ITEM-13   LMM 23/06/2020 - G20 Smart Cities Alliance Pilot City

MOTION

That City of Newcastle:

1) Notes that the Australia New Zealand Smart Cities Council has recommended City of Newcastle as a leading Australian City to become a G20 Smart Cities Alliance Pilot City;
2) Notes that the G20 Smart Cities Alliance aims to develop global best practice frameworks for ethical smart cities;
3) Notes that the G20 Smart Cities Alliance is underpinned by the World Economic Forum and includes Government and Industry partners acting in global collaboration;
4) Welcomes the endorsement of the Australia New Zealand Smart Cities Council as an acknowledgement of the leadership provided by Council and staff;
5) Signs a Letter of Intent with the World Economic Forum to establish mutually beneficial cooperation with the G20 Smart Cities Alliance as a Pilot City.

BACKGROUND:

The Newcastle Smart City Initiative has been deploying technology projects and programs guiding the transition of Newcastle in ways that maximise opportunities presented through integrated technology and data, citizen engagement, and innovation ecosystem economic development.

The initiative has garnered national and international recognition for Newcastle as a leading Australian smart city, and an emerging centre of technology and innovation leadership. The initiative has been the recipient of multiple awards for strategy, partnerships, and research and innovation collaboration awarded by the Smart Cities Council of Australia and New Zealand in 2018 and 2019.

The Smart Cities Council Australia New Zealand is the Australasia's leading authority in smart cities. It is a member-based organisation of cities and industry dedicated to catalysing action and investment in technology and data solutions.

The mission of the Smart Cities Council Australia New Zealand is guided by the United Nations Sustainable Development Goals (SGDs) and aims to encourage a world where technology and data have been harnessed to create smart, sustainable cities and communities with high-quality living and high-quality jobs.

Established in June 2019, the G20 Global Smart Cities Alliance on Technology Governance unites municipal, regional and national governments, private-sector partners and city residents around a shared set of principles for the responsible and ethical use of smart city technologies.

The Alliance establishes and advances global policy standards to help accelerate best practices, mitigate potential risks, and foster greater openness and public trust.

The World Economic Forum, the international organization for public-private cooperation, serves as secretariat for the Alliance.

The Alliance partners with leading international organizations and city networks source tried-and-tested policy approaches to govern the use of smart city technologies.

The Alliance's institutional partners represent more than 200,000 cities and local governments, leading companies, startups, research institutions, and civil society communities. In collaboration with these public and private-sector partners, the Alliance also helps co-design, pilot and advance new and innovative policy approaches to address unresolved governance gaps.

The G20 Smart Cities Alliance focuses on five key areas of transformational change driven by the adoption of emerging technologies. These are:
- Equity, inclusivity and social impact
- Privacy and Transparency
- Security and resilience
- Operational Sustainability, and
- Openness and Interoperability

These areas of policy focus are in close alignment with the Newcastle Smart City Strategy 2017-2021 (Attachment C).

The Alliance is currently accepting nominations from cities and private entities interested in contributing to, and piloting, these new global policy standards.

The World Economic Forum has engaged with the City of Newcastle on the recommendation of the Australian New Zealand Smart Cities Council as a leading example of smart city implementation in Australia.

The G20 Smart Cities Alliance is seeking cities from each member country to join the Alliance as pilot cities. Pilot cities will be a mixture of large, prominent cities and smaller cities with more constrained resources. The City of Newcastle has been invited to join the Alliance as a Pilot city.

Participation in the G20 Smart City Alliance will benefit City of Newcastle through:

- Membership in a global community of smart city practitioners to learn best practices and form partnerships
- Acceleration of technology governance to be prepared for next generation smart city technologies
- Opportunities to participate in pilot projects with leading institutions to develop new policies for global adoption
- Recognition as a leading city in the smart city domain, through media coverage and speaking opportunities

By joining the Alliance as a pilot city, City of Newcastle is committing to:

- Conduct a review of the city's relevant policies with reference to the policy framework that the Alliance is developing,
- Participate in online forums and workshops to contribute to the development of the policy framework and supporting tools,
- Provide the Forum with copies of the city's policies relevant to the policy framework, and

- Explore implementation of a policy to improve technology governance, where there has been shown to be a gap in existing policies

There is no cost in joining the G20 Smart Cities Alliance.

The identification of potential pilot projects is undertaken in collaboration with expert guidance provided by the Alliance and their partner organisations, which include some of the world's most capable leading city networks and institutions such as:

- Cities for All
- Open and Agile Cities
- World Economic Forum
- UK Catapult
- Smart City Expo World Congress
- ICLEI Local Governments for Sustainability
- WEGO World smart sustainable cities organisation

This opportunity represents a significant platform for CN to engage with international partners of stature, and to showcase Newcastle as a confident, future-focused city emerging to the international stage.

The implementation of international best practice policy and governance will further enhance the effectiveness of the Newcastle smart city initiative as a trusted and transformational agenda supporting the growth of the city as a smart, liveable and sustainable global city.

ATTACHMENTS

Attachment A: G20 Smart Cities Alliance – City Engagement Presentation
Attachment B: G20 Smart Cities Alliance – City Engagement Brief
Attachment C: City of Newcastle Smart City Strategy 2017-2021

Becoming a Pilot City

G20
Global
Smart Cities
Alliance

Smart city applications come with major technology governance challenges

G20
Global
Smart Cities
Alliance

Rapid growth of IoT in public spaces and smart city applications

⚠ Cybersecurity threats

⚠ Vendor-lock in

⚠ Loss of privacy

⚠ Fragmented business models

⚠ Social disruption and exclusion

The G20 called for this Alliance in response

Launch of the G20 Global Smart Cities Alliance on Technology Governance
October 9th, 2019, Asia Smart City Week, Yokohama, Japan

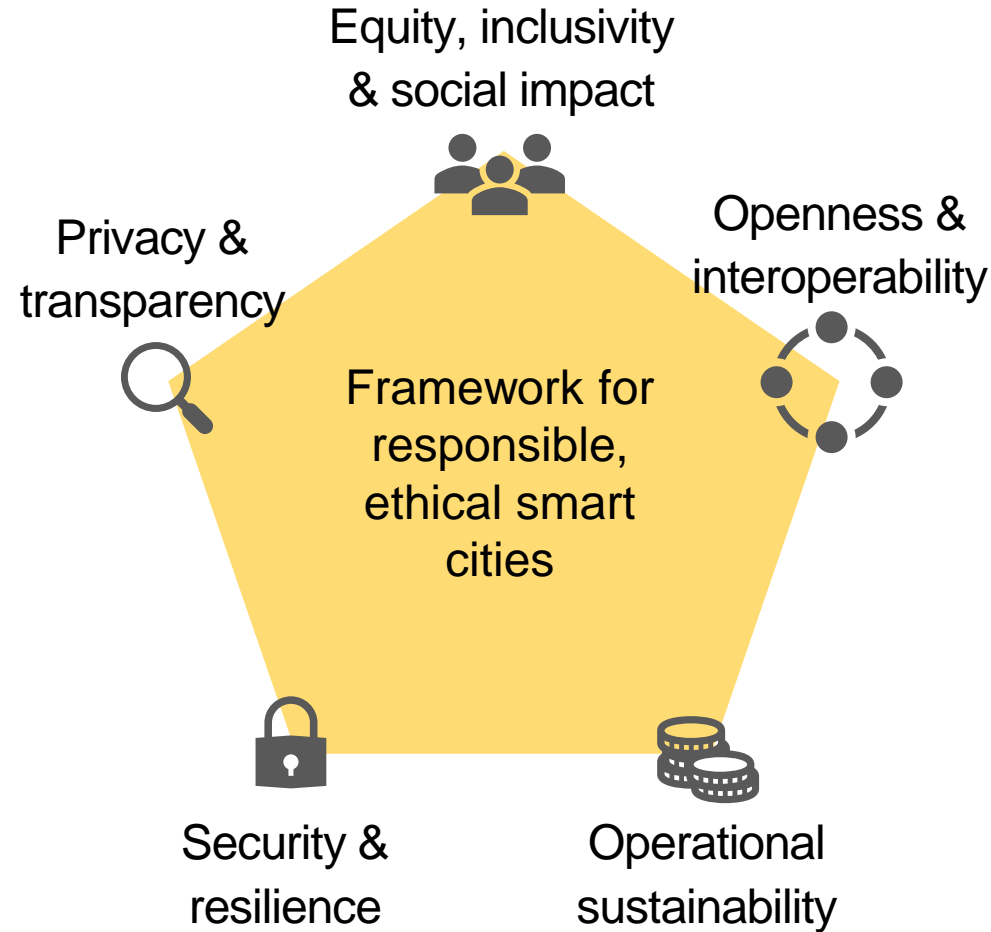*…the G20 encourages networking and experience-sharing among cities for the development of smart cities….Cities and networks of cities that express an interest may join a Global Smart City Coalition, which has been proposed to be established in October.*

G20 Ministerial Statement

After the G20's call to action, the world's leading city networks and institutions joined in

The Alliance aims to build a policy framework that spreads global norms for ethical smart cities

G20
Global
Smart Cities
Alliance

Equity, inclusivity
& social impact

Privacy &
transparency

Openness &
interoperability

Framework for
responsible,
ethical smart
cities

Security &
resilience

Operational
sustainability

We want something:

- Pragmatic

- Iterative

- Adaptable

- Measurable

- User-centred

We need to test this framework with a group of 20+ pioneering 'pilot cities'

Pilot cities will use the policy framework to examine their own policies. They will help improve the framework while identifying areas where their policies should improve.

Pilot cities will benefit from expert advice, collaboration opportunities and enhanced profiles

Membership in expert community

- 20+ smart city institutions and city networks
- Community events every month

Acceleration of tech governance maturity

- Impartial advice
- Practical assessment framework with no commercial agenda

Opportunities for pilot projects

- Platform for cutting edge collaborations with global players

Recognition as leading in smart cities

- Speaking opportunities at major events
- Profiles and features in public communications

To unlock these benefits, cities will need to commit time from officials to work with the Alliance

G20 Global Smart Cities Alliance

Minimum contribution:

- 2 calls with the Secretariat team

- Time for internal review of city policies (e.g. 1-2 days across several officers)

- Time for review of Alliance outputs (e.g. half a day)

Optional contribution:

- Participation in 2-3 virtual workshops

- Public commitment to policy reform

- Speaking at events

- Joining a pilot project consortium

How it works

G20 Global Smart Cities Alliance

Required steps:

| Letter of Intent (or equivalent) | Kick-off call for policy review with Secretariat | Internal review by city officials | Review call with Secretariat | Review and approve city profile |

Optional steps:

| | Nominate officer for Working Group | Commit to address policy gap | Agree pilot project | Participate in speaking events |

Outcomes:

| | Membership in expert community | Acceleration of tech governance maturity | Opportunities for pilot projects | Recognition as leading in smart cities |

Thank you!

G20
Global
Smart Cities
Alliance

Joining the G20 Global Smart Cities Alliance as a
Pilot City

Launch of the G20 Global Smart Cities Alliance on Technology Governance
October 9th, 2019, Asia Smart City Week, Yokohama, Japan

Background

The coronavirus pandemic has left governments and cities around the world scrambling for solutions, with many turning to emerging technologies for help, from contact tracing through mobile networks, to drone surveillance by police forces. This scramble is creating major governance challenges in areas like privacy, cybersecurity and interoperability – challenges that the G20 recognised as endemic to smart city technologies well before COVID-19 hit the global scene. It was because of these challenges that the G20 called for the creation of the G20 Global Smart Cities Alliance.

Launched in October 2019, the G20 Global Smart Cities Alliance unites municipal, regional and national governments, private-sector partners and cities' residents around a shared set of core guiding principles for the responsible use of smart city technologies. The Alliance establishes and advances global policy norms through the design, piloting and publication of policy frameworks on topics such as transparency, privacy and security. By putting in place better policies for smart cities, the Alliance will ensure that the governance environment is ready for the technologies that will ultimately make our cities more resilient, competitive, sustainable and liveable.

Pilot cities in the Alliance

The Alliance aims to identify 20+ cities in G20 countries and beyond to help pilot new global policy standards. These cities will be the first to test the policy framework we are developing, and the first to be considered for pilot projects to develop new policy standards. Your city is invited to speak to the Secretariat team about becoming a "pilot city".

Pilot cities will work with the Alliance to conduct a review of their existing policies and regulations related to the procurement, deployment and use of smart technologies. Following this review, each city will be encouraged to enact a policy based on the Alliance's global policy framework where they identify a gap in their current policies.

Pilot cities and their policies will be showcased and profiled on the Alliance website. In addition, these cities and organizations may be included in press materials and will have opportunities to speak at public events and Forums as ambassadors and leaders of the Alliance.

What benefits will pilot cities receive?

Membership in a global community of smart city practitioners to learn best practices and form partnerships

The Alliance already includes more than 20 of the world's leading smart city networks and institutions. Through our quarterly events and monthly workshops, you can connect with our community to share knowledge and opportunities. You can forge partnerships with other cities, with experts, and with trusted suppliers.

Acceleration of technology governance, so you are ready for the next generation of IoT and AI-powered smart city technologies

Through participating in the policy review and engaging with our community, you will receive independent, unbiased policy advice from smart city experts that will give your city a practical starting point for establishing the policies that smart city technologies require.

Opportunities to participate in pilot projects with leading institutions to develop new policies for global adoption

How should we tell people about IoT sensors on their street? How should planners anticipate and measure social impacts from technology? Many of the policy gaps in smart cities do not have clear, established answers for policymakers to adopt. The Alliance will invite pilot cities to participate in projects that will establish a model answer for other cities to follow.

Recognition as a leading city in the smart city domain, through press coverage and speaking opportunities

The Alliance will feature pilot cities heavily in public communications and will call on them to speak at high profile events including World Economic Forum events and prominent conferences in the smart city circuit.

What kind of cities are being considered?

The Alliance is proactively reaching out to cities within G20 countries, but will also accept cities outside the G20 to ensure full geographic representation. Pilot cities will be a mixture of large, prominent cities and small cities with more constrained resources.

What resources do pilot cities need to commit?

- The city will need to dedicate time from relevant officers to conduct a review of their existing policies against the draft policy framework that the Alliance Working Group is developing. This review is expected to require 2 calls with the Secretariat team, as well as several hours of research and analysis by city officers. Policies identified will be shared with Alliance partners and potentially profiled on the Alliance website

- The city will nominate an officer to take part in at least 50% of Alliance monthly virtual workshops to contribute to the development of the policy framework and supporting tools.

- City representatives may be called on to attend and speak at events on behalf of the pilot cities of the Alliance, such as the Smart City Expo World Congress, or the Global Technology Governance Summit.

- If the city elects to participate in a pilot project, this will require additional resourcing.

How to get involved

The first step is to get in touch with the Secretariat team at the World Economic Forum, by emailing Rushi Rama, Project Lead for the Alliance, at rushi.rama@weforum.org. If you are already in contact with the Centre for the Fourth Industrial Revolution, through a local office or affiliate centre, then you can communicate through this local office in case of language barriers.

After an introductory call, the Secretariat team will review your city's candidacy to ensure we maintain a balanced, representative mixture of pilot cities. If successful, your status as a pilot city can be confirmed via a signed Letter of Intent or another collaboration agreement as required. The Secretariat team can provide a Letter of Intent template for the city to review and sign. The Secretariat team will then arrange for a kick-off call to initiate the policy review process with the city.

Newcastle City Council

Smart City Strategy

2017 - 2021

The City of Newcastle

CONTENTS

NEWCASTLE: OUR CITY

Newcastle is the second largest non-capital urban centre, and the second oldest city in Australia. The Newcastle Local Government Area (LGA) is home to 152,948 people (2016 census) and welcomes about 4.1 million visitors each year. Our LGA is expected to continue to grow with an additional 32,000 people anticipated by 2036.

Newcastle is the cultural and economic capital of the Hunter - Australia's largest regional economy contributing around 8 percent of the economic activity in NSW, with a regional output of approximately $44.5 billion in 2017.

Newcastle has international profile as a major port city, gateway to the world for the Hunter's rich resources. A four time winner of the World Festival and Events City award, it is increasingly being acknowledged by international travel brands Lonely Planet and National Geographic as a must-visit destination, a 'hidden gem' and a smart city, creatively rising to the challenges of 21st century urban life.

We are known for our skilled workforce, high-standards of research and a business environment typified by cross-company collaboration and networking. Our services sector is strong in health and social care, finance and insurance, while construction is booming. Manufacturing in the region is highly capable and efficient and is facing the challenges of global competition with new products and an emphasis on quality outputs.

The highest number of artists per capita of any city in Australia drives an eclectic cultural scene, and enjoys a vibrant café culture and evening economy amid a rapidly renewing streetscape. Generations of these artists and performers are now morphing into contemporary practice within the new creative industries, while our traditional tinkerers and inventors are finding a place for their talents in high-value jobs such as aerospace, medical technology and advanced manufacturing.

Our city recognises that modern communications and technology can remove barriers and open up opportunities to join bigger markets through high-tech, creative and knowledge-based industries.
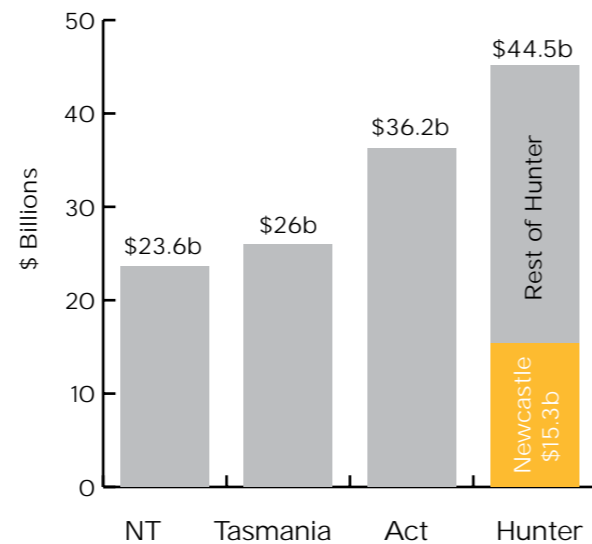
We are making these opportunities a reality.
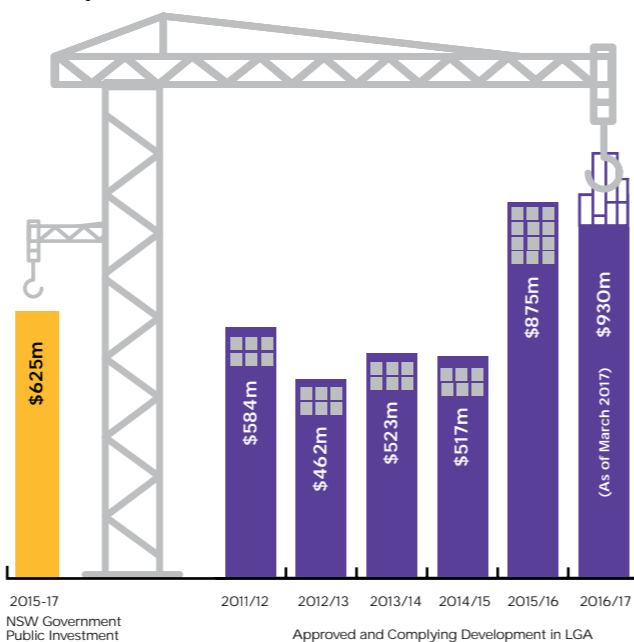
Population Growth
2011 - 2015

7.9% Newcastle **8.1%** Hunter Region
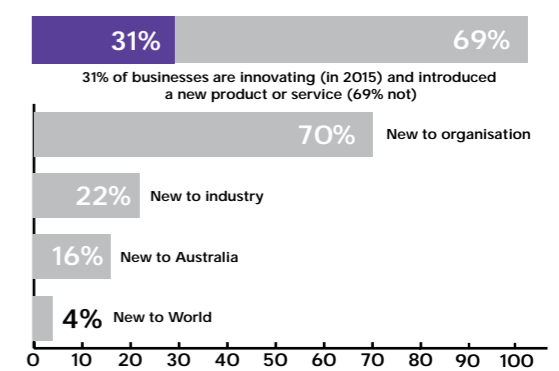
Hunter Region and Newcastle GRP 2016

$ Billions

- NT $23.6b
- Tasmania $26b
- Act $36.2b
- Hunter $44.5b (Rest of Hunter; Newcastle $15.3b)

Development & Infrastructure Investment

- $625m — 2015-17 NSW Government Public Investment
- $584m — 2011/12
- $462m — 2012/13
- $523m — 2013/14
- $517m — 2014/15
- $875m — 2015/16
- $930m — 2016/17 (As of March 2017)

Approved and Complying Development in LGA

Major Industries - Employment % (Dec 2016)

Newcastle / Hunter

- Health Care & Social Assistance
- Manufacturing
- Retail Trade
- Education & Training
- Professional, Scientific & Technical Services
- Accommodation & Food Services
- Public Administration & Safety
- Construction
- Transport, Postal & Warehousing
- Financial & Insurance Services
- Mining
- Other

Innovation in Hunter Businesses

31% | 69%

31% of businesses are innovating (in 2015) and introduced a new product or service (69% not)

- 70% New to organisation
- 22% New to industry
- 16% New to Australia
- 4% New to World

Regional Strategic Growth Areas

- Advanced Manufacturing
- Creative Industries
- Defence / Aerospace
- Food / Agribusiness
- Medical Technology & Pharmaceuticals
- Mining Equipment, Technology & Support
- Energy Resources

World Class Research Institutions: Areas of research strength

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

HMRI

CSIRO

nier

University of Newcastle
- Health & Medicine
- Science & Engineering
- Energy & Environment
- Sociology & Social Work
- Creative Industries

+ 1680 currently enrolled in PhDs
+ 7105 International students

Hunter Medical Research Institute
- Neuroscience & Mental Health
- Cancer Research
- Information Based Medicine
- Public Health

Commonwealth Scientific & Industrial Research Organisation
- Renewable Energy & Low Emission Technologies
- Energy Storage & Battery Technologies
- Electricity Grids & Energy Modelling
- Energy Efficient Buildings & Facilities

Newcastle Institute for Energy & Resources
- Resource Productivity & Efficiency
- Energy technologies
- Advanced Materials
- Land Use and Sustainability

Growth in University Degrees in Newcastle by M/F

Undergraduate Degrees (2001, 2006, 2011)
Postgraduate Degrees (2001, 2006, 2011)

● Male ● Female
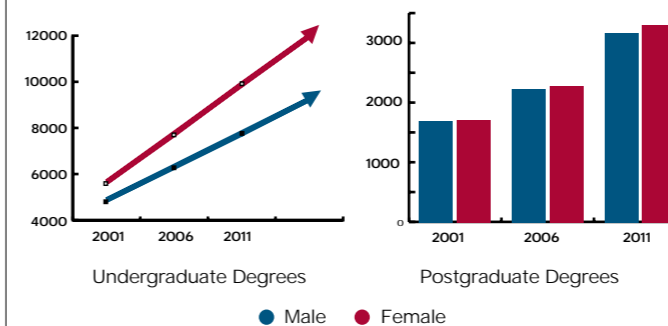
First in Family Tertiary Degrees

63.7% of undergraduate enrolment is first in family to attend university (currently 10,919 students)

52% of low socio-economic status enrolments are first in family (currently 3331 students)
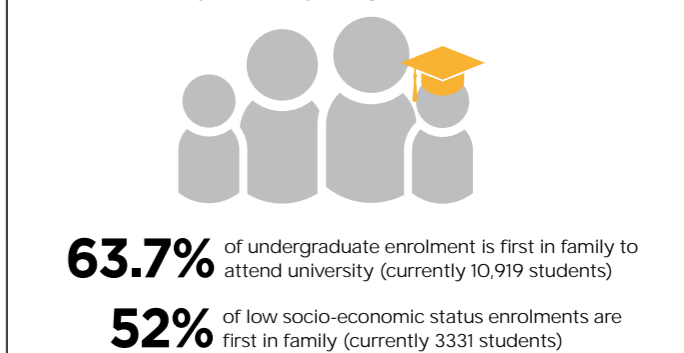
Enrolments in Science, Technology, Engineering, Mathematics & Medicine

2015 Enrolments		
Science & IT	5355	14%
Health & Medicine	7635	20%
Engineering & Built Environment	4663	12%
Total 2015		46% of total enrolments in STEM + M courses
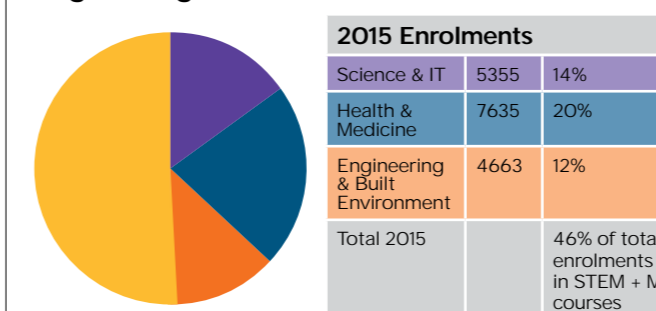
IP in 2015 (Newcastle & Lake Macquarie)

515 Trademark Applications

113 Patent Applications
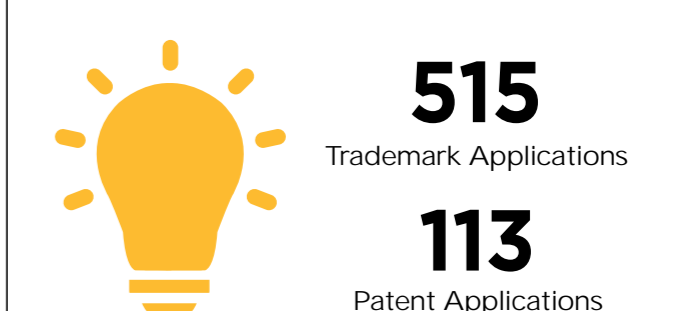
ABOUT THIS STRATEGY

Cities and regions globally are increasingly shifting towards innovation, bringing digitisation and the Internet of Things (IoT) into all aspects of human and business life. This movement is taking place in order to apply these technologies to addressing urban challenges while maintaining liveability. Smart cities are magnets for knowledge, talent, creativity, high value jobs and investment.

These cities are able to attract and retain talent and to grow their economy, while those that do not embrace this change will risk losing key demographics, resulting in economic, environmental and even social decline.

In an increasingly digital economy and technology-driven age, cities need to look towards new approaches, innovative technologies and smart infrastructure to create an environment that supports community and economic growth.

The Newcastle Smart City Strategy (2017-2021) is a four year framework outlining the key priorities and actions to be delivered by Council in its commitment to leading Newcastle's transition to a smart and innovative city.

It is one of a suite of Council strategies delivering on the strategic directions outlined in the *Newcastle 2030 Community Strategic Plan*.

The Newcastle 2030 vision for Newcastle is:

In 2030 Newcastle will be a smart, liveable and sustainable city. We will celebrate our unique city and protect our natural assets. We will build resilience in the face of future challenges and encourage innovation and creativity. As an inclusive community, we will embrace new residents and foster a culture of care.

We will be a leading lifestyle city with vibrant public places, connected transport networks and a distinctive

built environment. And as we make our way towards 2030, we will achieve all this within a framework of open and collaborative leadership.

The Smart City Strategy expands on Newcastle 2030 and outlines Council's role in working towards the delivery of our shared community vision for Newcastle.

Newcastle 2030 includes the strategic direction for Newcastle to be a smart and innovative city by delivering on community objectives to create a:

- Vibrant, diverse and resilient green economy built on educational excellence and research

- Culture that supports and encourages innovation and creativity at all levels

- Thriving city that attracts people to live, work, visit and invest

Newcastle 2030 incorporates six strategic directions in addition to Smart and Innovative City:

- Connected City

- Protected and Enhanced Environment

- Vibrant and Activated Public Places

- Caring and Inclusive Community

- Liveable and Distinct Built Environment

- Open and Collaborative Leadership

The Smart City Strategy supports the successful achievement of objectives spanning all of the seven strategic directions.

Smart City Initiative

The Newcastle Smart City Strategy is the roadmap for delivering Council's ambitious Newcastle Smart City Initiative. This initiative is influencing a city-wide revitalisation and regional transformation aimed at establishing Newcastle and the Hunter as an internationally recognised centre for technology innovation. It leverages the smart city movement to improve our liveability, sustainability and economic diversity, develop local innovation, build international profile and attract talent and inward investment to our city.

The Smart City Strategy will:

- Improve operational efficiency

- Achieve higher levels of sustainability

- Better service local community needs

- Stimulate economic development activity

- Increase community inclusion and participation

- Position Newcastle as a smart city internationally

PLANNING CONTEXT

Federal

AUSTRALIA

National Innovation and Science Agenda
$1.1 billion worth of Initiatives over four years to drive smart ideas that create business growth, local jobs and global success with a focus on four key pillars—culture and capital, collaboration, talent and skills government as exemplar—providing a framework for Australian innovation policy.

Smart Cities Plan
The Smart Cities Plan sets out the Australian Government's vision for our cities—metropolitan and regional—and its commitment to smart investment, smart policy and smart technology.

State

NSW

Open Data Action Plan (2016)
The release of usable and up-to-date datasets provides benefits that apply across government, to individuals and industry, and contributes to wider social and economic benefits. Open, transparent and accountable government is boosted by the availability of information on how government works and what it does.

The Digital Economy Industry Action Plan (2012)
The Digital Economy Industry Action Plan was developed to create a vision and strategy for the digital economy in NSW over the next decade.

Hunter Region

HUNTER

Smart Specialisation Strategy for the Hunter
The Smart Specialisation Strategy (S3) is an integral part of RDA Hunter's economic development agenda to advance the region's innovation network and grow the Hunter's international competitiveness. Smart specialisation is an OECD framework implemented widely across the European Union to deliver regional economic transformation through analysis of local competencies and discovery of new areas of opportunity.

Hunter Regional Plan 2036
The NSW Government's vision for the Hunter is to be 'the leading regional economy in Australia with a vibrant new metropolitan city at its heart'. To achieve this vision the Government has set four goals for the region:
1. A leading regional economy in Australia
2. A biodiversity-rich natural environment
3. Thriving communities
4. Greater housing choice and jobs.

City of Newcastle

NEWCASTLE

Newcastle Urban Transformation & Transport Program
The Newcastle Urban Transformation & Transport Program aims to strengthen connections between the city and the waterfront, create new jobs, provide more public space and amenity and deliver better transport. Led by UrbanGrowth NSW, the program is part of the NSW Government's $500 million plus commitment to revitalise Newcastle's city centre.

Newcastle 2030 Strategic Directions: a connected city, a protected and enhanced environment, vibrant and activated public places, a caring and inclusive community, a liveable and distinctive built environment, open and collaborative leadership

Strategic Direction: A Smart and Innovative City

Other Hunter Councils
• Lake Macquarie City Council - Digital Economy Strategy

Non-Government Initiatives
• STEM+M Strategy 2025 (2016) (University of Newcastle)
• NeW Futures Strategic Plan 2016-2025 (University of Newcastle)

Newcastle Smart City Initiative

• Vibrant, diverse and resilient green economy built on educational excellence and research
• Culture that supports and encourages innovation and creativity at all levels
• Thriving city that attracts people to live, work, visit and invest in

Newcastle City Council strategies

A COLLABORATIVE APPROACH

Becoming a smart city is a complex process and requires the sustained commitment of many different city stakeholders. It is not something that Council can achieve alone. We recognise that collaboration is critical to success in the smart city endeavor and have actively sought and established partnership strategies and collaborative approaches.

Our partnership with the University of Newcastle, Newcastle NOW and Hunter DiGiT secured $9.8m funding from the State Government's Hunter Infrastructure Investment Fund for the Hunter Innovation Project.

With Council and the University contributing $8 million, this $17.8 million project is a catalyst for accelerating the natural transition of the city and region. The Hunter Innovation Project will deliver foundational infrastructure and services across the following three major projects:

Smart City Infrastructure

We will be deploying smart city infrastructure initially throughout the Newcastle city centre. Digital connectivity through WiFi and LPWAN (low power wide area networks) will link sensors and integrated technology to provide detailed real time city data, facilitating an open-ended range of services and applications to improve the ease of access, efficiency and liveability of the city for residents, businesses and tourists.

Innovation Hub

An innovation hub is being built at the intersection of the University of Newcastle city campus, and the city's cultural spine. The innovation hub will bring together researchers, students, developers, entrepreneurs, investors, technical specialists and business advisors. By linking with existing innovation and entrepreneurship programs, the innovation hub will facilitate the launch of spinoffs, start-ups and mature companies; attract investment and businesses to the Hunter Region; encourage innovation and commercialisation; and produce the next generation of entrepreneurs, business leaders and inventors.

Digital Precinct

The digital precinct is a designated zone in the future CBD of the city with high speed fibre broadband (fttp). This concentrated capability, along with additional investment in a technology-integrated public domain, will give Newcastle a key competitive advantage in attracting and retaining high-tech, digital and creative industries to stay or locate in the city.

The Hunter Innovation Project is creating a city environment attracting entrepreneurs, start-ups and SMEs to locate, cluster and co-create a dynamic digital and innovation precinct in the heart of Newcastle.

The success of the Hunter Innovation Project has spurred Council to both instigate and seek out other collaborative approaches to the complex problems of smart city development. A number of other multi-stakeholder projects are currently underway that demonstrate clear improvements in the innovation ecosystem, and provide a greater chance of meeting our objectives.

Living Lab

A living lab is a model of collaborative innovation. Strategic work is underway across the region to establish a living lab in Newcastle. By bringing together research, industry, government and community, living labs are able to apply the expertise and experience of multiple disciplines and sectors to complex problems.

A living lab may focus on a service, product, technology or policy innovation, or any combination of these. Newcastle's Living Lab will create inter-disciplinary and applied research and technology development by inviting technology vendors, start-ups and research institutes to work with a range of end-users to co-create solutions. Establishing a specific city-scale test-bedding environment will effectively enhance the reputation and 'pull' of our city in terms of inward investment, and our regional goals around talent attraction and retention.

Hunter Regional Incubator

Newcastle and the wider Hunter Region are home to world-class research institutions and a vibrant innovation ecosystem centred on energy and resources, manufacturing and engineering, health technologies, defence/aerospace, the creative industries and a rapidly growing start-up and entrepreneurial sector.

Newcastle City Council has formed a collaboration of Hunter Region business, research, technical, administrative and entrepreneurial leadership to strategically develop an ecosystem with a particular focus on innovation growth areas.

The Hunter Regional Incubator strategy represents a new comprehensive approach to ecosystem development. The commitment of the project partners is to the development of a model geared towards providing fully coordinated and supported business development pathways through multiple regional facilities and services. The aim is to enhance opportunities for collaboration, innovation and commercialisation, and to provide a competitive advantage for Hunter-based businesses that have high-value potential and global ambitions.

National and International Networks

Newcastle is also actively collaborating beyond the city and region in order to advance smart city thinking and practice by providing platforms for sharing knowledge, experience and solutions. As a member of the Australian Smart Communities Association (ASCA), Newcastle is linked to our peer Australian smart cities to share knowledge and adoption of solutions that capitalise on the connectivity, reach and scale of the rapidly growing digital and technology sectors.

This network collaborative model is also being applied at an international scale. In 2017 Newcastle joined the Global Smart Cities and Communities Coalition (GSC3), a global alliance of smart cities. Its members, including Amsterdam, Eindhoven, Chicago and Austin, are key reference points as we develop our own specific smart city approach. These cities face challenges similar to Newcastle's and have addressed them through models from which we can learn. GSC3 also links cities to important global smart city partners, including financial institutions, research centres and universities, advisory services and thought leaders such as the Brookings Institute, Massachusetts Institute of Technology (MIT), European Network of Living Labs (ENoLL), and Metro Labs, among others.

Collaboration plays a fundamental role in enabling Newcastle and the Hunter to realise its potential as a key innovation ecosystem within Australia and the world.

SMART CITY VISION AND PRINCIPLES

This Smart City vision encapsulates the primary themes that emerged from our engagement process of collaboration, connectivity, efficiency, openness and people. The Newcastle Smart City Principles are an expansion of these themes.

Smart City Principles	
Collaboration	Ensure organisations are working together to realise or achieve positive change and success
Connectivity	Ensure the capacity for interconnection of people, platforms, systems and applications
Efficiency	Ensure orderly, capable, competent and valuable outcomes
Openness	Ensure access to data and a subsequent increase in transparency, acceptance, tolerance, receptiveness and understanding
People	Embrace and engage community, humanity and citizens

Delivering Our Vision

To deliver a smart city, two paradigms need to be combined: the digital and the non-digital. Only through integrating these two dimensions can we model the optimum outcome for Newcastle as a whole. Our focus on the digital economy must be balanced by seeking outcomes that benefit the non-digital community and that are culturally driven. We have considered influences across all sectors of society, prioritising inclusion, activation, creativity and community.

The delivery of the Smart City Strategy also works across two main timeframes. As Newcastle goes through the challenges of urban renewal, the Smart City Initiative will leverage these opportunities. Projects will be delivered within the life of this strategy to 2021. Funding for Smart City initiatives will be proposed and endorsed through annual Council operational planning. Grant funding opportunities are continually being sought. However, this strategy also seeks to lay appropriate groundwork for projects turning on a broader horizon measured in decades, and which will not reach fruition in the life of this strategy but in the full course of Newcastle's emergence as a dynamic and innovative city.

Smart City Vision
Newcastle is an open, collaborative, and connected smart city that uses technology to make things easier, more liveable and sustainable for everyone.

COUNCIL'S ROLE

Newcastle is undergoing a long-term transition from a primarily industrial city to one with diversified economic foundations. It is currently the focus of a NSW Government revitalisation agenda and is experiencing major urban renewal including light rail, growth in residential population and the development of a new university campus in the city centre.

Within this environment, the smart city initiative is a key contributor to the future of Newcastle.

Council has taken a leading role in development of Newcastle as a smart and innovative city.

What is a smart city?

Globally there is no single definition of a smart city. Each city must determine their interpretation, and their own objectives. Newcastle City Council's definition is a convergence of three interconnected statements.

- A smart city is one that puts the community at its centre
- A smart city enjoys smart and digitally connected public and urban infrastructure
- A smart city works to develop a thriving ecosystem to drive innovation and creativity

Smart cities are more than just places where technology is overlaid on a city structure. Just as important are more traditional city values of liveability, community, health, sustainability and economic resilience. Our smart city will underpin diversification of the local economy and drive inward investment along with the commercialisation of local and regional innovation.

Why do we need a smart city?

Our research and engagement has revealed five underlying drivers:

1. Attract and retain smart people

2. Innovation and creativity

3. Collaboration, education and training

4. Increased liveability, amenity and attractiveness

5. Pride and promotion
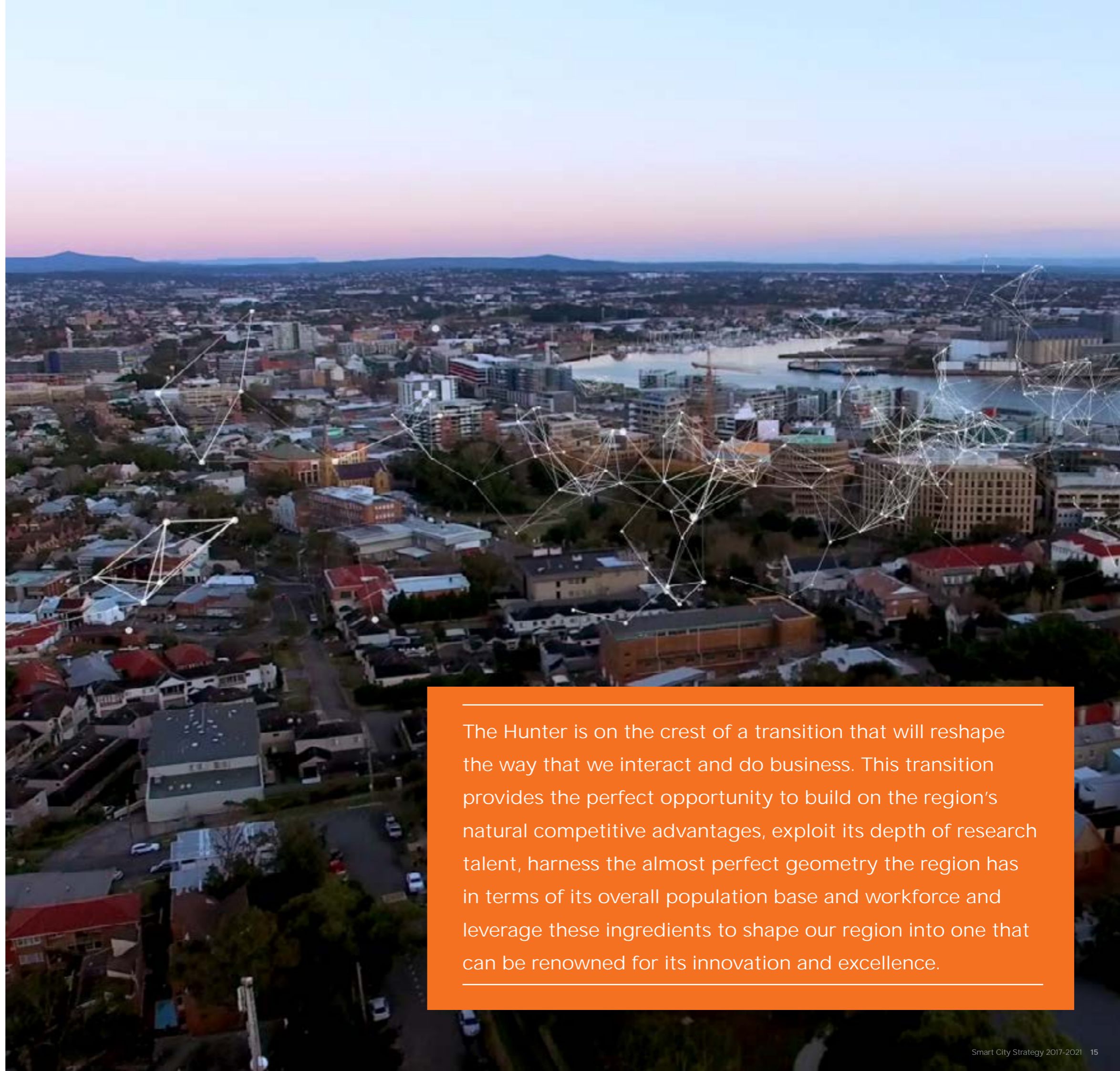
The Hunter is on the crest of a transition that will reshape the way that we interact and do business. This transition provides the perfect opportunity to build on the region's natural competitive advantages, exploit its depth of research talent, harness the almost perfect geometry the region has in terms of its overall population base and workforce and leverage these ingredients to shape our region into one that can be renowned for its innovation and excellence.

WHY DO WE NEED A SMART CITY?

1. Attract and retain smart people

Fundamentally, a smart city is about people. Cities now compete globally for investment, labor and talent. The creative capacity of our city is determined by the extent to which we can nurture our natural human potential, provide opportunity for our skilled and expert citizens, entice the return of talented Novocastrians who have travelled or made a life elsewhere, and attract creative and skilled individuals from afar.

Statistics show that the Hunter loses many university graduates annually to larger employment markets in Australia and internationally. Recent community engagement identified a number of reasons why Newcastle has difficulty retaining its educated youth, suggesting that there are not enough high-paying jobs or an adequate corporate environment to raise a business, meaning graduates end up moving to major cities to pursue their careers.

Often, these young people eventually return to make a life and take advantage of the family-friendly scale of the city and its outstanding natural settings and lifestyle opportunities. However, there is a great need to retain our talented graduates throughout the periods in their lives when they have an appetite for risk and a drive to create. The businesses and culture they create are the ultimate attractant for other talented people. It is well documented that the creative and entrepreneurial class seeks dynamic and vibrant cultural life, high levels of urban amenity and economic opportunity.

The four ideas of nurturing, retaining, returning and attracting talented people are cornerstones of the smart city endeavor.

Increasing the number of talented people calling the city home is central to providing opportunity for ideas to thrive, by supporting a culture that nurtures and respects thinking, creativity and risk.

A number of significant initiatives are underway across the region aiming to address the need to retain and attract talent:

- Ecosystem development programs including the Regional Incubator Strategy
- The Hunter Innovation Project
- Growing numbers of incubators and accelerator programs
- The STEM schools initiative and ME Program under the stewardship of Regional Development Australia - Hunter

This strategy will augment the urban renewal programs to provide greater economic opportunity, to accentuate smart technology and create enabling environments that add to Newcastle's existing lifestyle advantages.

2. Innovation and Creativity

The current era of rapid technological change has been termed the 4th industrial revolution. This term suggests that we are in the midst of a series of disruptions to existing systems and industries of a magnitude equivalent to the advent of the steam engine, electricity and the internet. This industrial revolution is driven by digitisation, the production and consumption of data, and the capacity of connected devices through the Internet of Things (IoT). Its common technologies are pervasive sensor networks, data analytics, additive manufacturing (3D printing), robotics and artificial intelligence. It is leading to the breakdown of boundaries between the virtual and the physical, as we access, analyse and make inferences from data, and change how we interact with inanimate objects; asking them to carry out forms of work that only a short time ago did not exist.

This is a landscape rich in opportunity and rife with challenge. New approaches to resource sustainability are needed; new business models are required to find directions for economic growth. Ensuring that the whole community is equipped to make this journey is paramount. The cities that are aware of these challenges and face them with confidence will be those in charge of their own destiny.

It is estimated that over 50 percent of the jobs of the future to be undertaken by the next generation do not yet currently exist. The only way to prepare for this is to produce creative, adaptive and innovative thinkers. For these reasons creativity and critical problem solving routinely appear at the top of employer's lists of desired attributes.

For the smart city to take full advantage of these opportunities there is a need to develop an experimental mindset and methodologies for encouraging an appropriate appetite for risk, and providing permission to fail, learn and start over.

Innovation is difficult and unpredictable but the entrepreneurial and collaborative models of thinking that best produce it can be learnt by a culture and adopted as normal.

Examples of key initiatives underway in the city that are driving this change to innovative and creative thinking are:

- Renew Newcastle cultural incubator
- Star4000 collaboration between University of Newcastle and Slingshot
- The Newcastle City Council's Smart City Initiative
- I2N, University of Newcastle's regional network of innovation hubs

The Smart City Strategy strives to achieve and implement innovation and creativity across all sectors, facilitating a smarter landscape and collaborative environment that Newcastle can build on. This strategy will emphasise the role of innovation and creativity as key tools for both creating and coping with change as the city moves into the future.

3. Collaboration, education and training

A city encompasses many different types of knowledge. The Newcastle Smart City strategy focuses on knowledge types that advance the local economy and society – those that give rise to creativity, innovation and problem

A city can only transition to a smart city through the long-term commitment of a wide variety of stakeholders. Collaboration is essential. The transition itself is a difficult and complex change management process where new ways of thinking are adopted, and new approaches to doing things are developed, practiced and implemented. These new approaches will necessarily exist side-by-side with legacy systems and traditional methods, providing further potential for fragmentation.

People from across the city working collectively towards common goals, developing the necessary processes to support the transition, is the only way it can happen.

What is needed is careful attention to collaboration around educational pathways extending from primary school through VET sectors and tertiary education. Also important are re-training opportunities for workers in downturn sectors being impacted by increasing automation. There is a need for general community programs to introduce new ideas and skills in a way that is not intimidating for the novice or layperson.

Good examples of current activities aiming to nurture collaborative education and training are:

- University of Newcastle's innovation and entrepreneurship degree
- NSW TAFE's Newcastle SkillsPoint Centre in manufacturing and robotics
- STEM Schools program featuring industry collaboration
- The STEMships program being piloted by the NSW Department of Industry
- NCC Libraries partnership with TAFE to deliver mechatronics and coding workshops

Council is not a lead player in formal education or training. In these arenas our role is to advocate for appropriate approaches in alignment with our vision. At an informal level of community education, Council is provider and funder of various community development programs, most prominently through our libraries, the Newcastle Museum and other cultural facilities. These facilities will play an important role in translating the opportunities of the smart city for the community. This strategy provides a framework to support the collaboration of stakeholders and alignment of efforts across the city.

# 4. Liveability, amenity and attractiveness

Liveability is crucial to the creation of a sustainable city community, as is the quality of amenity within its built urban fabric. The liveability, amenity and attractiveness of a city refers to the quality of social space, its economic dynamism, and the overall ability of local authorities and other stakeholders to develop a progressive and inclusive economy.

A smart city is one that focuses its resources on improving wellbeing, liveability and amenity. Its goal is to turn the ingenuity of its people towards creation of a better city and improved living environment, and a more connected and cohesive community. An attractive city, one blessed with ample green spaces, high quality public domain, and vibrant city economies across the day and into the night is a critical element in efforts to attract and retain talent.

The city has a unique opportunity to build upon is natural advantages which include high quality city beaches, open waterfront space, its human scale and heritage building stock, and its regional location as gateway to the recreational offerings of the Hunter Valley, Lake Macquarie and Port Stephens.

Newcastle is in the midst of unprecedented public investment in the key spaces of the city aiming to deliver improvements to liveability and amenity.

The integration of technology into the urban liveability agenda raises the prospect of utilising sensor technology to collect 'open data' on key city systems such as traffic movements, parking, pedestrian mobility and way-finding throughout the city. When integrated, this data can provide powerful insight into how the city functions and will further enhance urban, transport and development evaluation, and safety and emergency responses.
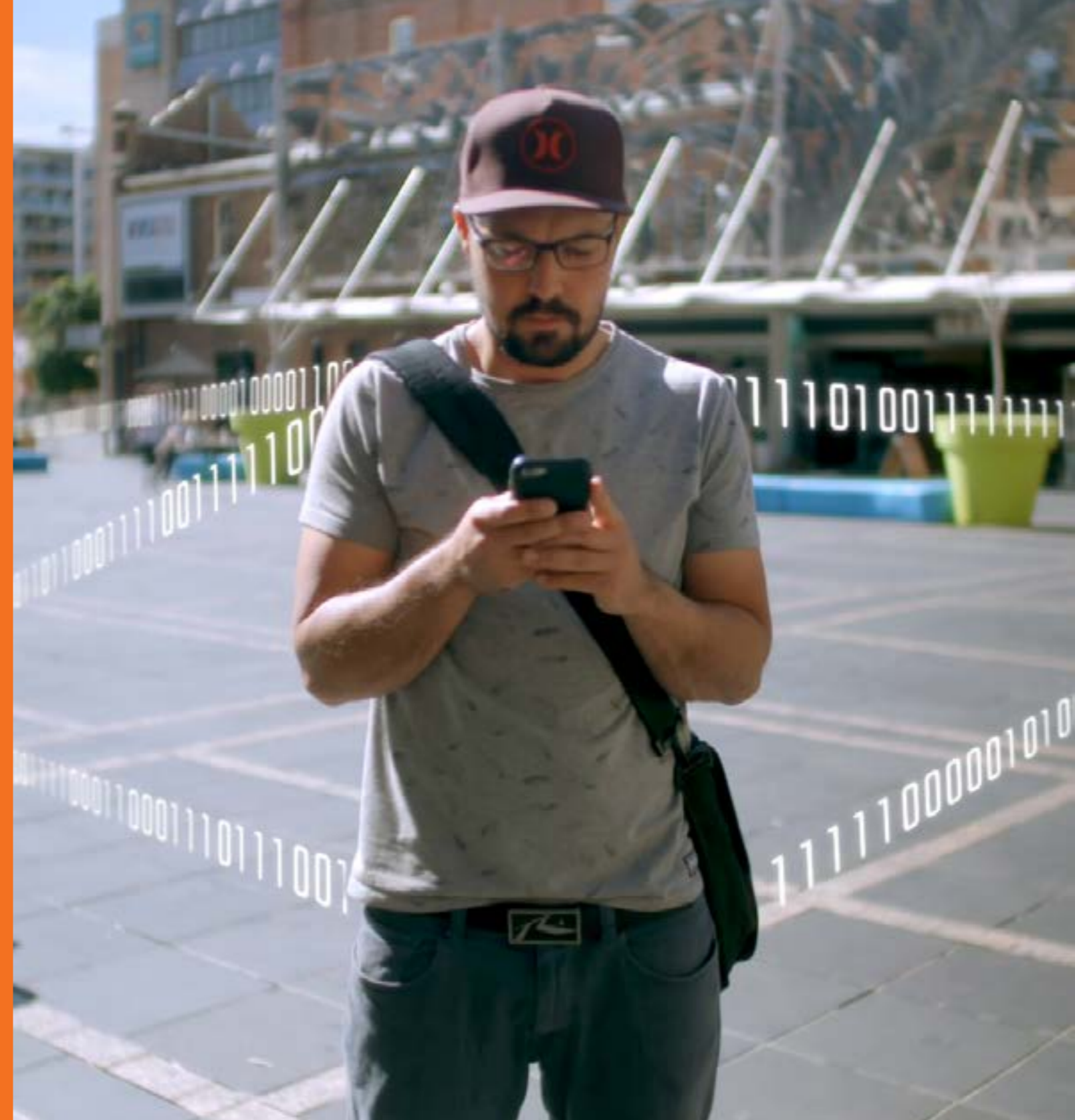
Key projects underway enhancing the liveability and amenity of the city centre include:

- Smart parking, lighting and free public WiFi
- Transport network upgrades including CBD light rail and transport on-demand buses
- Award-winning Bathers Way development and coastal revitalisation
- Improvements and upgrades to the city's green heart at Blackbutt
- Waterfront redevelopments continuing to deliver on Honeysuckle's potential

- City centre light rail and new north-south connectivity between the city and the harbour
- Public domain upgrades for Hunter Street and East End, Civic Park, Wheeler Place, Market Street Lawn and the West End

The Smart City Strategy will work with key partners to identify and implement opportunities for utilising technology in creating a more liveable city that is simpler to move around, and making it a vibrant and easy place in which to undertake business and socialise.

5. Pride and Promotion

A smart city is one that uses its resources effectively, and that harnesses its human potential and provides opportunity for its people. It is also a city that has a vision of its place in the world, and works to obtain that ambition. A smart city therefore engages its people in the process of shaping the future of the city, and gives them reason to be proud.

Recent community consultation events have identified that Newcastle residents are proud of their city and want to be able to continue to uplift and maintain the city's assets and identity.

However, in order to attract and retain creative and innovative people as well as see business growth and development within the city of Newcastle, there will need to be promotion of civic pride. Civic pride relates to how places promote and defend local identity and autonomy. It is an integral feature of a city, but its meaning and significance may sometimes be overlooked. Civic pride occurs at government, community and individual levels through successful execution of cultural policies that facilitate and promote identity formation.

Novocastrians have many reasons to be proud. The city is the Australian exemplar of successful transition to a post-industrial knowledge-based services economy. At the same time, the engineering and manufacturing expertise and depth of capability bequeathed us by the industrial past is acknowledged as genuinely world-class. This is an incredible resource as the region seeks to re-purpose these capabilities into 21st century growth sectors such as advanced manufacturing, precision health, internet of things and smart agriculture. Many challenges remain, particularly related to ongoing diversification of the economy, the need to provide high quality jobs and to address youth underemployment.

There are numerous current initiatives from across the city that provide cause for civic pride and add to the coherent promotion of the city:

- World-class research institutes including University of Newcastle, CSIRO Energy, Newcastle Institute for Energy and Resources, and Hunter Medical Research Institute
- Repeat winner of the World Festival and Events City awards
- Acknowledgment by Lonely Planet and National Geographic as a must-see destination
- Global interest in the homegrown Renew Newcastle cultural-led revitalisation model

The Smart City Strategy will bring together these many narratives and provide a consistent message across Australia that Newcastle, powerhouse of the industrial age, is embracing the challenges of the future with confidence.

COMMUNITY & STAKEHOLDER ENGAGEMENT

The vision for Newcastle as a smart and innovative city requires all three levels of government, the community, educational and research providers and business and industry sectors to work together to achieve a shared vision.

Stakeholder engagement with these groups has been central to ensuring that the Strategy is a shared vision. A range of activities were undertaken to engage with stakeholders with the aim to:
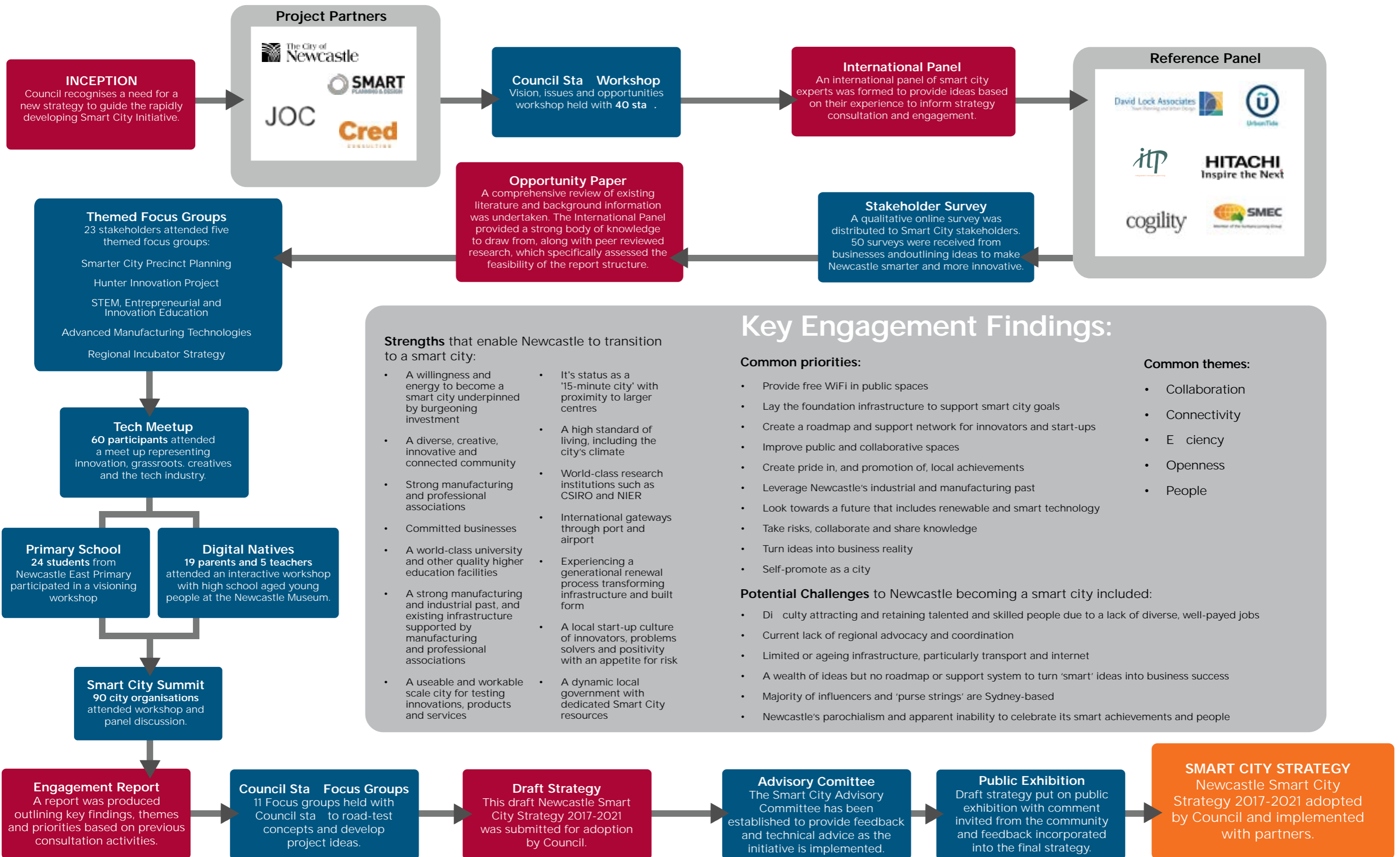
- Create a common vision for making Newcastle a smarter and more innovative city
- Define what a smart city is within the Newcastle context
- Audit what is already happening in Newcastle
- Collect ideas for what was possible and input into how to get there

The Newcastle Smart City Strategy is a collaborative strategic planning document that guides both Council and city stakeholders and partners into the future.

Newcastle boasts a number of assets that provide the foundations for it to become a globally recognised Smart City. With a strong industrial past, the city not only has the hard infrastructure for manufacturing but also the skills, knowledge and reputation. Other assets include its strong creative community of people who create things and have ideas, its walkable scale, its liveability and its quality education system.

THE ENGAGEMENT PROCESS   . . . WHAT YOU TOLD US

Project Partners

The City of Newcastle

SMART PLANNING & DESIGN

JOC

Cred CONSULTING

INCEPTION
Council recognises a need for a new strategy to guide the rapidly developing Smart City Initiative.

Council Sta   Workshop
Vision, issues and opportunities workshop held with **40 sta** .

International Panel
An international panel of smart city experts was formed to provide ideas based on their experience to inform strategy consultation and engagement.

Reference Panel

David Lock Associates

UrbanTide

itp

HITACHI Inspire the Next

cogility

SMEC

Themed Focus Groups
23 stakeholders attended five themed focus groups:

Smarter City Precinct Planning

Hunter Innovation Project

STEM, Entrepreneurial and Innovation Education

Advanced Manufacturing Technologies

Regional Incubator Strategy

Opportunity Paper
A comprehensive review of existing literature and background information was undertaken. The International Panel provided a strong body of knowledge to draw from, along with peer reviewed research, which specifically assessed the feasibility of the report structure.

Stakeholder Survey
A qualitative online survey was distributed to Smart City stakeholders. 50 surveys were received from businesses andoutlining ideas to make Newcastle smarter and more innovative.

Tech Meetup
60 participants attended a meet up representing innovation, grassroots. creatives and the tech industry.

Primary School
24 students from Newcastle East Primary participated in a visioning workshop

Digital Natives
19 parents and 5 teachers attended an interactive workshop with high school aged young people at the Newcastle Museum.

Smart City Summit
90 city organisations attended workshop and panel discussion.

Engagement Report
A report was produced outlining key findings, themes and priorities based on previous consultation activities.

Council Sta   Focus Groups
11 Focus groups held with Council sta   to road-test concepts and develop project ideas.

Draft Strategy
This draft Newcastle Smart City Strategy 2017-2021 was submitted for adoption by Council.

Advisory Comittee
The Smart City Advisory Committee has been established to provide feedback and technical advice as the initiative is implemented.

Public Exhibition
Draft strategy put on public exhibition with comment invited from the community and feedback incorporated into the final strategy.

SMART CITY STRATEGY
Newcastle Smart City Strategy 2017-2021 adopted by Council and implemented with partners.

Key Engagement Findings:

Strengths that enable Newcastle to transition to a smart city:

- A willingness and energy to become a smart city underpinned by burgeoning investment
- A diverse, creative, innovative and connected community
- Strong manufacturing and professional associations
- Committed businesses
- A world-class university and other quality higher education facilities
- A strong manufacturing and industrial past, and existing infrastructure supported by manufacturing and professional associations
- A useable and workable scale city for testing innovations, products and services

- It's status as a '15-minute city' with proximity to larger centres
- A high standard of living, including the city's climate
- World-class research institutions such as CSIRO and NIER
- International gateways through port and airport
- Experiencing a generational renewal process transforming infrastructure and built form
- A local start-up culture of innovators, problems solvers and positivity with an appetite for risk
- A dynamic local government with dedicated Smart City resources

Common priorities:

- Provide free WiFi in public spaces
- Lay the foundation infrastructure to support smart city goals
- Create a roadmap and support network for innovators and start-ups
- Improve public and collaborative spaces
- Create pride in, and promotion of, local achievements
- Leverage Newcastle's industrial and manufacturing past
- Look towards a future that includes renewable and smart technology
- Take risks, collaborate and share knowledge
- Turn ideas into business reality
- Self-promote as a city

Potential Challenges to Newcastle becoming a smart city included:

- Di   culty attracting and retaining talented and skilled people due to a lack of diverse, well-payed jobs
- Current lack of regional advocacy and coordination
- Limited or ageing infrastructure, particularly transport and internet
- A wealth of ideas but no roadmap or support system to turn 'smart' ideas into business success
- Majority of influencers and 'purse strings' are Sydney-based
- Newcastle's parochialism and apparent inability to celebrate its smart achievements and people

Common themes:

- Collaboration
- Connectivity
- E   ciency
- Openness
- People

NEWCASTLE SMART CITY

Our future city could look like this

SMART SCREENS
Interactive smart screens around the CBD provide information to help people find out the latest on what's going on in the city.

SMART BINS
Sensors linked to the IoT platform collect data on the city and transform everyday items into smart infrastructure. Bin sensors will detect when bins are full and optimise collection routes.

SMART ENERGY
Buildings are powered by the sun through solar panels connected to battery storage.

SMART MOBILITY
All forms of transport are linked together to make getting around simple and seamless. Timetables are synced and vehicle locations provided in real time to provide a better travel experience.

ELECTRIC VEHICLE CHARGE POINTS
Electric vehicle charge points are available around the city to recharge electric cars and other e-vehicles, all powered by the smart grid.

SMART CITY APP
A city app makes information on the city easily available. What's on in Newcastle, how to get to music venues and restaurants, or real time transport info is simple and up-to-date.

SMART PARKING AND TRAFFIC SENSORS
Sensors in the street detect available parking and send data to drivers. Intelligent traffic systems provide information to help driver's better handle congestion or accidents.

INTERNET OF THINGS (IOT)
An IoT platform connects almost any device in the city to the internet and to each other. Apps, sensors, and smart city applications generate data on the city.

INNOVATION HUB AND DIGITAL SANDBOX
City data collected through the IoT Platform is provided to the Innovation Hub for entrepreneurs, start-ups, researchers and students to experiment and collaborate on ideas for improving the city.

UNDERGROUND FIBRE OPTIC CABLING
Fibre optic cables run underground throughout the city bringing high-speed data and information to business, students, visitors and residents. The fibre-enabled city is attractive and more liveable.

FUTURE EDUCATION
The smart city has a University at its heart. NewSpace uses new ways of teaching and researching to drive forward our thinking about the challenges of the future.

PUBLIC WIFI
Free public WiFi is available providing high speed quality internet access no matter where you are in the CBD.

INTERACTIVE PLAY FEATURES
Sensor-based interactive lighting and water features create a dynamic public domain and provide entertainment and bring innovation to the city streets.

TECHNOLOGY IN THE STREET
Light rail stops with sensor-based smart lighting and technologies including interactive information screens, device charging, WiFi hotspot and help points to make life easier and safer.

SMART LIGHTING
Smart poles provide energy efficient LED lighting, but that's not all. Each pole can house WiFi signal points, sensors, public address system and more.

SMART PARKING APP
A smart parking app will guide drivers quickly to the best available parking spot near their destination; pay by phone and top up remotely.

This is an indicative illustration only.

LAMAN ST
KING ST
HUNTER ST
WORKSHOP WAY
HUNTER RIVER
N

STRATEGIES AND ACTIONS

The Smart City Strategy has been structured around six major focus areas, depicted as the Smart City Mandala. This mandala represents a model of smart city prioritisation and development adopted from Boyd Cohen's ground-breaking international framework.

The engagement process undertaken in preparation of this strategy sought to apply this smart city model to the local cultural and economic context. In order to achieve this goal a specific high-level objective was developed for each of the six focus areas, tailored to reflect community ambition and stakeholder feedback, and collectively deliver on the Newcastle smart city vision.

The six objectives aim to deliver positive change to the community, as well as improve planning, management and infrastructure. In addition, they reflect and integrate with the seven strategic directions that form the basis for *Newcastle 2030*.

Six focus areas

To further develop the approach as a response to the local context, each focus area within the Mandala is underpinned by a number of supporting sub-strategies, which have been developed through internal and external stakeholder engagement and according to international best practice.

These sub-strategies will be delivered through a program of corresponding actions that will build on one another over the life of the strategy.

The overall result is the adoption of international best practice methodology, thoroughly prioritised and developed to the local conditions and opportunities. The remainder of this document outlines the strategic framework and action plan across four years of the Newcastle Smart City Strategy.

How to read the following strategies and actions tables

Year the project is scheduled:

1	2017 - 18
2	2018 - 19
3	2019 - 20
4	2020 - 21
5+	2021+

Council's Role is broken into five key areas of responsibility

Lead	Council lead action
Collaborate	Council as an equal partner
Support	Council as an enabler
Advocate	Council taking an advocacy role
Investigate	Council conducting research and feasibility studies

SUMMARY OF KEY STRATEGIES

Smart Mobility

Objective: A city with connected technology-enabled infrastructure for multiple modes of mobility, that innovates towards future transport modes and prioritises walking and cycling

Strategy 1: ICT Integrated Multi-Modal Transport Planning
Deploy information communication technology initiatives that collect and leverage data supporting integrated transport

Strategy 2: Active Travel
Deploy and leverage city technology and digital platforms to enhance the delivery of cycleway and walkable city infrastructure

Strategy 3: Future Mobilities
Develop and deliver strategy and infrastructure to enable the adoption and integration of future modes of transport and mobility

Smart Governance

Objective: A global smart city with coordinated leadership and collaboration across government, industry and business, which leads the way and connects with its citizens

Strategy 1: Digital Transformation and e-Services
Adopt digital technologies and service platforms across the city to improve Council planning, asset management and service delivery

Strategy 2: Open Data
Create and adopt policy frameworks, open standards and information technology platforms to make appropriate city datasets accessible and available to increase productivity and growth

Strategy 3: Collaborative City
Develop partnering frameworks that create opportunities for city and industry stakeholders to partner effectively and efficiently with Council across a range of initiatives

Strategy 4: Digital Citizenship
Use digital platforms to enable improved communication and engagement between citizens and Council including fostering the capacity for community to influence decision-making

Strategy 5: Start-Up Led Innovation
Enable strategic interaction with start-ups, entrepreneurs and innovators to access and leverage entrepreneurial and disruptive thinking within Council

Strategy 6: Smart Policy and Procurement
Enhance policy frameworks to maximise the local economic and innovation benefits of Council strategic procurement

Smart Living

Objective: A city that makes life easier for everyone, which uses smart technology in its public places, and that develops new ways of connecting people and improving city amenity

Strategy 1: Smart City Infrastructure
Develop and deploy city-scale technology infrastructure to improve the amenity of the city and the lives of its residents and visitors

Strategy 2: Digitally Interactive Places
Deploy interactive technologies into a high quality public domain to create well loved, active, safe places of interest, education, and discovery

Strategy 3: Virtual City
Invest in digital applications to improve planning processes, infrastructure delivery and maintenance and citizen engagement

Smart Environment

Objective: A city that applies technology and innovation to ensure a cleaner and more sustainable future

Strategy 1: Greener Places
Deliver technology interventions that enhance sustainability in urban places, parks, waterways and building management

Strategy 2: Smarter Waste
Use technology and data to encourage sustainability in resource use, and improve the efficiency of waste collection and processing

Strategy 3: Sustainable Energy
Pilot and deploy technologies that improve energy and resource sustainability across Council and the broader community

Smart People

Objective: A city that invests in people and attracts talent to the area, which creates opportunities through emerging smart technologies and enables everyone to participate

Strategy 1: City Data
Enable access and utilisation of city data to improve planning, stimulate economic development, attract people to Newcastle and make people's lives easier

Strategy 2: Digital Inclusion
Provide access to digital technologies to reduce the digital divide, improve digital literacy and ensure equitable community access

Strategy 3: Digital Creative Newcastle
Provide access to city digital platforms to support creative industries and broaden audiences for supporting local cultural production

Strategy 4: Community Lab
Build capacity in understanding, engagement and interaction with emerging technologies to enable communities to participate meaningfully

Smart Economy

Objective: A city that invests in innovation and provides a roadmap and infrastructure to support successful business outcomes and attract industry and investment in smart sectors

Strategy 1: Innovation Ecosystem
Actively develop the regional innovation ecosystem's capacity to nurture businesses, artists, creatives and innovators and generate economic growth in key industry sectors

Strategy 2: City Digital Precinct
Seed the creation of a digitally connected innovation district in the Newcastle city centre to attract businesses and industries working in the digital economy and creative industries

Strategy 3: Collaborative Living Lab
Develop a model of collaborative industry led innovation to fast-track research, development and deployment of technology prototypes and solutions

Strategy 4: Attract Future Industries
Develop new approaches to incentive structures and promotional strategies to attract 21st century business and industry and incorporate into the Newcastle Economic Development Strategy

Strategy 5: City Image
Ensure strengthening of Newcastle's city image as a smart and innovative city through all city promotion and destination branding channels

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📶🚗 SMART MOBILITY

Objective: A city with connected technology-enabled infrastructure for multiple modes of mobility that innovates towards future transport modes and prioritises walking and cycling

The smart mobility theme focuses on how people move around the city, and use technology to support transport network design and function and to promote active and multi-modal travel. Newcastle is engaging in a more inclusive approach to mobility by improving services and infrastructure around the city. Council will complement these initiatives through developing traffic mapping applications and traffic sensors, and implementing digital wayfinding as a means of encouraging tourism and travel experiences. We are also creating the infrastructure to support the uptake of future modes of transport.

Smart Mobility Strategies

Program 1	ICT Integrated Multi-Modal Transport Planning		
Strategy	Deploy information communication technology initiatives that collect and leverage data supporting integrated transport		
1.1	Work with all levels of government and Transport for Newcastle to incorporate Information and Communications Technology (ICT) and data into transport planning	1-4	Support
1.2	Advocate for Transport for Newcastle in delivery of innovative rapid bus transit transport models including transport on-demand (TOD) and dynamic routing between key city sites	1-4	Advocate
1.3	Deploy IoT-based smart traffic monitoring systems, and collect real-time data analytics on city centre transport networks	2-4	Lead
1.4	Utilise real-time transport data to support efficient transport options including multi-modal Mobility-as-a-Service (MaaS) systems and dynamic signalling infrastructure	2-4	Support
1.5	Collect transport data from multiple stakeholders in the open data portal, and publish through city apps and digital platforms	2-4	Collaborate
Program 2	**Active Travel**		
Strategy	Deploy and leverage city technology and digital platforms to enhance the delivery of cycleway and walkable city infrastructure		
2.1	Use crowdsource methods and technology to collect data on informal city cycle routes and incorporate into cycleways planning	1	Lead
2.2	Develop a program for incorporating sensor-based triggering technologies into cycleways such as right-of-way at key intersections and LED lighting or luminescent materials for key commuter routes	2-4	Collaborate
2.3	Support bikeshare networks, including E-Bikes, through strategic planning of infrastructure and network facilities	2-4	Lead/Support
2.4	Deploy night-time wayfinding systems utilising digital components (apps, projections) to increase safe pedestrian mobility within night-time precincts	3	Lead
Program 3	**Future Mobilities**		
Strategy	Develop and deliver strategy and infrastructure to enable the adoption and integration of future modes of transport and mobility		
3.1	Develop the city centre IoT platform to enable use of the city as a test-bed facility for new mobilities technology including MaaS networks and autonomous and connected vehicles	1-4	Lead/Collaborate
3.2	Develop a plan for the transition of Council's fleet towards electric vehicles, including E-bikes for Council staff to use for short city centre work-related trips	1-4	Lead
3.3	Pilot smart transport real-time dynamic signalling through the city centre to manage vehicle flow and congestion and advocate for wider deployment	2-3	Collaborate
3.4	Work with research partners, transport providers and technology vendors to develop and test new mobilities technologies and regulatory innovations in Newcastle	2-4	Collaborate
3.5	Investigate opportunities for including rideshare (e.g. GoGet) as a proportion of Council's fleet to reduce fleet costs and increase vehicle use	3	Investigate

SMART GOVERNANCE

Objective: A global smart city with coordinated leadership and collaboration across government, industry and business, which leads the way and connects with its citizens.

The smart governance theme focuses on how Council operates and sets policy to achieve the smart city vision. This includes our own adoption and use of technology and digital services, how we think about data and use it to improve asset management and our service delivery and make these processes more transparent, and how we organise our relationships across the city with external partners, industry, start-ups and citizens.

Smart Governance Strategies

Program 1	Digital Transformation and e-Services		
Strategy	Adopt digital technologies and service platforms across the city to improve Council planning, asset management and service delivery		
1.1	Develop and implement corporate cloud hybrid data storage and recovery including investigating opportunities for a regional data centre co-invested with key city partners	1-2	Lead/Collaborate
1.2	Upgrade real time management of Council assets including GPS system for heavy fleet, digital asset inventory and integrated works programming	1-3	Lead
1.3	Enable digital services including online submission and tracking of development applications, public exhibition submissions and grants management	1-4	Lead
1.4	Investigate online and remote customer service assistance through telepresence facilities and virtual conversational interfaces such as digital concierges	2-3	Investigate

Program 2	Open Data		
Strategy	Create and adopt policy frameworks, open standards and information technology platforms to make appropriate city datasets accessible and available to increase productivity and growth		
2.1	Adopt Internet of Things (IoT) and metadata standards to ensure interoperability and searchability of diverse data sets	1	Lead
2.2	Develop a strategic approach to open data within Council that includes open-by-default clauses and data licensing frameworks	1-2	Lead
2.3	Create a city open data portal to make freely available council open data sets, city IoT data, and archival big data	2	Lead
2.4	Establish data-sharing arrangements with city stakeholders and data partners to publish open data through the open data portal	2-4	Collaborate

Program 3	Collaborative City		
Strategy	Develop partnering frameworks that create opportunities for city and industry stakeholders to partner effectively and efficiently with Council across a range of initiatives		
3.1	Develop the iQ events series as a regular city stakeholder engagement and collaborative strategic program	1	Lead
3.2	Develop a City Partnering Framework to identify and promote all opportunities for partnering with the City on the Newcastle Smart City Initiative and the Hunter Innovation Project	1	Lead
3.3	Engage with key city land and asset owners to integrate smart city technology capabilities as part of flagship city revitalisation projects	1-4	Advocate
3.4	Create an online portal for informing industry and start-ups about current and future project partnering opportunities and as a mechanism to receive innovative partner proposals	2	Lead

Program 4	Digital Citizenship		
Strategy	Use digital platforms to enable improved communication and engagement between citizens and Council including fostering the capacity for community to influence decision-making		
4.1	Accelerate adoption and rollout of digital consultation tools and platforms	1-3	Lead
4.2	Explore and evaluate digital and app technology enabling resident reporting of issues relating to Council assets and services	2	Investigate
4.3	Develop a digital citizen engagement platform to improve Council-to-citizen and peer-to-peer (P2P) communication between city residents, workers, visitors and business and to incentivise behaviour change through challenge and rewards style programs	2	Lead
4.4	Utilise social media data mining to map social networks and identify and engage with key influencers and change agents across issues	3	Lead

Program 5	Start-Up Led Innovation		
Strategy	Enable strategic interaction with start-ups, entrepreneurs and innovators to access and leverage entrepreneurial and disruptive thinking within Council		
5.1	Support innovation-based events and programs that enable Council to propose challenges for collaborative problem solving	1-4	Collaborate
5.2	Run an annual staff engagement and voting process for identifying Council challenges and opportunities to be addressed through hackathon challenges and start-up engagement	2	Lead
5.3	Develop a 'Start-Up Matchmaker' program of bi-annual pitch events to connect Council business units with start-ups, and supported by an internal pilot development fund to part-subsidise innovative proof of concept projects	2-4	Collaborate
5.4	Develop a business case for an annual Start-up in Residence Program (StiR) to embed a start-up inside an interdisciplinary Council team to co-design a solution to a key challenge priority	3	Investigate

Program 6	Smart Policy and Procurement		
Strategy	Enhance policy frameworks to maximise the local economic and innovation benefits of Council strategic procurement		
6.1	Review and update relevant policy frameworks to appropriately support the adoption of innovative proposals, fast-track pilot technology deployments, and local economic development in tender and procurement processes	1-2	Lead
6.2	Create a technology, digital and innovation-themed competitive grants stream within the Economic Development Sponsorship Program designed to foster smart city-related activities	2	Lead
6.3	Ensure that savings and revenue from smart city infrastructure deployments are directed to a general fund for maintaining existing and funding future smart city projects	2-4	Lead
6.4	Explore the creation, with city partners, of a City Fund for investing in technology focused creative industries that are unique to the Hunter Region	3	Investigate

SMART LIVING

Objective: A city that makes life easier for everyone, which uses smart technology in its public places, and that develops new ways of connecting people and improving city amenity

The smart living theme will identify, deploy and leverage technology and digital applications to improve the liveability, amenity and experience of the city. It hinges foremost on the development of advanced digital connectivity and smart technology in the city centre, which enables sensors and devices to connect and share information, and to generate insights from this data to identify further opportunities for city improvements and community ingenuity.

Smart Living Strategies			
Program 1	**Smart City Infrastructure**		
Strategy	Develop and deploy city-scale technology infrastructure to improve the amenity of the city and the lives of its residents and visitors		
1.1	Deploy WiFi with free public access across the City Centre, including within Council-owned cultural facilities and public buildings	1-2	Lead
1.2	Create a secure Internet of Things (IoT) platform in the city centre that includes sensor array and integrated data analytics, and utilise for smart city applications	1-4	Lead
1.3	Develop a smart parking network in the city centre including sensors, wayfinding and payments apps, dynamic signage and digital permit systems	2	Lead
1.4	Deploy an electric vehicle (EV) charge point network and infrastructure and promote through an EV-friendly city campaign	2-4	Lead
1.5	Incorporate technology infrastructure products into the public domain technical manual to ensure the progressive rollout of smart city infrastructure beyond the city centre	2	Lead
1.6	Pilot smart crime prevention applications with key city partners including Newcastle Police to improve community safety and security	2-3	Collaborate

Program 2	**Digitally Interactive Places**		
Strategy	Deploy interactive technologies into a high quality public domain to create well loved, active, safe places of interest, education, and discovery		
2.1	Install a network of interactive digital screens in public spaces throughout the city centre and local town centres and create an open-ended range of city apps to improve city amenity, local business opportunities and information services	1-4	Lead
2.2	Develop a program for installing a Bluetooth beacon network across the city and utilise to provide place specific wayfinding and city information	2	Lead
2.3	Utilise beacon network and sensor technologies to create interactive interpretation sites and deliver city information including interactive city tours, creative placemaking content and environmental education	2-5+	Lead/Collaborate
2.4	Utilise sensor-based technology in the design of play features within public space design (e.g. interactive lighting and water features)	2-5+	Lead

Program 3	**Virtual City**		
Strategy	Invest in digital applications to improve planning processes, infrastructure delivery and maintenance and citizen engagement		
3.1	Continue to build capability within the 3-D city model including exploration of innovative data capture and enabling importation of digital assets from professional and community stakeholders	1-4	Lead
3.2	Encourage virtual reality (VR) and augmented reality (AR) applications for heritage, arts and culture, events, education and training	1-4	Lead/Collaborate
3.3	Provide and promote access to the 3-D city model across Council to leverage its use for predictive urban planning, modelling and novel Council applications	3	Lead
3.4	Investigate augmented reality (AR) applications that can be used in city development processes to inform community and gather feedback	3	Investigate

SMART ENVIRONMENT

Objective: A city that applies technology and innovation to create a cleaner and more sustainable future

The smart environment theme aims to enhance the use of innovative technology and data in natural, aquatic and built environment management. This includes accelerating our adoption of renewables, visionary transformation of the Summerhill site into a future energy centre, encouraging a higher quality of urban design and a greener city, and getting smarter about our resources, including water sensitive design and re-use of waste.

Smart Environment Strategies			
Program 1	**Greener Places**		
Strategy	Deliver technology interventions that enhance sustainability in urban places, parks, waterways and building management		
1.1	Review and update Newcastle 2020 Carbon and Water Management Action Plan	1	Lead
1.2	Develop a program for installing Internet of Things (IoT) sensor clusters across the local government area (LGA) to monitor environmental conditions in urban, natural and aquatic environments	1-4	Lead
1.3	Pilot with CSIRO and other research institutes intelligent building controls and occupant engagement in key Council facilities to create smarter, more energy efficient buildings	2	Collaborate
1.4	Implement smart controls and management systems for booking and managing Council-owned park floodlights	2	Lead
1.5	Pilot with CSIRO predictive electric hot water heating and storage in key Council facilities to improve energy and water efficiency	2-4	Collaborate
1.6	Develop business case for enhancing building management systems in Council facilities towards fully IoT-enabled building information modelling (BIM) and remote monitoring and management capability	3-4	Investigate

Program 2	**Smarter Waste**		
Strategy	Use technology and data to encourage sustainability in resource use, and improve the efficiency of waste collection and processing		
2.1	Pilot and deploy smart bin infrastructure in the city centre, including the use of waste data to identify key bin locations based on demand	2	Lead
2.2	Utilise sensors for domestic garbage pick-up to collect waste data to charge by weight and incentivise recycling	2	Lead
2.3	Install reverse vending machines to engage the community and provide incentives to reduce waste through a container deposit scheme	3	Lead
2.4	Investigate and pilot large-scale waste-to-energy technology and plant as part of long-term transformation of Summerhill into an Energy Centre	4-5+	Investigate

Program 3	**Sustainable Energy**		
Strategy	Pilot and deploy technologies that improve energy and resource sustainability across Council and the broader community		
3.1	Work with Ausgrid to pilot LED upgrades and seek Clean Energy Finance Corporation (CEFC) funding to accelerate whole-of-local government area (LGA) LED street light replacement program	1-2	Collaborate
3.2	Develop a mid-scale Summerhill Solar Farm project (5 megawatt capacity) to offset Council energy use and greenhouse emissions	1-3	Lead
3.3	Trial and deploy smart lighting across the city centre via integrated smart pole technology and then roll out to town centres	1-5+	Lead
3.4	Develop Virtual Net Metering capabilities to aggregate city's solar capacity and offset energy usage across key assets (towards 100% renewables)	2-4	Lead
3.5	Expand solar battery storage capacity and create scalable, storage networks across Council assets including investigating investment in megawatt scale batteries co-located with Summerhill Solar Farm Project	3-4	Lead/Investigate
3.6	Investigate opportunities with state and federal government to facilitate loan finance accelerating uptake of community solar PV, battery storage and EV	3-4	Lead/Collaborate

SMART PEOPLE

Objective: A city that invests in people and attracts talent to the area, which creates opportunities through emerging smart technologies and enables everyone to participate

A smart city is ultimately about people. Newcastle is actively promoting its assets and facilities to engage and retain smart people. This theme of the strategy will deliver initiatives that aim to address the digital divide, and ensure an inclusive city environment. It will work to equip community with the skills to engage fully with the smart city, and create opportunities for creative expression and economic growth through provision of open access technology and data platforms

Smart People Strategies

Program 1	City Data		
Strategy	Enable access and utilisation of city data to improve planning, stimulate economic development, attract people to Newcastle and make people's lives easier		
1.1	Develop a city App for easy access to Council services and information on the city	1-2	Collaborate
1.2	Create a customisable city dashboard for quick visualisation of key city data indicators for citizens and visitors	2	Lead
1.3	Develop experimental data 'sandbox' and appropriate licensing agreements for high value real-time city IoT data for innovation hubs, researchers and entrepreneurs	2-3	Collaborate
1.4	Encourage community use of city data through free access and promotional programs encouraging people to identify and request datasets they want on the portal, dashboard and sandbox	2-4	Collaborate

Program 2	Digital Inclusion		
Strategy	Provide access to digital technologies to reduce the digital divide, improve digital literacy and ensure equitable community access		
2.1	Incorporate standards enhancing disability inclusion principles into all smart city technology installations, digital platforms and city apps	1	Collaborate
2.2	Adopt programming to increase community levels of digital literacy around cyber security, e-commerce, privacy and big data	1-4	Lead
2.3	Provide support for community access courses such as U3A, Children's University, Tech Savvy Seniors and Coder Clubs	1-4	Support
2.4	Create 'We Lend Tech', a lendable collection through the Newcastle Region Library that provides affordable access to internet, mobile devices, virtual and augmented reality and other emerging technologies	2-4	Lead
2.5	Pilot, deploy and promote inclusive smart assistive technology in the public domain to improve equity of access to the city	2-4	Collaborate

Program 3	Digital Creative Newcastle		
Strategy	Provide access to city digital platforms to support creative industries and broaden audiences for culture supporting local cultural production		
3.1	Increase the regular presentation of technology-based arts and science creative content across Council's cultural facilities (Gallery/ Museum/Theatre)	1-4	Lead
3.2	Pilot and undertake the digitisation of city creative works collections and make them available through virtual programming and self-curated collections	1-4	Lead/Collaborate
3.3	Facilitate and broker relationships between creative producers and funders through creative hackathons and pitch events	2-4	Collaborate
3.4	Support local cultural production by providing local designers, creatives and tech start-ups access to city digital platforms to showcase original creative content	3-4	Support

Program 4	Community Lab		
Strategy	Build capacity in understanding, engagement and interaction with emerging technologies to enable communities to participate meaningfully		
4.1	Develop a community lab program including free IoT sensor kits, access to city data and the low-power wide-area network (LPWAN) and specialist mentoring and expert advice to encourage community IoT projects	1-3	Lead/Collaborate
4.2	Establish a community Makerspace in the Newcastle Region Library and use for technology-centric community programming such as coding clubs, robotics and mechatronics workshops, IoT labs, and citizen science courses	1-4	Lead
4.3	Develop integrated programming with University of Newcastle and NSW TAFE tech centres and digital fabrication studios to enable community lab participants access to specialised equipment, or to progress into more formal innovation processes	2	Collaborate
4.4	Create a 'supernova-style' interactive demonstration space to showcase and translate new technologies for the general community	2-3	Lead
4.5	Recruit an active panel of community members interested in participating as test audiences and co-creators in Living Lab projects	2-4	Lead

SMART ECONOMY

Objective: A city that invests in innovation and provides a roadmap and infrastructure to support successful business outcomes and attract industry and investment in smart sectors

The smart economy theme will work to further encourage diversification of the city and regional economy towards the growth areas of the 21st century. Newcastle's strengthening economy is a result of diligent collaboration between the government, local businesses and the community. This focus area will undertake to better understand and enable collaboration and growth in the innovation ecosystem, create a city environment conducive to the digital and technology-led sectors, and develop business attraction and promotional strategies to bring the industries of the future to Newcastle.

Smart Economy Strategies			
Program 1	**Innovation Ecosystem**		
Strategy	Actively develop the regional innovation ecosystem's capacity to nurture businesses, artists, creatives and innovators and generate economic growth in key industry sectors		
1.1	Lead the collaborative strategic development to establish the Hunter Regional Incubator network and associated projects	1	Lead/Collaborate
1.2	Conduct regional ecosystem auditing and mapping and use to develop an online, virtual ecosystem tool for navigating and enhancing the collaborative potential of the innovation ecosystem	1-2	Lead
1.3	Review and update the Newcastle economic development strategy to incorporate short and long-term strategic actions for the local innovation ecosystem	2	Lead
1.4	Engage with government and the finance sector to identify and implement commercialisation and investment support structures and international market access pathways for local business	2-4	Collaborate
Program 2	**City Digital Precinct**		
Strategy	Seed the creation of a digitally connected innovation district in the Newcastle city centre to attract businesses and industries working in the digital economy and creative industries		
2.1	Engage stakeholders to map the short and long-term ambitions for the City Digital Precinct as an interdisciplinary innovation district	1	Lead
2.2	Work with city partners and government agencies to entice high profile institutions and corporates to the City Digital Precinct as anchor tenants and magnet attractors	1-4	Collaborate
2.3	Work with partners to develop incentive and support packages for start-ups and small to medium enterprises (SMEs)	2	Collaborate
2.4	Work with Renew Newcastle and Newcastle NOW to create an effective legal framework and promotional products to identify appropriate spaces to support graduating businesses from hubs and incubators into the City Digital Precinct	2-3	Collaborate
2.5	Develop promotional material and engage a public relations firm to promote the City Digital Precinct nationally and internationally	3	Lead
Program 3	**Collaborative Living Lab**		
Strategy	Develop a model of collaborative industry led innovation to fast-track research, development and deployment of technology prototypes and solutions		
3.1	Create a Living Lab as a model of collaborative innovation based on regional competitive advantages including energy and resources, advanced manufacturing, transport, health, and smart city applications	1	Collaborate
3.2	Support establishment of a smart city research capability within the University of Newcastle to provide independent evaluation of technologies and lab projects	1-4	Collaborate/Support
3.3	Invite technology, research partners and start-ups to access the smart city to prototype, pilot and evaluate new technologies and urban infrastructure and services that address local, state and national level urban challenges and priorities	2	Lead
3.4	Create a Local Industry Network Collaborative (LINC) as an organised assembly of local industry players who can be accessed for living lab projects	2	Lead
Program 4	**Attract Future Industries**		
Strategy	Develop new approaches to incentive structures and promotional strategies to attract 21st century business and industry and incorporate into the Newcastle Economic Development Strategy		
4.1	Plan for future industries across the local government area including appropriate land use, and identifying a city competitive advantages and incentives framework, and a coordinated business attraction strategy targeting growth sectors and high value industries	1-2	Lead
4.2	Work with Port Stephens Council and Williamtown Aerospace Centre to support the growth of advanced aerospace, defence and associated industries in Newcastle and the Hunter	2	Collaborate
4.3	Engage with NSW and Federal Government agencies to develop incentive packages to attract key industry and research players to city	2-4	Collaborate
4.4	Develop with key partners, including Austrade, a national and international promotional program for future Industries in Newcastle	3	Collaborate
Program 5	**City Image**		
Strategy	Ensure strengthening of Newcastle's city image as a smart and innovative city through all city promotion and destination branding channels		
5.1	Undertake strategic smart city marketing campaigns such as Newcastle 360 which leverages city alumni networks	1	Lead/Collaborate
5.2	Partner with stakeholders to develop and deliver coordinated and targeted strategies to promote the Hunter to national and international start-up, entrepreneur and investor markets	1-2	Collaborate
5.3	Promote Newcastle and the Hunter Region nationally and internationally as a diverse, desirable and dynamic innovation ecosystem	1-4	Lead/Collaborate
5.4	Develop and deliver an international profile, signature technology and innovation themed festival for Newcastle, and leverage as a driver for innovation and prototyping, and advancement of key industry sectors	1-4	Lead
5.5	Identify and participate in key international networks, organisations and events to further the profile of the city	1-4	Lead

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PHOTO CREDITS

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