪ Infrastructure that will underpin Tasmania's continued prosperity	✓

Level	Relevant policy	Objectives	Assessment
City	Hobart 2025 strategic outcomes	▪ Opportunities for education, employment and fulfilling careers and retaining our young people ▪ Lifestyle that will encourage all ages to see the city as a desirable location and lifelong home ▪ Quality development with the principles of sustainable cities and the reduction of ecological impacts pursued ▪ The city continues to enjoy the benefits of scale and proximity ▪ A safe and healthy city ▪ A destination of choice and a place for business ▪ Clever thinking and support for creativity will help build a strong economic foundation	✓

APPENDIX G. Detailed implementation schedule

University of Tasmania - STEM

ID	Task Name	Duration	Start	Finish
1	Start date	0 wks	Mon 10/10/16	Mon 10/10/16
2	**Phase 1 - Planning**	104 wks	Mon 3/10/16	Fri 28/09/18
3	**1. Secure sites**	39 wks	Mon 2/01/17	Fri 29/09/17
4	1.1 Amalgamate property titles	13 wks	Mon 2/01/17	Fri 31/03/17
5	1.2 Transfer title of subsidiary site	26 wks	Mon 2/01/17	Fri 30/06/17
6	1.3 Establish biological and agricultural precinct on Domain	39 wks	Mon 2/01/17	Fri 29/09/17
7	**2. Secure Funding**	26 wks	Mon 2/01/17	Fri 30/06/17
8	2.1 Commonwealth funding	13 wks	Mon 3/04/17	Fri 30/06/17
9	2.2 State funding	26 wks	Mon 2/01/17	Fri 30/06/17
10	2.3 University of Tasmania funding	26 wks	Mon 2/01/17	Fri 30/06/17
11	**3. Stakeholder Engagement**	195 wks	Mon 3/04/17	Fri 25/12/20
12	3.1 Develop communications plan	195 wks	Mon 3/04/17	Fri 25/12/20
13	**4. Finalise feasibility studies**	26 wks	Mon 3/10/16	Fri 31/03/17
14	4.1 Research and teaching requirements	26 wks	Mon 3/10/16	Fri 31/03/17
15	4.2 Student experience	13 wks	Mon 3/10/16	Fri 30/12/16
16	4.3 Infrastructure testing	26 wks	Mon 3/10/16	Fri 31/03/17
17	4.4 Benchmarking	13 wks	Mon 3/10/16	Fri 30/12/16
18	4.5 Cost estimates	13 wks	Mon 2/01/17	Fri 31/03/17
19	4.6 Urban design principles	13 wks	Mon 2/01/17	Fri 31/03/17
20	**5. Governance**	221 wks	Mon 2/01/17	Fri 26/03/21
21	5.1 Decision making	13 wks	Mon 2/01/17	Fri 31/03/17
22	5.2 Project management	208 wks	Mon 3/04/17	Fri 26/03/21
23	5.3 Reporting to Commonwealth	195 wks	Mon 3/07/17	Fri 26/03/21
24	**6. Design**	174 wks	Mon 6/03/17	Fri 3/07/20
25	6.1 Shortlist Principal Consultant	13 wks	Mon 6/03/17	Fri 2/06/17
26	6.2 Select Principal Consultant	13 wks	Mon 5/06/17	Fri 1/09/17
27	6.3 Establish University development committees	170 wks	Mon 3/04/17	Fri 3/07/20
28	6.4 Technical input to design	170 wks	Mon 3/04/17	Fri 3/07/20
29	6.5 Design development	26 wks	Mon 4/09/17	Fri 2/03/18
30	**7. Site Investigation**	26 wks	Mon 3/07/17	Fri 29/12/17
31	7.1 Technical investigations of site	13 wks	Mon 3/07/17	Fri 29/09/17
32	7.2 Technical reports	13 wks	Mon 2/10/17	Fri 29/12/17
33	**8. Planning Permit**	39 wks	Mon 4/09/17	Fri 1/06/18
34	8.1 Prepare Development Application (DA)	26 wks	Mon 4/09/17	Fri 2/03/18

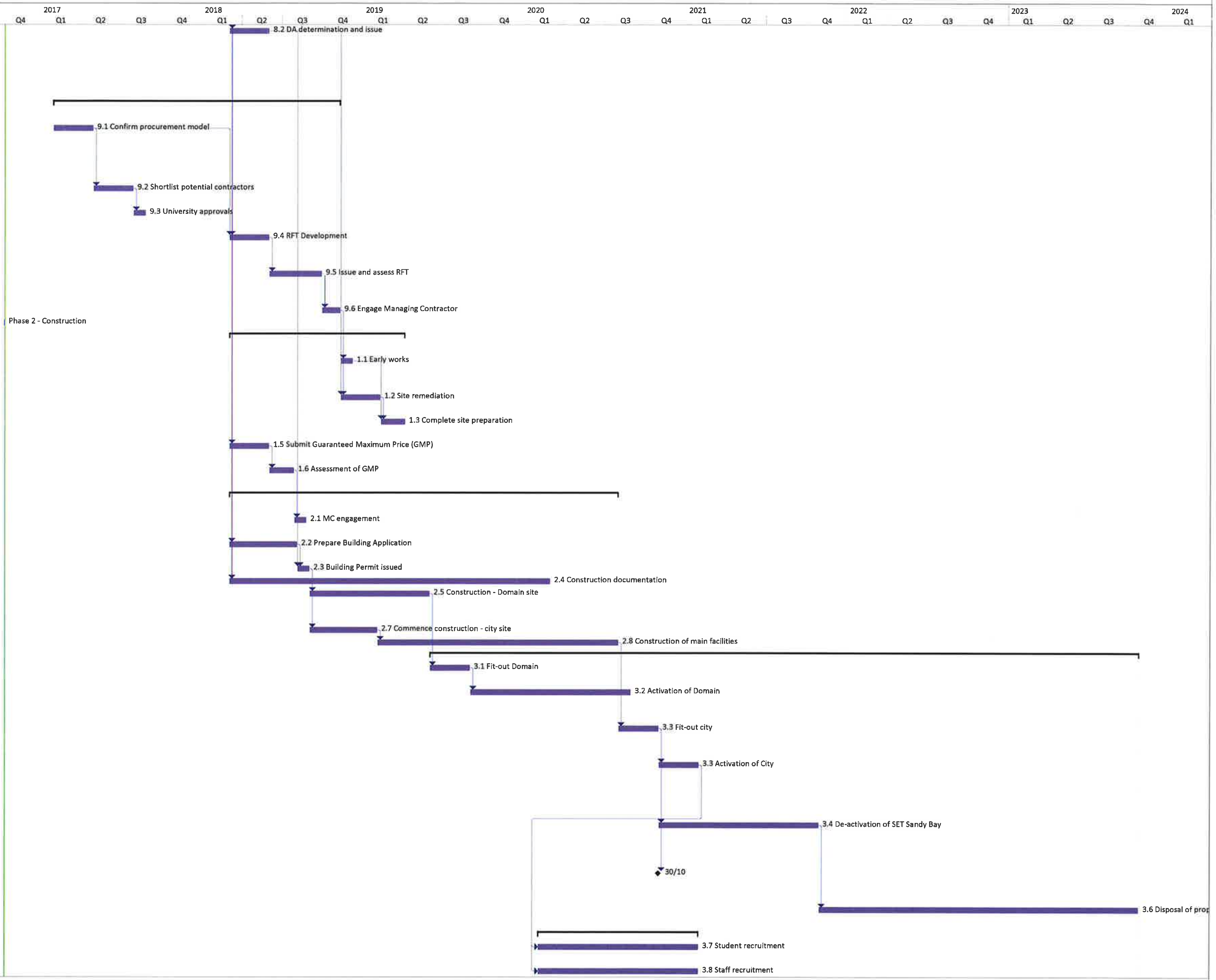


Project: STEM Hobart Gantt Cha
Date: Wed 12/10/16

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

University of Tasmania - STEM

ID	Task Name	Duration	Start	Finish
35	8.2 DA determination and issue	13 wks	Mon 5/03/18	Fri 1/06/18
36	**9. Procurement Model and Engagement**	93 wks	Mon 30/01/17	Fri 9/11/18
37	9.1 Confirm procurement model	13 wks	Mon 30/01/17	Fri 28/04/17
38	9.2 Shortlist potential contractors	13 wks	Mon 1/05/17	Fri 28/07/17
39	9.3 University approvals	4 wks	Mon 31/07/17	Fri 25/08/17
40	9.4 RFT Development	13 wks	Mon 5/03/18	Fri 1/06/18
41	9.5 Issue and assess RFT	17 wks	Mon 4/06/18	Fri 28/09/18
42	9.6 Engage Managing Contractor	6 wks	Mon 1/10/18	Fri 9/11/18
43	**Phase 2 - Construction**	0.2 wks	Mon 10/10/16	Mon 10/10/16
44	**1. Construction Stage 1 – early works**	57 wks	Mon 5/03/18	Fri 5/04/19
45	1.1 Early works	4 wks	Mon 12/11/18	Fri 7/12/18
46	1.2 Site remediation	13 wks	Mon 12/11/18	Fri 8/02/19
47	1.3 Complete site preparation	8 wks	Mon 11/02/19	Fri 5/04/19
48	1.5 Submit Guaranteed Maximum Price (GMP)	13 wks	Mon 5/03/18	Fri 1/06/18
49	1.6 Assessment of GMP	8 wks	Mon 4/06/18	Fri 27/07/18
50	**2. Construction Stage 2 – construction of major facilities**	126 wks	Mon 5/03/18	Fri 31/07/20
51	2.1 MC engagement	4 wks	Mon 30/07/18	Fri 24/08/18
52	2.2 Prepare Building Application	22 wks	Mon 5/03/18	Fri 3/08/18
53	2.3 Building Permit issued	4 wks	Mon 6/08/18	Fri 31/08/18
54	2.4 Construction documentation	104 wks	Mon 5/03/18	Fri 28/02/20
55	2.5 Construction - Domain site	39 wks	Mon 3/09/18	Fri 31/05/19
56	2.7 Commence construction - city s	22 wks	Mon 3/09/18	Fri 1/02/19
57	2.8 Construction of main facilities	78 wks	Mon 4/02/19	Fri 31/07/20
58	**Phase 3 – Transition**	230 wks	Mon 3/06/19	Fri 27/10/23
59	3.1 Fit-out Domain	13 wks	Mon 3/06/19	Fri 30/08/19
60	3.2 Activation of Domain	52 wks	Mon 2/09/19	Fri 28/08/20
61	3.3 Fit-out city	13 wks	Mon 3/08/20	Fri 30/10/20
62	3.3 Activation of City	13 wks	Mon 2/11/20	Fri 29/01/21
63	3.4 De-activation of SET Sandy Bay	52 wks	Mon 2/11/20	Fri 29/10/21
64	3.5 Other operations SB	0 wks	Fri 30/10/20	Fri 30/10/20
65	3.6 Disposal of property	104 wks	Mon 1/11/21	Fri 27/10/23
66	**Task**	52 wks	Mon 3/02/20	Fri 29/01/21
67	3.7 Student recruitment	52 wks	Mon 3/02/20	Fri 29/01/21
68	3.8 Staff recruitment	52 wks	Mon 3/02/20	Fri 29/01/21



Project: STEM Hobart Gantt Cha
Date: Wed 12/10/16

Task	Summary	Inactive Milestone	Duration-only	Start-only	External Milestone	Manual Progress
Split	Project Summary	Inactive Summary	Manual Summary Rollup	Finish-only	Deadline	
Milestone	Inactive Task	Manual Task	Manual Summary	External Tasks	Progress	

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