



Evaluation of the Smart Cities Programme
2015-2016
Land Information New Zealand

Final Report

December 2016

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Glossary

Word	Definition
CCOC	Cloud City Operation Centre – an internet based system constructed by NEC which creates a standardised ‘Internet-of-Things’ platform which can send and receive data from numerous sensors and devices, with the ability to display key metrics and maps from each of those devices.
Effectiveness	The extent to which a programme or project achieves its immediate objectives or produces its desired outcomes.
Efficiency	The optimal transformation of inputs to outputs.
Evaluation	The systematic determination of quality, value, and importance of something ¹ .
Evaluation criteria	Categories that are used to systematically and transparently make an evaluative judgement in a meaningful and informative way. These broad categories are supported by performance criteria (and definitions of these performance criteria). See Performance Criteria.
Frameworks	A skeleton (or scaffolding) of aligned items/components which support a particular approach (to achieve something).
Hub	A collaborative online platform, used as a key programme management and evaluation tool for capturing, managing, and sharing documents, data, and learnings, and facilitating discussion between all stakeholders.
Impact	The positive and negative changes produced by an organisation/programme/project both direct, indirect, intended, and unintended. Also see Outcomes/Impacts above.
Inputs	The money, materials, equipment, staff, consultants, and other resources that are required for a programme or project to happen.
Integrated Way of Working (WoW)	Integrated approach to evaluative monitoring and evaluative thinking that focuses on a collaborative and adaptive project management style. Follows a phased approach through ‘plan’, ‘monitor’, and ‘change’ stages that support and underpin a continuous learning and improvement cycle.
KITE	A sensor device created by NEC to rapidly measure data and send information to a platform
Model	A diagrammatic depiction of how a project/programme/intervention/area of focus/organisation intends to achieve its desired results/outcomes. Also known as/referred to as a ‘logic model’, ‘intervention logic’, ‘results diagram’ and other similar terms. Components include inputs, activities, outputs and outcomes/impacts (see below).
Outcomes/impacts	Positive and negative, primary and secondary effects (changes) produced by an intervention, directly or indirectly, intended or unintended. NOTE: Outcomes and Impacts can be used interchangeable, but <i>in general</i> Outcomes often refer to the intended changes, and Impacts refers to all changes that occur (such as positive or negative unintended changes).

¹ Aotearoa New Zealand Evaluation Association (Anzea) August 2014: <http://www.anzea.org.nz/evaluation/what-is-evaluation/>

Word	Definition
Outputs	The products, capital goods and services that results from an intervention. It may also include immediate changes resulting from the intervention, which are relevant to the achievement of the outcomes.
Qualitative	Information that is expressed in words (usually) as descriptions or distinctions based on some quality or characteristic rather than on some quantity or measured value. Note that sometimes qualitative sometimes gets converted into quantitative measures (e.g., counting how many people reported 'satisfied' to a question regarding their satisfaction), typically to make reporting this information easier.
Quantitative	Information (data) that is expressed numerically (a quantity or amount) e.g., number of students, percentage graduated.
Relevance	The extent to which the activity is suited to the needs and aspirations of the 'beneficiaries'/key stakeholders of the project/programme/policy/organisation.
Sustainability	The extent to which a project, programme, or organisation is likely to continue/endure. <i>And</i> The extent to which the results of a project, programme, or activities undertaken by an organisation, are likely to continue/endure after formal assistance/support stops.

Executive summary

Background

There is a growing trend internationally and in New Zealand to see how 'smart' sensing technology can be used to more efficiently and effectively deliver services and manage assets. These types of technologies are capable of producing and displaying real-time data and trends – allowing decision-makers access to the most up-to-date and reliable information. Numerous cities around the world, such as Santander, Copenhagen, Helsinki, and Milton Keynes, have recognised the benefits of these sensing technologies for measuring the social and economic 'health' of a city in real-time as they pursue the goal of becoming 'smart' cities.

In 2015 Land Information New Zealand (LINZ), with funding from the Treasury Better Public Service Seed Fund established the Smart Cities programme. This programme sought to apply an agile approach to developing and testing 13 'smart' 'proof of concept' projects across Auckland, Wellington and Christchurch. The primary intent of the programme was to test if a central government agency could work collaboratively with multiple local councils and private companies to operationalise the use of real-time monitoring and sensing technology, with a strong focus on capturing the learnings from this 'experimental' approach.

The programme's outcomes were framed around to the Treasury Higher Living Standards, to improve the lives of New Zealand citizens through the *safe and better use of data*, as well as supporting the development of the 'Better Public Service' through innovative approaches to both infrastructure investment and inter-agency collaboration. The programme has had success in both regards, leveraging funding from multiple agencies (including the private sector), and inter-agency collaboration being highlighted as a critical success for the entire programme.

Approach

Evaluation was embedded as an integral part of the programme and the programme's management, to capture and share critical learnings. The evaluation function was embedded through the development and use of an online platform (the Smart Cities 'Hub') from the outset of the programme. The Hub was used as a repository for all project management information (including project updates and reports), information and learnings. As well as capturing learnings, the evaluation played a part in fostering a collaborative working environment. It played a key role in bringing to light and sharing relevant articles and stories about 'smart cities' and smart technology throughout the world, and facilitating and capturing 'virtual' discussions.

The evaluation approach was framed around four key points through the programme. The 'baseline', midpoint, endpoint and 'final' stages. At these points, the project information captured in the Hub was augmented by evaluation workshops (including wider stakeholders), and semi-structured interviews with internal and external stakeholders. To support the final evaluation report, a stakeholder survey was also used as a data collection tool. This was distributed by the evaluation team and the project managers to a wider group of stakeholders, both within councils and government departments, as well as private businesses involved in the implementation and delivery of smart technology solutions.

In each evaluation report, findings were presented against the following evaluation objectives: relevance, efficiency, effectiveness and impact, sustainability, the cross-cutting issue of privacy, and lessons learned. For this final evaluation report, overall judgements of the programme's performance against these areas was also completed.

Findings

The evaluation team found that overall, the programme has been highly relevant, well run, and has achieved what it set out to achieve, including identifying a number of critical learnings. Key learnings and critical success factors in the early stages of the programme surrounded stakeholder buy-in, and capturing and communicating the intent of the projects. The support (by way of funding) from central government helped to overcome this initial challenge. The concept of smart cities also gained increasing clarity over the life of the programme as more concrete examples became apparent at both a global and national level.

Over the life of the programme, all projects ran to budget and schedule. There was some slippage across multiple projects due to wait times for civil engineering inputs, and longer than expected testing and calibration time for sensors, but these delays were minor. One project succumbed to a drawn-out procurement process, needing to go back to market to contract for a visualisation tool.

Overall, the projects have delivered efficient and effective smart sensing systems, capturing and processing data to produce useful analytics that can inform decision-making. Data visualisation tools are also starting to produce digestible, real-time data. Examples include data for air quality, water quality, traffic and pedestrian counts. This data is now being used to create a more accurate picture of how these cities work, how citizens interact with their urban environment, and where council spending would be most effective.

These projects, and the programme, have also gained wide attention internationally. This has been a consequence of the innovative and unique way in which the programme has been managed and funded, as well as the cutting-edge nature of the technology and systems being implemented. A result of this attention, several project managers and NEC have been asked to speak at national and international conferences and forums and have also been asked to host international delegations interested in smart cities.

The sustainability of the programme is somewhat unclear. As the programme was designed to be a 'proof of concept,' there was no explicit incorporation or requirement to plan for the future of the programme of work beyond developing a Strategic Assessment. Some stakeholders have suggested it would be a waste if the programme did not continue, while others suggested that the programme has served its purpose as a vehicle to test these types of projects.

Conclusion and recommendations

The programme identified a number of highly valuable lessons, with wide applicability including to central and local government, private enterprise, as well as not-for-profit and others, such as the tertiary sector.

Given the learnings identified from this programme and its broader relevance to central government, planning on how to maintain the momentum and support for these projects should be considered. This programme has demonstrated smart technology as value in terms of the data and analytics that can be provided to central government agencies, but also in clarifying both central government approach (policy) to managing emerging technologies and 'big data', and decisions regarding any future crown investment in this area. Four key recommendations have been identified, which focus on disseminating the learnings widely, and exploring how to continue building on the success and momentum of the programme's achievements.

1. Introduction

1.1. Background

The term 'smart city' can be defined as 'a city that interconnects the physical infrastructure, the IT infrastructure, social infrastructure and business infrastructure to increase the collective standardised intelligence of the city.'² With urbanisation increasing globally, there is a need for councils and governments to have the most reliable and accurate data possible to make well informed policy decisions. This approach to managing a city (interconnection between modern IT, social and business infrastructures) has been developed out of a need for an accurate, real-time and innovative way to measure social metrics; population pressure being put on urban environments has an impact on the general liveability of cities – systems such as waste management, healthcare, and the wider urban environment, for example air pollution, water pollution, traffic congestion – are all affected by increasing numbers of people living, working and playing in cities. 'Smart city solutions' not only offer the ability to measure and display real-time data and metrics about when, where and how a city is used – they also offer opportunities to 'democratise,' or bring the public more actively into policy development, through the use of inclusive and open governance processes.

Throughout New Zealand, government departments, city councils as well as private businesses, have been testing new sensing technology, developed to measure specific human environment metrics. These types of technologies are capable of producing and displaying real-time data and trends, allowing decision-makers access to the most up-to-date and reliable information. Numerous cities around the world, including Santander, Copenhagen, Helsinki, and Milton Keynes, have recognised the benefits of these sensing technologies for measuring the social and economic 'health' of a city in real time.

Although there is no universal definition of 'smart cities'³, Deakin and Al Wear⁴ have identified four factors that contribute to the definition of a smart city:

1. The application of a wide range of electronic and digital technologies to communities and cities.
2. The use of information and communications technology (ICT) to transform life and working environments within the region.
3. The embedding of such ICTs in government systems.
4. The territorialisation of practices that bring ICTs and people together to enhance the innovation and knowledge they offer.

They note that the definition is not just about possessing ICT technology, but that governments (or legislative authorities) use this technology in such a way that positively impacts the local community.

Combining a co-creation approach with smart city principles and technologies offers an efficient and practical way for organisations such as local government to engage with other stakeholders (including their citizens/ratepayers) to collectively identify problems and develop solutions. Smart cities technologies can provide a platform for new engagement mechanisms, opening new possibilities and opportunities for citizen involvement in council work (e.g., mobile apps, open data, crowdsourcing, virtual design, augmented reality). Importantly, this enables citizens to have a positive influence on the development of public policy,

² Prakash, Surya; Kumar, Ashwani; Shekhar, Shashank; Khant, Abhikumar. "Understanding the concept of Smart Cities' *International Journal of Advance Engineering and Research Development* (Vol 3 – Issue 3, March 2016 pp 321)

³ See the Definition and Overviews section of the Smart Cities Council website: <http://smartcitiescouncil.com/smart-cities-information-center/definitions-and-overviews> . The Wikipedia page on Smart Cities also contains a large number of useful links and reference material. https://en.wikipedia.org/wiki/Smart_city

⁴ Deakin, Mark; Al Waer, Husam. 'From Intelligent to Smart Cities'. *Journal of Intelligent Buildings International: From Intelligent Cities to Smart Cities*. 3 (3). doi:10.1080/17508975.2011.586671.

consent processing, and service provision. Co-creation aims to move mind-sets from what technology developments can do towards what stakeholders' *need* when reshaping public services.

1.2. The Smart Cities programme

The Smart Cities programme has been funded by Treasury's Better Public Services (BPS) seed fund which intends to⁵:

- speed up development of initiatives and innovation
- reduce transaction costs and the administrative burden of cross-agency collaboration
- remove disincentives for lead and early adopter agencies to support the exploration and development of cross-agency initiatives, contributing to better public services and deliver improvements.

LINZ successfully applied to this fund to set up a Project Management Office (PMO) and undertake a series of pilot projects to explore new 'sensing technologies'. The programme intent was to capture and share learnings via a collaborative way of working; test the potential benefits of these technologies; and establish if they could contribute to enhancing citizens' quality of life and better outcomes via more efficiently and effectively managed urban environments. The learnings from the programme would then inform a Strategic Assessment, regarding the value (or not) of further investment (via more formal government funding channels) at the conclusion of the programme.

While the programme of work initially focused on Christchurch, it expanded to include Wellington and Auckland. The six key intended benefits from the programme (as outlined in the original BPS Seed Fund Application) were:

1. **Data volume and quality** – access to more data sources to improve the use of evidence in policy formation, and improve planning and decision processes (local, regional, national).
2. **Data governance** – accelerated innovation in the field of data governance, opportunity to study the required regulatory frameworks for big data and data infrastructure requirements.
3. **Built environment resilience and asset management** – improved maintenance planning, environmental impact management, asset lifetime extension, and asset utilisation and operating cost savings.
4. **Science and innovation** – attraction of international talent to experiment and develop technologies in the cities involved.
5. **International reputation and credibility** – supports sales and marketing efforts, provides proof of our claims, and demonstrates support partners, proof of ability to deliver, momentum/critical mass.
6. **Economic growth** – new business opportunities, employment and export earnings through existing and start-up companies leveraging sensor technologies and data services developed in Christchurch (now including Wellington and Auckland).

The Smart Cities programme eventually comprised of 13 'Proof of Concept' (POC) projects in Auckland (Panuku Development and Digital Auckland), Wellington (Wellington City Council), and Christchurch (Christchurch City Council) to explore the use of these 'sensing technologies.'

The programme built on initial work done in Christchurch by the Sensing Cities Trust, who championed the concept and opportunity of Smart Cities in Christchurch post-earthquake, as well as work undertaken jointly

⁵ <http://www.treasury.govt.nz/statesector/betterpublicservices/bpsseedfund>. Retrieved 26 October 2016.

by Wellington City Council and NEC following an MOU signed in May 2014. Their MOU was established reflecting a commitment and vision articulated in the council's 2011 Smart Capital Vision⁶.

The Smart Cities programme also benefited from the learnings from an early 'advanced' programme of work already underway between WCC and NEC the Safer Cities 'Living Lab' in Cuba Mall. In Auckland, Development Auckland (now Panuku Development Auckland) had established their 'Wynyard Quarter Smart'⁷ that "*aims to stimulate creativity and innovative partnerships that result in dynamic, beautiful and sustainable communities*" as part of their sustainable development framework. This programme provided a further opportunity to test innovative 'smart' solutions within their wider programme of work. Digital Auckland were already underway with projects such as the 3D reference 'visualisation' of Auckland to assist planners communicate the 20-year master plan with their technology partner Nextspace.

1.3. The role of evaluation in the Smart Cities programme

Because this programme focused on testing proof-of-concept projects, embedding evaluation into the programme was recognised as important to ensure lessons weren't lost as project managers focused on delivery. The evaluation function allowed a dedicated resource to the programme, and expertise to critically and objectively scan, gather, and present findings and lessons in a systematic and structured format (see section 2 for further details on the evaluation approach taken).

The evaluation was supported by the collection and management of all key programme data, and feedback provided to the programme stakeholders at four agreed points in time. All reports presented findings against the overall evaluation objectives, with emphasis changing with time as outlined below for the three preceding reports.

1. **The Baseline report** (completed December 2015) captured the first two-to-three months of the programme and focused on the relevancy of the programme, with some early findings regarding efficiency and effectiveness. Emerging lessons learned from this phase of the programme were also included.
2. **The Mid-point report** (completed April 2016) captured the period of time where projects were in active establishment, and placed a greater emphasis on efficiency and effectiveness, emerging findings regarding sustainability, and a 'check' against relevance. Emerging lessons learned were also included.
3. **The End-point report** (completed August 2016) focused on effectiveness, impact, sustainability, and lessons learned, with a 'check' against relevance and efficiency.

1.4. Purpose and scope of this report

The final evaluation report is intended to augment and complement the previous evaluation reports. The report presents the key findings that have emerged during the life of the programme from September 2015 until December 2016 against the evaluation objectives. Additional data collection activities particularly focused on gathering information to inform the generation of lessons learned and sustainability, as the programme comes to an end.

This report should therefore be treated as a summary document with a focus on lessons learned, including 'what next'. For an in-depth understanding of the findings and lessons that were learned during the course of the programme, this report should be read in conjunction with the three other evaluation reports.

⁶ <http://wellington.govt.nz/~media/your-council/plans-policies-and-bylaws/plans-and-policies/a-to-z/wellington2040/files/wgtn2040-brochure.pdf>

⁷ <http://www.wynyard-quarter.co.nz/wqsmart/>

2. Approach and methodology

This section outlines the overall purpose of incorporating evaluation into the Smart Cities programme, and provided an overview to the approach, methodology, and methods and data sources that have been utilised.

The Smart Cities programme was not only about the idea that generating and using more readily available real time data would result in better social and economic outcomes for all. It was also about testing the approach being used to design, build and implement the projects in order to establish if this kind of approach can work for Government (to achieve its objectives of a better public service).

Because the Smart Cities programme was set up as a pilot, the approach taken to evaluate the programme needed to be flexible and be able to change as new understanding was gained. Consequently, an embedded evaluation approach was adopted that integrated project planning, management and evaluation activities.

The evaluation approach adopted and embedded an evaluative 'integrated way of working' (see glossary) within the programme's management, following a phased adaptive management approach through a 'plan', 'monitor', 'change' cyclical process. This approach supported and underpinned a continuous learning and improvement cycle that integrated those evaluation activities, and encouraged an evaluative culture based on lessons learned and informed decision-making.

The evaluation approach was designed with four goals in mind:

1. A collaborative approach to capture and use data with a range of stakeholders.
2. 'Track and report as you go' for enhancing results, shared learning, and an adaptive management approach (where project management, risk management, and evaluation activities are linked and complementary).
3. Track performance at multiple levels, with clear links to the results model and framework (to monitor performance and enable analysis and reporting of achievement of the programme as a whole).
4. Support the cities to grow their knowledge and experience in 'Smart Cities' and improve city infrastructure, and thereby contribute to achieving each cities goals and enhanced quality of life for New Zealanders.

To support the systematic collection of data to address the above goals and inform the high level Better Public Service objectives, an evaluation approach was developed around three key elements. The evaluation objectives (and associated questions), the outcomes model, and the project maturity framework. These three elements have guided the way in which data has been collected and reported over the course of the programme.

The findings in this report are framed around the overall evaluation criteria, however the findings have also been summarised against the outcomes model (see section 2.2 and section 4) that summarises the overall progress, achievement, and learnings per project including against the maturity level.

An overview of the evaluation approach is provided in Figure 1, with details on the different framework elements and data collection methods provided in the following sections.

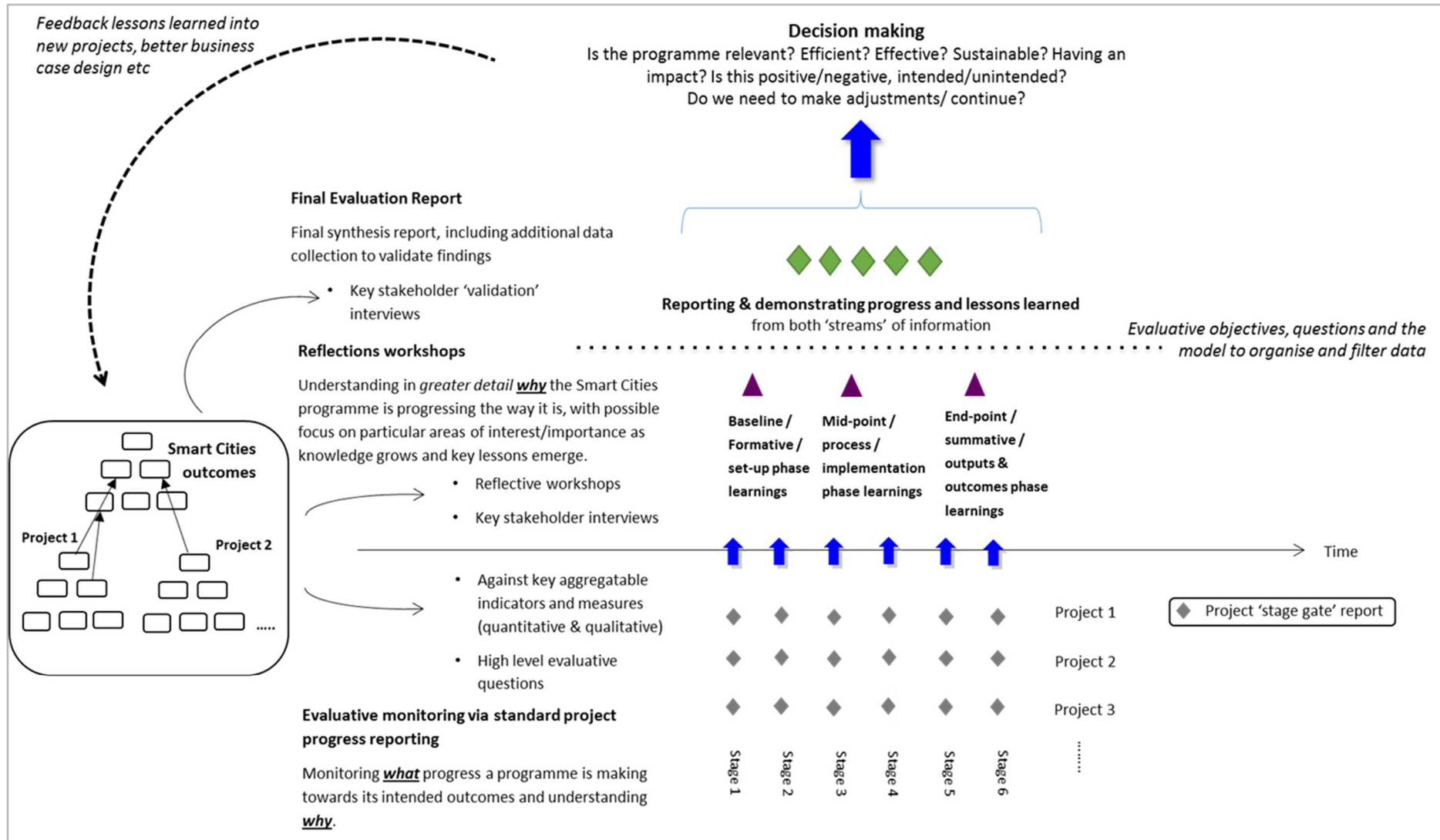


Figure 1. Shows the overall evaluation approach and data collection points for the Smart Cities programme

2.1. Evaluation purpose, objectives, and questions

The purpose of the Smart Cities programme evaluation was to generate insights and information to answer the core information objectives (see section 2.1.1). As outlined above, this programme was not only about enabling the use of emerging and existing technology, but also testing the approach being used to design, build and implement the projects to establish if this type of agile approach to interagency collaboration can be successful.

The overall evaluation approach involved the adoption of the OECD-DAC five evaluation criteria of relevance, efficiency, effectiveness, impact, and sustainability⁸ as the guiding framework to define the information objectives for the evaluation.

Two additions were also made. First, 'lessons learned' as this was a key objective of the programme, and later (following the baseline report) the incorporation of 'privacy' as a cross-cutting issue. These categories also broadly align to the categories applied by the Office of the Auditor General for performance reporting.

1. **Relevance** – The extent to which the Smart Cities programme met a clear need identified by stakeholders.
2. **Efficiency** – The extent to which inputs were transformed into outputs in the most optimal way.
3. **Effectiveness and impact** – The extent to which the immediate objectives were achieved, and the extent to which the programme resulted in changes both positive and negative, intended and unintended, direct and indirect.
4. **Sustainability** – The extent to which the changes are likely to endure/last.
5. **Lessons learned** – What lessons can be learned that can inform decision-making on similar or related projects/programmes or policies.
6. **Cross-cutting (privacy)** – what lessons can be learned from the Smart Cities programme regarding the effective consideration and management of privacy issues.

Detailed evaluation questions were then developed against each of these objectives to guide the data collection. These questions were reviewed at each 'iteration' or stage of the evaluation. At these points, questions could be added or refined, which resulted in the final set of evaluation questions growing from 13 initially (see Appendix A) to 21 (see Table 1). Following the baseline report, a specific focus was also given to the cross-cutting issue of 'privacy', with specific questions incorporated against this criterion.

The evaluation objectives also provide the framework against which final evaluative judgements have been made on the programme's performance (see 2.5 for details).

⁸ <http://www.oecd.org/dac/evaluation/daccriteriaforevaluatingdevelopmentassistance.htm>

Table 1. Final evaluation criteria and evaluation questions for the LINZ Smart Cities programme.

Evaluation criteria	Evaluation questions
Relevance – The extent to which the Smart Cities programme met a clear need identified by stakeholders.	<ol style="list-style-type: none"> 1. What was the intent of Smart Cities programme? Has it changed? 2. What assumptions were made? To what extent did they change (and in what ways). 3. How well understood was the programme by key ‘external’ stakeholders (e.g., policy makers)? Why, Why not?
Efficiency – The extent to which inputs were transformed into outputs in the most optimal way.	<ol style="list-style-type: none"> 4. What were the components of the programme as a whole as well as individual projects? How well have they been implemented? Was anything missing? 5. Were the governance and project management arrangements ‘fit for purpose’ for this type of agile project? 6. What contextual factors influenced the implementation of the programme?
Effectiveness and impact – The extent to which the immediate objectives were achieved, and the extent to which the programme resulted in changes both positive and negative, intended and unintended, direct and indirect.	<ol style="list-style-type: none"> 7. What has happened as a result of these pilot projects individually, and as a whole? 8. Has this stimulated investment in the ‘Smart Cities’ area that wouldn’t have happened otherwise? 9. Is the programme acting as a catalyst in other areas (e.g., adoption of common platforms)? 10. Has the programme leveraged investment or resources from third parties?
Sustainability – The extent to which the changes are likely to endure/last.	<ol style="list-style-type: none"> 11. What is the likelihood these projects will continue in future without additional funding? 12. What needs to be in place for this to happen?
Lessons learned – What lessons can be learned that can inform decision on similar or related projects/programmes or policies.	<ol style="list-style-type: none"> 13. What can Central Government learn from this project in relation to programme’s collaborative approach, including working with Local Government and the private sector? 14. What has this programme highlighted that would inform what good governance ‘looks like’ for Smart Cities type initiatives? 15. What lessons can we learn about the assumptions that have been made (e.g., can we identify systematic ‘errors’ in the assumptions)? 16. What lessons can be learned from the programme regarding how to effectively design and deploy Smart Cities solutions or similar/related projects and programmes in other local or central government agencies?
Cross-cutting (privacy) – What lessons can be learned from the Smart Cities programme regarding the effective consideration and management of privacy issues.	<ol style="list-style-type: none"> 17. How well have privacy considerations been thought through during the planning and design of projects/technologies? 18. How well have privacy considerations been managed by individual projects and the programme as a whole? 19. Have privacy issues impacted on the achievement of the expected outputs and outcomes? 20. What impact (if any) does managing privacy issues have on the sustainability of these projects? 21. What other lessons can be learned from the programme regarding how to effectively consider the potential impacts to privacy in the design and deployment of Smart Cities solutions or similar/related projects and programmes?

Local government wellbeings

Economic Growth

Risk Managed

Sustainable Future

Social Cohesion

Increased Equity

Improved economic wellbeing

Improved social wellbeing

Improved environmental wellbeing

Improved cultural wellbeing

A seamlessly engaged and involved public

More resilient and prosperous communities
(people, education, commerce, culture policy...)

More efficient and sustainable use of resources
(water, air, energy, materials) ...)

Better quality and more effective services
(energy, water, transport, building...)

More user-friendly infrastructure
(land, roads, buildings, communication technology, utilities...)

Sustainable natural environment
(topography, environment, resources...)

The New Zealand experience informs smart cities developments internationally

Public buy-in to the idea of smart technology

Increased opportunities for public to actively engage in the use of smart technology

High quality and appropriately informed data governance

Responsibility for governance and oversight of smart technology clarified

Behaviour change (ways of working) in the public and private sector

Development of a clear operating business model for Smart technology solutions

Grow our international reputation as a smart nation

Outcomes

Privacy considerations are better considered in Smart Cities and other similar projects

Better detection and response to physical and social environmental issues

More efficient and effective management of assets over their life-cycle

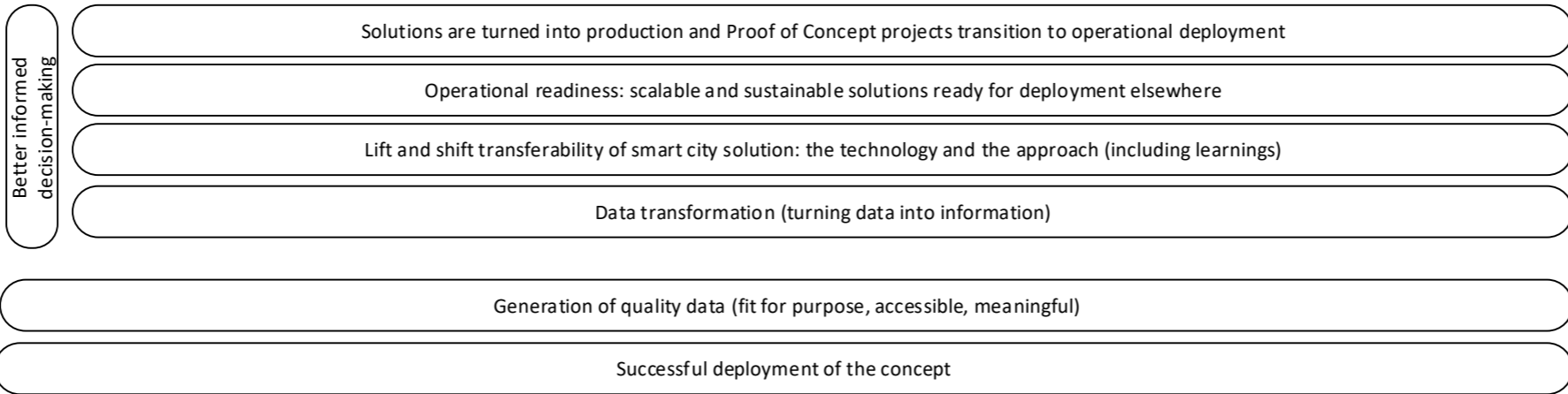
Clearer understanding of what 'smart cities' means

Improved collaboration between local government and central agencies and other organisations

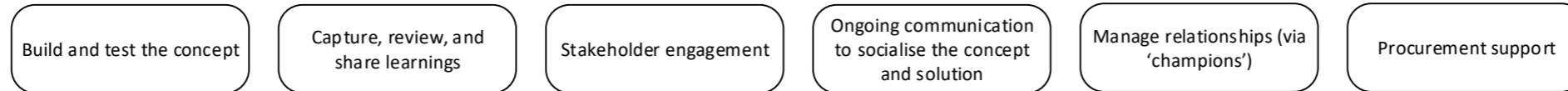
Enable new research and development opportunities

Support and investment in Smart technology solutions

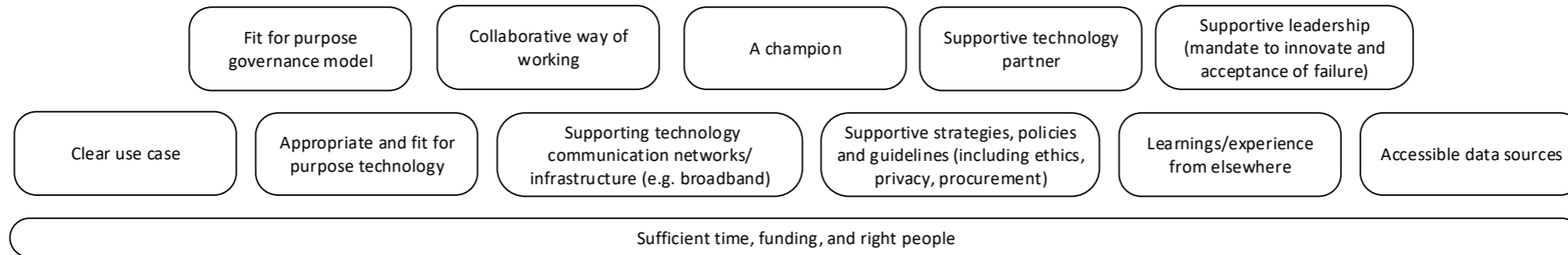
Outputs



Activities



Inputs



Collaborative way of working together – intercity partnerships and community of practice

Figure 2 Outcomes model of the Smart Cities Programme

2.2. Outcomes model

The project application forms requested the identification of key inputs required, outputs expected, and outcomes the projects expected to achieve. The form also prompted the applicant to consider the contribution of their project to the four 'wellbeings' that have guided local government policy (as previously defined in the Local Government Act) as well as the Treasury's Higher Living Standards. From this starting point, an outcomes model was iteratively developed during the course of the programme to depict in diagrammatic form (see Figure 2) the overall learnings of the programme, summarised in Section 4.

The outcomes model diagrammatically reflects the Smart Cities programme, from the inputs it required, the activities completed, details on the process of building, testing, and deploying smart technology solutions for Smart Cities projects. It also gives a more detailed representation of the actual or likely outcomes needed to realise the benefits of smart cities. As such the model can be treated as a brief roadmap or guide to implementing smart technology solutions elsewhere in New Zealand, including the outcomes (benefits) they can lead to (realise).

Given the emergent nature of the programme – testing innovative solutions in an emerging area – the outcomes model should be treated as a snapshot in time and a working or evolving version of the programme, in particular, the ordering and placement of some boxes (particularly of the lower level outcomes). These should not be viewed as finalised, as there is different rationale for grouping them in different ways. In this instance, outcomes that lead to or are closely linked to each other have been aligned together. At times this has led to some related boxes being separated further than what logic might dictate. This is simply a challenge of presenting information that is highly interconnected.

2.3. Project maturity framework

In conjunction with the outcomes model, a project maturity framework was also developed to articulate the various stages this kind of sensing infrastructure projects pass through. The rationale for this was to providing an alternative mechanism to compare key learnings across projects at each maturity level and inform lessons learned. This is shown in Appendix B.

2.4. Methods and data sources

The final evaluation took a mixed-method design and utilised the data collection methods and sources detailed in the sections below.

2.4.1. The Smart Cities Evaluation Hub

The Evaluation Consult Hub is an integrated, online workspace that has been designed specifically for monitoring and evaluative projects. The Hub used several key tools to capture information and create an area where sharing information related to the Smart Cities projects and related works could be stored. These tools included the data sources contained within the Hub:

1. The Smart Cities Data Entry Portal:
 - a. **Project overview form:** a description of the project, including details of which high level outcomes the project intended to contribute to and how strongly they contributed to those outcomes.
 - b. **Project application forms:** the background information of the projects, including: the original project application information, anticipated activities, resources, funding and investment amounts, outputs and outcomes.
 - c. **Risk register:** a register to log and track risks, and update them as required. This included mitigations, and risk scoring which would elevate risks to the programme manager.
 - d. **Issues register:** once risks became issues, they would move to this section and become issues – which were then dealt with by the programme manager.

- e. **Monthly progress reports:** these reports were completed monthly by each project manager and are submitted and logged into the evaluation Hub. These reports detail the highlights, lowlights, what's coming up next as well as giving indications of budget, resource use, scope and any possible impacts on other projects.
 - f. **Toll gate reports:** these were completed when projects moved from one level of maturity to the next. They gave a detailed overview of what happened at that project's stage, what the key learnings were for the project, and how the project was achieving its intended outcomes.
 - g. **Lessons learned reports:** completed at 'toll gates' where projects moved from one level of maturity to the next, referencing back to what was originally expected (as detailed in the project application form).
 - h. **Privacy learnings:** this form was used to capture any information that was either interesting or useful in terms of managing privacy within each of the projects.
 - i. **General reflections:** these were free text boxes that were created using the key evaluation questions and criteria, where project managers could put any relevant or interesting information against their projects
 - j. **Programme learnings:** a form to capture overall learnings from each cities Programme
 - k. **Outcomes examples:** this section was created to allow project managers to put key examples of outcomes in preparation for the final evaluation workshop, in order to create a more in depth conversation and to help shape the final model of the programme.
2. **Newsfeed:** this tool was used as a place where anyone could put relevant articles, comments or questions regarding the programme overall, as well as the wider smart cities area of work. This tool proved particularly useful in terms of distributing news articles and other information that may not have been readily available to everyone on the Smart Cities programme.
 3. **Document library:** this was a key repository for all programme documentation, including:
 - a. evaluative documents (including the baseline, midpoint and endpoint reports)
 - b. governance group documents and meeting minutes
 - c. LINZ documents, including project applications
 - d. monthly progress reports
 - e. privacy documents.
 4. **Calendar and tasks:** this was a scheduling tool that was used to coordinate timings with workshops, due dates for evaluation reports and monthly reports.
 5. **Glossary:** a key list of evaluation terms and definitions.

2.4.2. Evaluation workshops

Three workshops were held in November 2015, April 2016 and August 2016. They brought together those directly involved in the programme (project managers), as well as other indirect stakeholders such as the Privacy Commission, Statistics New Zealand, and Treasury. These workshops provided opportunities for all involved to engage with higher level analysis of emerging themes, key learnings and outcomes of the programme. The format of each workshop varied slightly, but as the programme progressed the focus was on consolidating learnings, particularly around refinements of the outcomes model.

2.4.3. Key stakeholder interviews

A total of 34 qualitative interviews were undertaken with 14 people during the course of the programme, with a range of key informants and Smart Cities as well as ‘smart sensing’ stakeholders. Stakeholders were interviewed for each of the evaluation reports and are detailed in those reports.

For the final evaluation report the following stakeholders (see Table 2) were interviewed (included as part of the total above).

Table 2. List of key stakeholders interviewed for the final evaluation report

Name	Organisation and title	Relation to programme
Alison Holt	Founder of Longitude 174, a governance and information technology specialist	External to programme, expert in area of work
Andrew Nixon	Project manager at Wellington City Council	External to programme
Camille Mosely	Catalyst project lead at Data Futures Forum/Statistics New Zealand	External to programme, project lead for an offshoot of the Data Futures Forum
Evelyn Wareham	General Manager at Statistics New Zealand	External to programme, previous member of the Data Futures Forum
Jenny Rains	Manager of community services at Wellington City Council	External to programme, worked with NEC to create the Living Lab, and the ‘Safe City’ project
Ken Renz	Technical manager at Digital Auckland, programme manager for 3D+ Asset and Non-Asset management project	Internal to programme
Margot Christeller	Director of Leaver Ltd	Internal to programme, previous Christchurch lead for the Smart Cities programme
Nerissa Wallace	Group manager sector data programmes at LINZ	Internal to programme, LINZ programme sponsor
Olga Speranskaya	Commercial manager of Government to Government Partnerships at New Zealand Trade and Enterprise	External to programme, working to promote New Zealand government’s expertise to the world
Philippa Bowron	Head of innovation at Wellington City Council	Internal to programme, responsible for helping to set up the Wellington Smart Cities projects
Roger Fairclough	Principal advisor (Infrastructure Resilience and Research) at New Zealand Treasury	External to the programme, secured funding for the programme through the Better Public Services fund
Teresa McCallum	Programme manager for the Christchurch Smart Cities projects	Internal to programme
Tim Packer	Head of Smart City Solutions at NEC New Zealand	Internal to programme
Viv Heslop	Sustainability lead at Panuku Development Auckland, programme manager for Wynyard Quarter Smart	Internal to programme

2.4.4. Online wider stakeholder survey

An online survey was developed to collect feedback from wider stakeholders on the wider knowledge and use of 'smart sensing technology'. The survey was provided to all project managers and they were asked to circulate to any stakeholders they deemed appropriate. This included internal and external stakeholders, and was not limited to organisation type (i.e. the survey could be circulated to government or non-government organisations). The survey was sent to 45 stakeholders, with 11 responses (for more details see Appendix E).

2.4.5. Citizens voice tool

A tool was developed as an additional data collection method to enable the project managers to systematically gather 'the man on the streets' views on Smart Cities and Smart Technology. A paper-based and online tool was developed, guidelines and instructions developed (including a webinar) and support made available to the project managers. However due mainly to time constraints, no project managers were able to gather this data (despite express intentions to do so by some). These tools remain available to the project managers and the programme should they wish to use them in future, and are included in Appendix F for reference.

2.5. Making overall evaluative judgements

For transparency, a simple rubric was developed against which the overall evaluative judgements of the programme's performance could be made (Appendix H). The rubric provides a clear description of what 'good' looks like, against which judgements of performance can be made.

The rubric was developed based on structured feedback we sought from programme stakeholders in the final evaluation workshop (followed up remotely) asking for their own judgements (including rationale) of the programme's performance, and the evaluation team's own knowledge of the programme.

Judgements were made using a four-level scale from using performance qualifiers of high, good, somewhat, or poor. Statements regarding the confidence of the judgements have also been included, which reflects the strength of the evidence base.

2.6. Limitations

The evaluation has identified three limitations in the data and/or approach. None of these have had a material impact on the robustness of the overall findings presented here, however they have been highlighted for completeness.

1. **Some patchy and inconsistent programme information.** Information was collected on the programme in several different ways which have been listed in 2.2.1. Programme documentation that was compulsory (the application form, monthly reports, and toll gate reports) were in general completed as required. However, a number of other mechanisms to capture data were under-utilised or not utilised as requested, even with effort and support from both the programme co-ordinator, and the evaluation team. Examples include systematically capturing privacy learnings, programme learnings, and documenting the intended contribution to outcomes. To overcome this the evaluation team incorporated a number of strategies during the evaluation workshops to 'fill' some data gaps where possible. Overall the evaluation team found that face-to-face, or phone conversations, were the most efficient and effective way to gather data required. This resulted in a wider limitation (in terms of capturing and sharing learnings) in that information captured during stakeholder interviews was not logged in the Hub, due to privacy and confidentiality reasons. Some of this information could have instead been captured in the Hub by project managers, the contents of which will be made available to all project managers and LINZ at the end of the programme.

2. **Limited quantitative data.** There were efforts early in the programme to have indicative values (e.g., dollar savings, or efficiency gains expressed in monetary terms) for projects, however this proved challenging. Instead the focus of the evaluation has been on documenting the learnings examples and other indirect evidence of the outcomes (benefits) both direct and indirect of the projects.
3. **No inclusion of the public (citizens) voice.** Whilst this was not considered as part of the original design, given the developments and increasing use of smart technology generally, the evaluation would have benefited from this perspective. This has not substantively impacted on the findings of the evaluation; however it would have included the public's view of these developments – providing a richer source of information for decision-makers and other readers of the evaluation.

3. Evaluation findings

This section summarises the overall findings of the Smart Cities programme’s performance against each of the evaluation criteria. The findings presented here build on what emerged from each of the three previous evaluation reports completed during the programme. Consistently repeated findings are included here, as well as any additional findings that emerged from data gathered as part of this final report. This includes additional stakeholder interviews and the wider stakeholder survey.

3.1. Relevance

The extent to which the Smart Cities programme met a clear need identified by stakeholders

The relevance of the programme is best understood to have several layers. The first layer relates to the suite of individual projects, and the extent to which they have met the needs of the stakeholders in their city – in other words the direct stakeholders of the programme.

The second layer is the relevance of the programme to indirect stakeholders. These include other local government authorities, central government ministries and agencies, as well as other involved parties (including international stakeholders) who were interested in the use of smart sensing technology.

The third layer is the relevance of the programme to LINZ – the main broker and contract holder of the funding received via the Better Public Service Seed Fund. With this they established a Project Management Office to ensure the programme was delivered successfully, and had overall responsibility for the delivery of the programme output (strategic assessment). This aspect of relevance has been treated as a slightly separate issue and discussed in more detail in section 3.4. Sustainability, as the relevance of the Smart Cities programme and its contribution or ‘fit’ with LINZ’s ‘business-as-usual’ functions was found to be less explicit because the programme fell outside of LINZ’s current mandate. This may impact on future work carried out in this area.

The key findings regarding the programme’s relevance are summarised below.

- **Overall, the Smart Cities programme is regarded as highly relevant** to those directly involved (at the city level), as well as being of particular interest and relevance to a number of indirect stakeholders and their programmes of work/areas of responsibility. A key reason the proof of concept projects themselves were highly relevant was because at the programme’s inception there was a strong focus on selecting well-defined problems or issues, with use cases that have clear benefits to the council in running more efficiently and effectively.

“Our water networks are based on (ancient) technology – gravity. We don’t give credence to ‘what’s the utilisation.’ But if we had the capacity to smartly monitor the source, the supply process and the end consumer, you can manage that in a far smarter way...that is absolutely what we need across all infrastructure...[such as] the transport system. We want to make sure that people get the benefit of that at a personal level.”
(Indirect stakeholder)

“Effective management of our assets will be hugely improved by being able to do this... [an] asset team said this is a game changer for them...so the impact will be huge. I suspect any council would be in the same position... as long as it proves itself we will all get a gold star, that’s for sure.” *(Direct stakeholder)*

As the programme progressed its wider relevance was exemplified by the strong interest in the programme from other stakeholders, such as the Ministerial visit with Wellington and Christchurch's mayors to WCC and NEC in April (Image 1).

Project managers also reported that they have experienced consistent and persistent interest in their projects from wider stakeholders in their city. Either due to their desire to be included in any future expansion of the work (e.g. to encompass new sensors or in new geographic areas), or because they wish to access and use the infrastructure (e.g., the KITEs) or the data streams. This has included other public agencies, as well as other institutions such as universities, and the private sector.



Image 1: Minister and Mayors toured NEC headquarters on 4 April (L-R) – former Wellington Mayor Celia Wade-Brown, Christchurch Mayor Lianne Dalziel, Hon. Minister Louise Upston, CEO, NEC APAC Tetsuro Akagi (Photo: NEC New Zealand)

“Now that we’ve got the functionality [of the KITEs and CCOC], the bar is really low to come and play in the sandpit” (Direct stakeholder)

At times this growing interest and enthusiasm has caused challenges for the project managers in being able to balance the time required to respond to interest in their projects and programmes of work and ensure the delivery of the projects themselves.

- **Work being undertaken in New Zealand has received significant international interest, as the concept of Smart Cities grows in relevance globally.** All project managers as well as NEC (the main technology partner for 12 of the 13 projects) have been invited to speak at international conferences or present to other agencies and councils about their Smart Cities work. Delegations have also been visiting to learn more about the work being done in New Zealand (much of which has occurred as part of the Smart Cities programme). For example, NEC and WCC hosted visits from both Victorian Minister of small business, innovation and trade⁹ and the Australian Capital Territory Chief Minister¹⁰ (Image 2). Christchurch and Wellington hosted a royal delegation from Holland in November 2016, who visited and discussed the Smart Cities projects as part of their schedule.



Image 2: (L-R) Head of Smart City Solutions Tim Packer, NEC New Zealand; Head of Innovation Phillipa Bowron, Wellington City Council; Australian Capital Territory Chief Minister Andrew Barr; General Manager of Corporate Strategy Takashi Tada, NEC Australia (Photo: NEC New Zealand)

⁹ <http://www.stuff.co.nz/business/79877187/nec-smart-city-technology-brings-australian-government-minster-to-wellington>

¹⁰ http://nz.nec.com/en_NZ/press/201607/201607_01.html

“The lessons learnt for these projects are now benefitting Australia NEC and city colleagues with [a] sharing session now completed for Adelaide City, Ipswich City and ACT Canberra. Proof of concept projects are being developed in Adelaide utilising the KITE platform.” (Direct stakeholder)

The relevance of the work being undertaken from NEC’s New Zealand operation has also been deemed of such significance that NEC international commissioned an advertisement that ran for one-month on CNN global television channel that profiled the Smart Cities work being done in New Zealand.¹¹

- **The programme also has relevance to the wider public sector, regarding the use and management of technology ‘big data’.** The growing relevance and importance of this area has already lead to a number of central government initiatives including the New Zealand Data Futures Forum (and subsequently the Data Futures Partnership and Secretariat) and the Open Government Information and Data Programme. Whilst this programme has focused on the application and use of smart technology to enable more efficient and effective management of cities, the technology and learnings are more broadly applicable. This programme’s learnings are particularly relevant, as they are *practical* demonstrations of what can be done and the associated risks and opportunities that arise from ‘smart’ technology. This would be appropriate and prudent to consider within a broader ‘New Zealand Inc’ policy framework, such as the catalyst projects funded by the Data Futures Partnership, which are very similar in nature to these Smart Cities projects.

“The smart cities programme is hugely relevant. It is a prime example of the use of data to improve people’s lives and also improve the running of a city which in turn improves things further down the line.” (Indirect stakeholder)

- **The programme also has indirect relevance to the wider public sector by exploring different ways of working that can contribute to building a Better Public Service.** This programme has tested all three of the goals of the BPS seed fund (outlined in section 1.2). The learnings from this programme are therefore of much wider relevance in terms of policy development or informing other changes that may be explored to the public service, to deliver better outcomes for New Zealand.

“Actually, the intent and expectation and desire and opportunity are no less applicable and no less apparent in Wellington than any other place in New Zealand.” (Direct stakeholder)

“There’s obviously opportunity in local government to do a lot more, as there are in health, education, and those other places... These proof of concepts are really proving technologies...” (Direct stakeholder)

¹¹ <http://www.nec.com/en/global/onlinetv/en/society/wellington.html>

3.2. Efficiency

The extent to which the programme was delivered in the most optimal way.

For the Smart Cities programme, the efficiency criteria relate to the operation of the programme as a whole, rather than the success (or otherwise) in delivering the projects individually – although the programme management has a clear linkage to the efficient delivery of the projects in providing the necessary and agreed support, guidance, and inputs. This criterion therefore focuses on the programme elements such as the efficiency of the programme management office, the governance structure, and any other support functions such as the evaluation inputs (including the Smart Cities Hub).

- **Overall, most stakeholders who have been directly involved in the programme have felt the programme has run efficiently.** The programme structure was regarded as fit for purpose, and the support and guidance from the Programme Director, Programme Co-ordinator, and the evaluation team has been timely and helpful.

“...because LINZ set this up to be agile, quick, failure is an option (not one we’re trying to get) that enabled me to carry that same culture through...so I was really clear with the mandate of quick, iterative type lessons than a big waterfall type projects, so LINZ leading the way with the fit for purpose governance model, and it’s not to say there was an absence of governance, but a concept of ‘good enough’... rather than expecting all this great information at the beginning.” (Direct stakeholder)

- **Delays throughout the programme have been attributed primarily to technical issues**, which were successfully worked through, and were standard for a proof of concept project. Examples included issues such as civil engineering works taking time to be able to put KITEs up on power poles, and minor bugs in the KITEs to do with Wi-Fi reception issues. These were common but did not negatively threaten the affected projects. Only one project suffered major difficulties – the 3D+ Asset and Non-Asset Management project. This project was originally scheduled to be one of the first to complete its work. However just as the programme began, this project’s visualisation tool supplier went into receivership. This led to substantial delays in finding an alternative. Compounding this delay were requirements placed on the project manager to complete a comprehensive procurement process. In all other projects, a more flexible (and fast) approach to procurement for ‘fast-fail’ proof of concept projects was accepted. Additional findings regarding procurement and its implications on these kinds of projects can be found in section 3.6 Lessons learned.
- **The collaborative way of working and multi-city approach has been consistently identified as one of the most fundamental components of the programme’s efficiency and effectiveness.** This manifested itself in two key ways, firstly the ability of others to leverage off work completed by others, either by avoiding pitfalls learned elsewhere, or by more strategically ‘spreading’ the learnings. For example, Christchurch programme of work directly built off the work previously done in Wellington with the use of the CCOC (Cloud City Operations Centre), the flexible sensing platform (KITEs) and then an array of different sensors ‘plugging in’ to this. In doing so, Christchurch avoided replicating mistakes and learnings (and therefore the costs) already made in Wellington. The portfolio of projects with NEC as a partner also adopted a semi-strategic/coordinated approach minimised individual risk and maximising opportunities for learning by staggered deployment of KITEs in all three cities. This allowed the efficient identification learnings – from testing new sensors (e.g. air and water quality sensors) in particular – by ‘road testing’ them in different places and different ways.

“...it [the programme] couldn’t have been achieved through any single one entity, we couldn’t have achieved this by ourselves, Wellington wouldn’t have achieved it by self, nor would LINZ, so that has got to be one of these arrangements where there is high level collaboration and high level skin in the game.” (Direct stakeholder)

- **Underpinning the success of the collaborative way of working within the programme was a recognition that there is mutual benefit from working together.** The collaborative way of working, not only between local government agencies, but also between local and central government, and the partnership approach taken between the cities and the technology partner (notably NEC) has resulted in considerable efficiency gains.

“It was fantastic to see firsthand how Wellington City Council and NEC New Zealand are working together to achieve real solutions to city problems by implementing innovative technology. It is clear why this is such a successful partnership and a model that Canberra can draw inspiration from as we work towards becoming a leading international smart city” Australian Capital Territory Chief Minister, Andrew Barr

“This is true expert discussion, which is very rare. This is a very advanced level relationship ...where [because of] the level of understanding [between] each other and respect and expertise [jointly held] you are able to bypass a lot of the political discussion and you can progress really quickly.... that tells you volumes about this programme” (indirect stakeholder)

- **The tripartite investment arrangement, between central government, local government, and the private sector meant excellent value for money, and enabled the ‘fast fail’ approach by keeping things moving.** This programme has seen an initial investment by central government of \$970,000 on the projects (split roughly in thirds across the three cities), result in leveraging in-kind investment of \$1,500,000 from the councils and approximately \$640,000 from private sector technology partners.

The tripartite arrangement also assisted in promptly addressing challenges. Two key obstacles were identified early on by most stakeholders directly involved in these projects – limited or lack of support for the projects, and challenges with procurement. In both cases, the fact that local government officials could see that both central government and the private sector were willing to contribute funds were key to overcoming these. This approach helped to diminish concerns regarding risk and also assisted in demonstrating that procurement processes could be adapted to accommodate these projects without violating the principles of a fair procurement process. For these projects, procurement teams were asked to adapt to a ‘different’ normal. This allowed different working arrangements that has led to rapid progress and deployment that wouldn’t have otherwise been possible. The influence of this tripartite arrangement was a critical success factor in the efficiency of the programme.

“Collectively, you get much bigger bang for your buck.” (Direct stakeholder)

“The old way of working, for example - procurement, service agreements, etc, that impedes speed and agility for the new way of working... [we are] Stuck in old ways of working because of the nature of council work – we do these set tasks; pick up the rubbish, hand out parking tickets, and it’s very much a risk-free environment – this programme has been ‘shaking up’ that formula because of its high risk, fast fail approach.” (Indirect stakeholder)

“...because it’s a catalyst – it’s not what it does, it’s the catalyst for all those other things – the forward works viewer, the open data, the standardisation initiatives...and the catalyst for working local government, central government, and private companies. And private companies are faster and you get stuff done quicker.” (Indirect stakeholder)

“...given that we are in local council – we need to prepare procurement and legal teams for the nature of proof-of-concept [projects] and partnering with them because the contracts are different to what we [normally] go through. You need to have your procurement team on your side and in your headspace. We need to do due diligence but maybe not the same level of rigour. Memorandums of understanding – rather than a contract. Getting them [procurement teams] in the right space and bringing them in the objectives to get them on the ground and running.” (Direct stakeholder)

- **Smart use of technology such as the Evaluation Hub was a key enabler of collaboration and sharing in the programme.** The Hub allow different people involved in the programme to contribute, converse, as well as efficiently log key information (such as monthly reports) even when geographically dispersed across the country.

“There wouldn’t have been that visibility...and because you have been using the Hub, everybody gets to see what everybody is doing. It has been a true collaborative project, and I think that brings in another set of values that you wouldn’t have really had [otherwise].” (Direct stakeholder)

However, despite clear systems and processes, instructions, and other support *some* documentation on the programme was inconsistent. For the most part this reflected the constraints on time resources available to the project managers. The evaluation team worked hard with the programme director and co-ordinator to ensure documentation was as complete as possible, that also balanced the time constraints of the project managers. The evaluation team took care to address any gaps in knowledge during each evaluation phase when conducting key stakeholder interviews. This represented a more efficient way for the project managers to communicate key information to the evaluation team.

- **The programme forged strong relationships at a technical level, but relationships at a more strategic level were weak.** Visibility of the programme with wider and interested stakeholders was low, particularly with those who could inform or influence the next steps of the programme. This has had implications on the sustainability and wider impact (in sharing the learnings) of the programme (see section 3.4 and 3.6 for further discussion). More explicit direction from the governance group could have mitigated this, however there was never a set mandate about taking this programme forward. This also created challenges in identifying where the ‘home’ for these types of programmes might reside long term (also see section 3.4 Sustainability).

“I actually think (the value of the) programme has been very poorly publicised, when talking to friends and other people who work with data they have no idea what is going on...I’m not entirely sure what’s going on...” (Indirect stakeholder)

The programme also highlighted a key tension and challenge in successfully coordinating a collection of projects that are both individual but also part of a ‘collection’. This was highlighted in the failure for the collection of smart cities projects in applying for catalyst funding via the Data Futures Partnership. The evaluation found that whilst applications were drafted by each city, and discussions were held between the Programme Director and the Data Futures Partnership Secretariat, the final application(s) were never submitted. The reason for this is unclear, but highlights the potential challenges and risks associated with programme’s structured in this way.

3.3. Effectiveness and impact

The extent to which the intended outputs and outputs have been achieved, as well as any other impacts arising from the Smart Cities programme.

Although the programme’s projects mostly finished in early stages of maturity (see Appendix B), there have been early outcomes and benefits arising from the individual projects, as well as the programme as a whole. At the end of December 2016 most projects were capturing data and generating analytics, delivering data that can be used to inform both council and central government decisions at both an operational and strategic level.

The effectiveness of the programme has also been evidenced by the strong international interest in both the individual projects as well as the way the programme overall was designed, implemented and delivered. The wider programme has created and documented critical learnings and systems, which can now be used to create a generic, deployable data capturing system.

A summary of the programme level achievements are provide in 3.3.1, followed by a summary of the project (city) level achievements. For more details and snapshots on each project, refer to Appendix C.

3.3.1. Programme level achievements

- **The effectiveness and impact of the programme has been significant** – almost all the projects under the programme have started to produce high quality, usable data and analytics. The work completed in Wellington – the most mature programme – has been delivering analytics of high value. Although it is difficult to measure the effectiveness of these projects (in dollar terms), the ability to understand pedestrian flows, measure and count traffic, and gauge air quality are examples of the demonstrable benefits arising from these projects.

“We are already having discussions about how we will use that [all the data] ... [for example] the transport data is critical, because of CO² stuff. That will create a better picture of the air and air quality.” (Direct stakeholder)

“LINZ has done really well. In terms of pulling people together, learnings, leveraging, that facilitation and getting stuff moving.” (Direct stakeholder)

“This is a good news story, it’s a success story... we have delivered what we said we would, [and] I think there are efficiencies and effectiveness that come from this.” (Direct stakeholder)

- **The programme has also been very successful in its way of working.** There has been a strong emphasis on collaboration and implementing learnings from each of the cities, which has been an unintended outcome in and of itself (see Section 3.2 Efficiency for more detail).

“I think that a really good learning has been the working with the councils, and there have been really good relationships developed. If you see this not in isolation but as a suite of programmes, there has been a lot of good stuff going on between local government and central government. And I’m really happy about the relationships around this.” (Direct stakeholder)

- **The project’s achievements are clearly contributing to the goals of the Better Public Services Seed Fund.** The projects in Wellington and Christchurch are creating data sets which will help to accurately inform forward planning and asset management. A key outcome of the programme has been the realisation that these projects have the opportunity to significantly lower council maintenance and running costs, create and foster inter- and intra-council relationships, and create a more targeted approach to asset management through use of ‘real time’ information.

“Tracking people and tracking things as they go through a geographical area...[then] using that collection of data to drive quality. [That allowed council to] measure and track cyclists going through that area, and used that data to figure out where the cycle paths should be. And to work out how to best help cyclists. That could actually drive quality. [And that is] better for the decisions generally, even how to police All Blacks games...” (Indirect stakeholder)

“Part of this is the nature of collaboration, so all these disparate organisations and government agencies now have come to the agreement that collaboration and sharing info is critical. But [it is] also that we can do it effectively and efficiently through smart tech. The other learning, which has been surprising, was that much of what we had assumed was the case, wasn’t... when we overlayed the data and realised that the expectations weren’t the reality.” (Indirect stakeholder)

- **The wider impacts of the programme have been extremely positive – specifically the international attention on the Smart Cities programme.** There have been requests for project managers and others to present at conferences on the projects themselves, and broader interest on ‘how New Zealand is achieving this’ on the international stage. NEC has been directly showcasing the work undertaken in Wellington, Christchurch, and the water sensor in Auckland. Through the use of technology and new data capture systems, New Zealand is creating world leading ways of working.

“[The international attention is] absolutely significant... And you know, I’ve not seen the likes of it in any other country so far...but the coalition has been a special thing...I haven’t actually seen anything quite like it anywhere else. It comes down to this is the right country, and it’s the right environment to do this sort of stuff.” (Direct stakeholder)

- **There is interest in the applicability of sensing technology being used by other local government and central government agencies.** The service delivery and customer interaction components of these projects were identified as potentially applicable to many areas of government. Examples included Housing New Zealand (e.g. sensors in housing New Zealand managed stock), Ministry of Justice, Ministry of Education (potential extension of the sensing technology used in the Safer Cities Living Lab to detect anti-social behaviour such as bullying in schools), and the Ministry of Social Development. The evaluation was not able to contact and interview these agencies directly, however, indirectly a range of stakeholders spoken too (both directly and indirectly involved with the programme) could see the applicability of the sensing technology to a much wider range of agencies and organisations.

“This is the first time in the world we are testing the Smart Nation platform. That’s got a lot of interest ... from places like Hamilton, Queenstown, Tauranga, Palmerston North, Opotiki, Nelson” (Direct stakeholder)



Image 3: Product of the Flexible Sensing Platform – a KITE – installed on a power pole in Christchurch

“[We are] creating those conversations between the cities. This is creating an environment where we can become friends and actively help each other” (Direct stakeholder)

- **The programme has created opportunities for business growth and collaboration.** The KITEs (the flexible sensing platform – see Image 3) have been developed by NEC within the Smart Cities programme are now being commercialised and deployed elsewhere, such as Australia (also see section 3.1 – Relevance). The programme has also created opportunities for smaller New Zealand-based technology companies. For example, in Christchurch, Connetics – a Christchurch based infrastructure company – has been contracted to install KITEs for the Pedestrian Mobility Tracking project. There have also been approaches and arrangements developed with tertiary organisations to access and use the KITEs and data streams emerging from these¹².

Other examples of inter-business collaboration include the recent memorandum of collaboration between 2degrees and NEC (Image 4), which “outlines an initiative to develop innovative technologies and advance network solutions for smart cities.”¹³, a key enabler for rolling out KITEs.



Image 4: 2degrees CEO Stewart Sherriff and NEC's Katsuhiro Ito sign a memorandum of collaboration

- **The effectiveness and impact of the programme has been enhanced in part by the development and installation of an ‘open platform’.** This flexible sensing platform (the KITE network), developed within the Smart Cities programme has provided an open platform upon which a range of different sensors can be developed and ‘plugged in’. This creates *significant* opportunities going forward for other private companies to develop ‘smart’ technology in New Zealand, some of which is already being realised (see bullet point above).
- **The effectiveness and impact of the programme has also been enhanced by supporting the development of smart technology that can be ‘lifted and shifted’.** This has been most effectively tested between Wellington and Christchurch sets of projects. These (together with the water sensor in Wynyard Quarter Smart) have demonstrated a ‘set’ of smart technology that could be readily adopted by other local councils with an integrated data platform, analytics, and visualisation that can inform the broader running of the city. The projects in the Wynyard Quarter have revolved around creating a smart precinct – with the use of data and analytic techniques specifically applied to that area. It is less integrated within a wider city level infrastructure and service management, but is still informative. The 3D Asset and Non-Assets Management viewer (similar to the forward-works viewer) has the potential to be integrated and used by the wider council, but until the concept has been tested and proven, the evaluation is not in a position to make any specific comment on its broader relevance and applicability to other public service agencies and organisations.
- **Visibility, and therefore knowledge, of the programme on the national level was much lower.** Stakeholders within central government were extremely interested in the programme and were very keen to learn more about what has been done, to better understand the learnings from this programme, and where connections/linkages might exist given the focus the government has

¹² Exact details on arrangement with third parties cannot be provided due to commercial sensitivity and non-disclosure agreements.

¹³ http://nz.nec.com/en_NZ/press/201606/201606_02.html

provided, and the increased recognition more generally about better (more efficient and effective) use of data at all levels. Other central government stakeholders commented or inquired about the communications around the programme (and lack thereof). Given the interest internationally, this was a strange contrast.

“What next? I think there is value coming out of it [but] it has been very poorly publicised. My colleagues...aren’t even aware of these projects. I [don’t] think selling the value... has been done well.” (Direct stakeholder)

3.3.2. Project (city) level achievements

Wellington

- The Wellington projects have been mostly completed and delivered. Previous delays caused by civil engineering and unexpected Wi-Fi issues have been overcome, and KITEs are now being deployed around the city.
 - *Flexible Sensing Platform*: this project is tracking well, having overcome previous Wi-Fi issues. All KITEs now have dual backhaul options – if one data transfer system fails, there is now a backup system in place. Next steps include rolling out more KITEs to Courtney Place, Cuba Mall, Manners Mall, and the Railway Station.
 - *Smart Cities Backbone Wellington*: no changes to the backbone, as all major capabilities have been delivered. Reports continue to improve as more KITEs are installed, sending more data to the backbone.
 - *CCTV Multimodal Transport and Pedestrian Counting*: this project has been delivered, with key data and analytics being displayed in the CCOC.

Christchurch

- Progress for the Christchurch projects has been significant, with major milestones being reached. Although some projects have had unforeseen delays, most of the projects are ahead of schedule, with some producing analytics already.
 - *Open City Verticals ‘Smart City Block’*: this project contains six discrete projects, each at a separate level of maturity. The overall project is testing the ability to unbundle vertical city services, such as street lighting, waste management, drainage and car parking, so that cities are not constrained to investing in single-use-case vertically integrated products:
 - *Vital Signs*: several KITEs have now been installed throughout Christchurch city, monitoring such things as carbon dioxide levels, barometric pressure, noise, luminosity, and air temperature. These KITEs are now sending data back through to the CCOC
 - *Smart Parking*: this project seeks to piggyback off learnings and systems recently operationalised in Wellington. Testing of sensors has been completed, with the demonstration unit ready to be displayed to wider stakeholders
 - *Rubbish Monitoring*: this project seeks to install sensors in rubbish bins, and is exploring compression units for peak rubbish areas. The sensors have been designed and tested, with installation and identification of sites for the compression units to be completed.

- *Smart City Lighting*: sensors are being tested to be placed in street lights, with key data being sent back to the CCOC, in order to save power by being able to detect when the lights can be turned off automatically, as well as testing the best luminosity for city lights. This project is now ready to be initiated, and is waiting on the Asset Management team to confirm locations for installation
- *Pedestrian Mobility Tracking*: working off progress made in the Wellington CCTV Multimodal and Pedestrian Counting project, this project is installing KITEs and Wi-Fi sensors in and around key pedestrian areas in the central business district of Christchurch, in order to provide a more detailed understanding of real-time pedestrian flows and movement. There had, at first, been difficulties in engaging with the right stakeholders for permission to place KITEs at key 'choke points' but backup locations have been identified, and installation has been completed at Restart Mall.
- *Air Quality*: with the ability to collect high quality air data using the KITE platform, this project seeks to place nodes at key areas throughout the city. With more sensors and data comes a better understanding of air quality – existing information and data from weather stations can be pulled through to the CCOC platform. Particle monitoring sensors are currently undergoing testing and calibration with Environment Canterbury's sensors. Next steps will be to provide a detailed report on the quality of the data being pulled through by the KITEs.
- *Sensing Water*: this project seeks to implement near real-time monitoring of wet weather flooding events. At the outset, this project was expecting to use new sensors to monitor water levels, however NIWA (National Institute of Water and Atmospheric research) and the Christchurch City Council have created a water monitoring system, which has allowed this project to focus solely on providing a visualisation tool and model of flood prone areas, as well as providing an application that the public will be able to access.
- *Smart Cities Backbone* (Image 5): this project piggybacks off the Wellington Smart Cities Backbone – the Christchurch backbone has been successfully installed, with KITE data feeds being integrated into the backbone. Only small pieces of work remain to get the full functionality expected of the backbone, with an application programme interface expected to be delivered by the end of October 2016.
- *Flexible Sensing Platform*: this project has seen the creation and installation of the KITE sensors throughout Christchurch. The first tranche has been rolled out successfully, with data being displayed back to the backbone. The next tranche of KITE installations will begin once sites have been identified, with discussions held with AntarcticaNZ regarding placing two KITE sensors in Antarctica this season.

Christchurch Key Performance Indicators (KPIs)

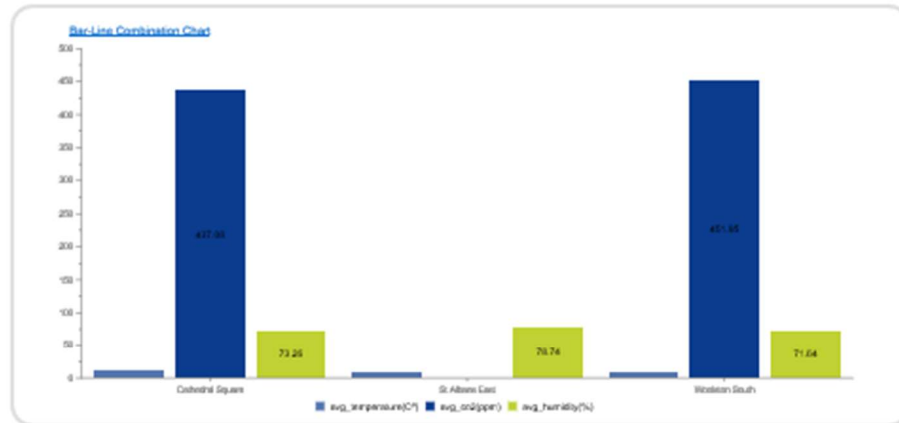
KPI Last Values By Service

CO2 [ppm]	Humidity [%]	Sound [dB]	Temperature [°C]	Pressure [Pa]	Luminosity [lux]
434.9	63.47	13212.33	10.53	99819.27	286

Multi-Service Comparison By KPI

Select KPI: Start date: End date:

CO2 Temperature Humidity Sound Pressure Luminosity



Multi-District KPI Comparison By Service

Select service: Start date: End date:

Woolston South Cathedral Square St Albans East



Image 5: Real-time data being displayed in a dashboard, showing carbon dioxide, humidity, sound, temperature, pressure, and luminosity.

Auckland

- Both Auckland projects have had scheduling delays, with the Wynyard Quarter Smart sensors undergoing testing, and 3D+ Asset Management going into the final stages of procurement and contracting.
- *Wynyard Quarter Smart*: this project contained two discrete sub-projects, both of which are at separate stages. These projects have hit minor road bumps:

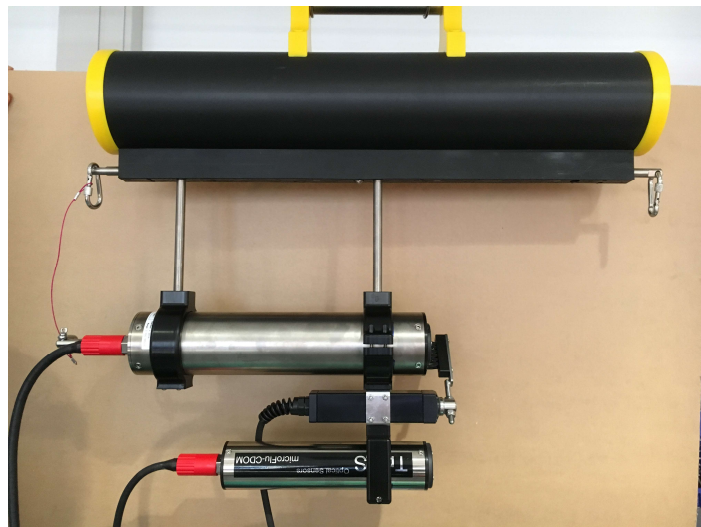


Image 6: Water quality sensor

- *Water Sensors*: this project is testing sensors to detect water quality in St Marys Bay. These sensors are also undergoing testing, and need a trench to be dug for them to be installed (Image 6).

Multimodal Vehicle Counting: similar to the Wellington Multimodal Transport and Pedestrian counting project, this project seeks to install sensors to detect pedestrian and other modal transport movements in the Wynyard Quarter. The sensors are currently undergoing testing and calibration, with the intention of being able to display live multimodal counting on the Wynyard Quarter website (Image 7).

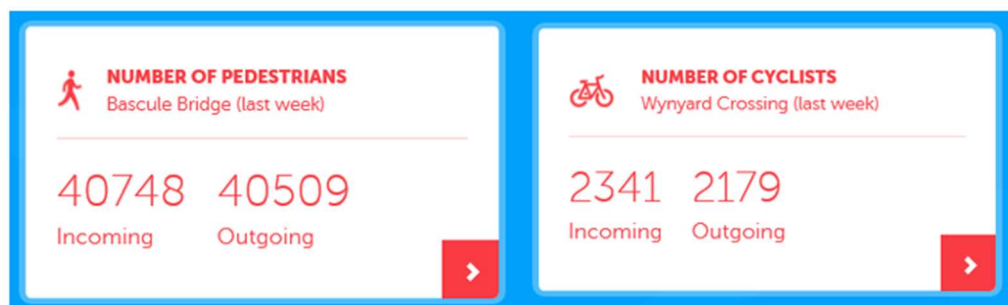


Image 7: Wynyard Quarter Smart dashboard displaying number of cyclist and pedestrian visits to the Wynyard Quarter

- *3D+ Asset and Non-Asset Management*: this project is seeking to create a 3-dimensional map of council assets across Auckland city. Since the projects inception, there have been roadblocks, with the private company contracted to produce the 3D system going into receivership at the start of 2016. This has significantly delayed progress, with the project having to go back through the traditional procurement process, and having to go back to market for the 3D visualisation tool. At this stage, the project is in the process of finalising procurement and signing contracts to engage another provider to deliver the 3D mapping tool. Delivery for this project is expected in late December 2016, early January 2017.

3.4. Sustainability

The extent to which the changes are likely to last or endure.

There are strong arguments for continuing these projects beyond the ‘proof of concept’ phase (see section 3.3 Effectiveness and Impact). For the most part their viability is clear, the projects are at the forefront of a global push towards creating more efficient and effective monitoring and sensing systems.

At a local level the sustainability of the projects is reasonably secure, as the projects are being delivered by council/organisational structures that will see them continue. However, at the central government level this is much less clear. Key findings are detailed below, several of which are also further discussed in the section 3.6 (Lessons learned).

- **There is no clear pathway for this programme going forward.** This has happened for four interrelated reasons:
 - Because of the **proof of concept nature of the programme.** The programme was designed to test whether these types of projects could succeed at any level within local and central government – having almost all the projects succeed and continue to be successful was not accounted for at the outset of the programme.
 - **The lack of ownership or logical home within central government of the programme.** There is no natural home within central government for this type of unique programme – this reflects the fact that emerging technology and smarter collection and use of data (including ‘big data’) is rapidly evolving as a ‘cross-cutting’ issue, that doesn’t fit into any central government department’s core business. See section 3.6 for a related discussion on this.
 - **The lack of ‘scaffolding’ to transition the programme.** This was partly due to the fact the programme implementation set up was very fast (due to delays in formally establishing the programme), but was mainly as a result of the programme design as a ‘proof-of-concept’ programme. The implications of this is discussed further in section 3.6 (lessons learned)
 - **A funding structure with no provision for continuation or a transition process** beyond the standard business case development process, which can be very slow. This highlights a potential tension in the intent of the BPS seed funding, supporting agile, proof of concept approach deliberately designed to test whether this work could be done, not to test whether it could be done *long term*.

“...there’s no natural owner for the smart cities work, and that’s been one of the issues taking the BPS stuff – there is no obvious agency to pick them up. That has been an issue for us.” (Direct stakeholder)

“In my view, we didn’t have that programme structure around this.” (Direct stakeholder)

“...So who is going to take ownership...the ongoing funding, [and] the model that we are going to use in the future, [as well as] the ongoing governance – [is going to be the challenge, e.g.,] is it going to be a multi-agency approach?” (Direct stakeholder)

- **Many stakeholders were surprised and disappointed there wasn't going to automatically be a continuation or next phase of the project.** These stakeholders were external to the programme, but still expressed disappointment at the potential opportunities lost from the end of the programme. This disappointment is understandable considering the clear benefits being demonstrated (both intended and unintended), and that most of the projects have transitioned into full operationalisation or 'business as usual'.

"I wasn't aware of that...I didn't realise it was coming to the end. I would say that's a mistake... [and it] must be a regret... We kind need something else, Smart City 2.0. To follow on...because it's a catalyst – it's not what it does, it's a catalyst of all those other things, the Forward Works Viewer, Open Data, the standardisation initiatives..." (Indirect stakeholder)

"I think it is imperative that the programme is sustained - it needs support and funding, from either local or central government to assist that sustainability." (Direct stakeholder)

"We've got to make sure that this continues, because we are streets ahead of many other cities on the planet, and at the rate we are going we are going to continue that momentum." (Direct stakeholder)

At the end of the programme, the sustainability of its outcomes currently depends heavily on the strength of relationships built within this programme.

"[At the end of the programme] I'm hoping there is enough of a relationship built to actually keep it [the programme] going. LINZ is currently providing the ongoing scaffolding and that really helps to keep it on the top of my mind." (Direct stakeholder)

- **The programme has had very limited visibility**, both within central government, as well as local government. The lack of communication about what this programme is, what its outcomes are, how it has been managed and funded, has been partially because it has no set home, no set life beyond the end of 2016, and because of the proof of concept nature of the programme. This runs contrary to how the programme is viewed internationally – this work has been held up as a beacon of what can be achieved in the public sphere.

"...The last time I heard about this was about a year ago, at which point it would have been handed over to LINZ, and has transformed into an extremely valuable looking programme, which I have heard nothing about" (Indirect stakeholder)

“I think [LINZ] probably has under played the success stories for this, partly because [they] don’t know what the future is for it. So that’s something that they are trying to manage. That they don’t over sell expectations to ministers, because at the end of the day LINZ have a programme coordinator and a programme manager, and that’s it.” (Direct stakeholder)

“I try and watch what’s going on in the data space, but I haven’t heard anything much about how this is operating or what its delivering.” (Indirect stakeholder)

3.5. Cross-cutting – privacy

Privacy was moved explicitly into the evaluation framework as it became more apparent it was an issue that needed systematic consideration in these types of projects. There can be a hostility towards projects that collect personal information, even if that information is anonymised and handled with the utmost security. These types of projects can be seen as intruding into the privacy of individuals.

Overall, the programme has managed these privacy issues by placing them at the front and centre of each of the projects – a recognition of the fact that if thought about structurally, privacy issues can be a motivator to disseminate information and foster openness in the public sector. This section summarises issues that relate to management of privacy considerations as well as lessons learned that relate specifically to effectively managing privacy considerations for ‘smart’ projects where technology is rapidly developed and deployed. Key findings regarding privacy are summarised below.

- **A coordinated approach to managing privacy issues has benefitted the projects and the programme overall.** Privacy issues have the potential to derail these types of projects as, by their nature, they push the boundaries of what the public considers an acceptable level of monitoring and ‘surveillance’. This issue of ‘social licence’ is wrapped within these projects and their future use, and with that comes the sense that these projects are either doing work *with* people or *to* them. Clear and transparent communications surrounding this issue can help to offset these fears. For example, explaining exactly what happens to the data that is being collected and distributing those datasets so that the public can see exactly what is being captured and how that data is handled can alleviate fears of ‘big brother’. This then allows for a more informed and educated debate about the potential use of rich datasets. Learnings within the programme, particularly from the WCC Living Lab, illustrated the benefits of open transparent communication (also see section 3.6 Lessons learned).

“Once you’ve put that privacy intention into what you’re collecting and retaining, then innovative uses become a lot easier to manage from then on because you actually get privacy-by-design.” (Direct stakeholder)

“Social licence is the collective vibe of the public around what is an acceptable set of outcomes.... [some things may be] legal, but [it can] absolutely enrage people because it [isn’t] part of their expectations and the level of surveillance that they are able to accept.” (Direct stakeholder)

“Then you can get that consensual decision making going forward and making sure we are putting the right governance and laws in place, to actually get the outcomes to make sure that we don’t invade people’s privacy and that we have the right balance in place.”

(Indirect stakeholder)

Putting privacy concerns front-and-centre of the projects is critical to both their viability and sustainability. This is the most prudent approach to manage privacy considerations and demonstrate to the public up front that those issues regarding anonymisation of identifiable data have been acknowledged and dealt with. Because of the nature of these projects – that they collect data that could be linked back to a specific individual – privacy concerns for the programme were raised at the outset. A built-in and systematic approach to privacy concerns ensured that they have been addressed in a way that creates and fosters an openness and general transparency around the goals and intentions of the projects. This approach needs to remain at the core of these and similar projects because of their nature (the way they are collecting and using data). There was also the risk of a ‘domino effect’ within the programme, where if one project was seen as too intrusive or pushing the boundaries too far of what is socially acceptable and is thus abandoned, it could have caused other projects it had linkages to (actual or perceived) to lose their social licence as well.

“The reputation risk is very high – you want to get the public to trust that sharing data is for the good of all.” (Indirect stakeholder)

“The whole concept of privacy you have to put that first and foremost, you have to front foot the topic...From a public engagement point of view, Smart Cities has a privacy stigma, there is no doubt about it. It’s the first conversation with any public meeting I have. We, as champions of Smart Cities, need to help the public understand, and with understanding comes more common sense conversations about what is arguably a heated topic.” (Direct stakeholder)

- **The Privacy Commission was engaged proactively throughout the programme,** with a representative sitting in on governance meetings, attending workshops and made generally available at any time to the project managers. This has been a key success for the programme, as there have been other examples of smart technology being trialled New Zealand without privacy concerns being placed front and centre, which led to the abandonment of those projects because of public backlash.

“[Bringing in the Privacy Commission was] absolutely positive, I think that that was a master stroke on everyone’s part, and the vendor really enjoyed the engagement with the council and privacy commission... From that perspective... it’s been really interesting, but also as a citizen and a user, I find that assuring that we are making sure that we treat that with utmost priority.” (Direct stakeholder)

- **The programme highlighted the challenge of ‘safely’ managing aggregate data sets.** There is a risk that as more and more data is collected and becomes publicly available, there is the increased chance of personal identification. There is a potential risk that eventually there will be large enough data sets to be able to pick people out of the data (also section 3.6 Lessons learned). This programme created a forum where issues such as this could be discussed for further consideration by those involved.

- **The Smart Cities programme has shed light on privacy issues which are challenging current regulation regarding emerging technology and managing privacy issues.** Because there have been no programmes like this before in New Zealand, the programme has helped to surface these emerging issues.

“I’d like to see central government come up with some principles related to this type of project and to the whole data sharing...there is a lot of potentially sensitive data from collecting data from citizens on the streets... And one of my concerns is that it’s so easy to identify anyone in New Zealand that you... have got data that can be used for good or evil. The way of working (for Smart Cities) has strong ethical guidelines and governance principles but you’d want those raised to the central government level to enable that trust and respect for organisations to begin sharing data and saying ‘I can throw my data in here, because I know these principles will apply and that my data won’t fall into the wrong hands.’” (Indirect stakeholder)

“One thing is that the commercial value of the data is huge. That’s an element too, and that’s something only central government can...it’s not a matter of controlling, but setting down some fundamental guidelines...I think there are some other elements too – privacy law is set up for just standard people using data for their own use. So I don’t think the privacy legislation covers the things you’re doing, or in a comprehensive way...I think maybe there is some of the GDPR (General Data Protection Regulation) elements would need to go into the privacy legislation.” (Indirect stakeholder)

3.6. Lessons learned

This section summarises key lessons that have been learned overall by the programme, gleaned from all five focus areas on evaluation. These can inform decisions being made on this programme, or may inform other similar or related projects and programmes.

The evaluation has identified a number of lessons that are of much broader relevance, not only to agencies and organisations that might be seeking to test or deploy smart technology, but also lessons that have implications more broadly to the public service; its way of working; and considerations regarding what would be ‘fit for purpose’ to ensure New Zealand is in the best position to capitalise on the rapid developments in smart technology and the use of ‘big data’.

Some of the lessons learned involve the identification of ‘critical success factors’ which were identified in consultation with those directly involved in the programme. These have also been highlighted in the programme performance snapshot (section 4).

- **Both the initiation and success of the projects and this programme were due to influential champions.** This was a key theme that emerges from the baseline report, and was consistently identified as a critical success factor (in association with having strong support from senior leaders/the executive management team). Because these proof of concept programmes are new, different, and innovative, they can be challenging to understand and are generally perceived to be riskier (part due to the fact they are hard to define). Most project managers involved in this programme reported experiencing considerable resistance to their projects early on. This was only overcome once senior leaders and managers were ‘on board’, and typically required extensive consultation,

repeated presentations and explanations of the benefits, and a champion at that level. In some cases, this involved the strong direction to others lower down in the organisation to be flexible and work constructively to ensure the projects could be delivered. Issues with procurement are an excellent illustration of this challenge (also see the bullet point on the tripartite arrangement, page 20-21). As highlighted in section 3.1, as more concrete examples of what ‘smart’ technology and smart cities looked like, it became much easier to explain and understand the potential value and benefits of the concepts tested by the Smart Cities programme.

- **A general understanding on what ‘smart’ cities might mean continues to grow, however the idea of what ‘smart cities’ means remains poorly understood.** At the beginning of the programme a key challenge faced by the project managers was trying to explain the intent of the proof-of-concept projects and what they would be delivering. These, by their nature, involved new, innovative, and different ways of doing things and are therefore by definition often difficult to define. Stakeholders interviewed or surveyed highlighted the challenge that whilst as a general idea, people can be easily interested and excited by the concept (and at times the ‘promise’) of Smart Cities, convincing decision-makers at the executive level to fund or invest can be more challenging.

“This is new ground for us, so we’re learning as we go. It’s very similar to the beginnings of the internet!” (Direct stakeholder)

“We have great support, but it’s very difficult to convert this to financial support. Most organisations are unwilling to invest in development. They want a working product.” (Indirect stakeholder)

Stakeholder feedback has been clear – and this programme has clearly demonstrated in the interest in the projects as they started to ‘deliver’ something – that the relevance and value of these types of projects is only really understood by others once concrete examples are available.

“As proof of concepts demonstrate their worth, this will become an easier sell to executive management and the general public.” (Indirect stakeholder)

- Ensuring you have a clear use-case, understanding the outcomes you’re seeking, and not being technology driven is key. This was a learning and key message repeated by stakeholders throughout the programme, and remains an important learning. Stakeholders emphasised the importance of being clear about the solutions you are looking for and then understanding how technology can support that, rather than the other way around. Being very selective about the size and scope of the project was also identified as important, to ensure it was manageable and sized appropriately to be a proof of concept. By following these guidelines, these stakeholders felt they had ‘got it right’ in the planning and preparation phase.

“we didn’t ever want to be technology driven.....in the end technology providers will tell you they can do anything for you, so we wanted to start with defining what it was we wanted to achieve.” (Direct stakeholder)

“From an inputs point of view, the way we’ve been approaching things is look at the problem or challenge first, so get away from the bling and say ‘what are the real issues we’ve got?’” (Direct stakeholder)

- **The involvement of LINZ as a central government ‘partner’ made a significant difference to progress early on.** As detailed above, these projects were considered risky and were difficult to understand resulting in limited support initially. The fact that LINZ was putting ‘skin in the game’ made a considerable difference to many of the project managers’ ability to sell their projects to their executive. LINZ’s involvement in the programme has two key influences. One was the fact that money was being contributed from another party, making the potentially ‘risky’ investment ‘safer’. The fact investment was also being provided by the technology partner under a tripartite partnership further reduced concerns. The involvement by LINZ as a central government agency also eased anxieties or concerns involving the perceived risks more generally. In other words, if central government was prepared to invest money, this was a signal that the risks associated were acceptable at local government level. This was repeatedly highlighted as a key success to this programme of work.

“At an executive level... they were certainly impressed... that Treasury would take an interest, and that is even has a bigger and brighter future if we can prove it across council and across the country. It’s certainly being noticed and commented on. It’s made it an easier sell” (Direct stakeholder)

- **Procurement proved to be key ‘make or break’ factor in the progress of projects.** Procurement processes had a considerable impact on the ability of projects to get underway. It was recognised from the programme’s outset that normal procurement processes were not fit-for-purpose for proof-of-concept projects. The implication was that for the projects to get up and running quickly (as these types of projects are agile and ‘fast fail’) the procurement rules needed to be adapted. This proved difficult, and typically required the intervention or direction from senior leadership to find ways to enable the projects to proceed. The challenges of operating safely but differently within the procurement rules also affected LINZ, with advice and guidance from Treasury assisting in the establishment of the programme that enabled the funding model required for the programme to run. The impact of procurement on the ability to run these ‘fast fail’ projects (which do not involve large sums of money) has been best exemplified by the 3D+ asset and non-asset project. Whilst initially delayed due to the collapse of their technology partner at the start of the programme, months of delays were also incurred due the requirement from council for his project to follow normal procurement processes (such as running an open tender process). The project finally started in mid-October 2016, when all projects were due to wind-up.

“[They] literally had to say ‘this is different’ and proof of concept means we can break the procurement rules. But we didn’t break them, we brought the procurement team in and agreed [we’d work together] but a top down approach that said ‘this is going to be different – that’s the point of it’.” (Indirect stakeholder)

“In order to achieve some of these things you need another model...nobody wants to be spending money they shouldn't, but [they can't work] with a level of structure that means 6 months later you're still waiting for an autograph... [to spend] chump change.” (Direct stakeholder)

- **This programme also highlighted that the application and use of smart technology in the public sector is demanding a different business model.** The application and use of smart technology is at a point where there is still enormous potential to be explored. This exploration (for the benefit of public services) is best delivered in partnership between the public agency, and the technology provider(s), where a flexible and adaptive approach to finding solutions to problems or use cases can be adopted that meets the needs of all parties. However, the typical way of working with ‘suppliers’ does not accommodate this approach, as exemplified by the challenges with procurement. Instead, a business model that reflects mutual benefit needed to be developed. Each city and organisation has found different ways to approaching partnerships (which cannot be detailed for commercial sensitivity reasons), but in all cases the relationship was negotiated in such a way that flow-on benefits to the private sector partner are recognised and understood (e.g. commercialising aspects of what is developed), and clear opportunities to walk away have been built into the contracting approach.

“It's not a supplier relationship – it's a people of similar interests' relationship...it's more than just a business relationship. And that had different boundaries and different ways of working and different ways of being measured. And that's the key difference. So rather than suppliers and commodity thinking...it collaborative and innovative thinking. We can be seen to be at the beginning of something and we have to agree that that evolution can take the supplier in one direction and us in another. And as long as we are comfortable with the direction we are going in we don't turn around and say hang on they just made a billion dollars. We have to make that conscious decision. So it's a bit different.” (Direct stakeholder)

Another key learning from these projects has been the recognition that future application of ‘smart’ technology (in the provision of public services at least) no longer lends itself to a proprietary approach, which is risky (potentially costly and has limited flexibility) to public agencies. Instead what has been developed and implemented here (with the NEC projects) has been the development of an open platform (the flexible sensing platform – KITEs) upon which other sensors can be ‘plugged in’ depending on the information requirements. Whilst there has been progress within this programme grappling with the implications of this different way of working, the solutions have by no means be identified. This will continue to be a key issue to work through, the ramifications of which will be critical to all involved.

“It's a gnarly issue (the business model) but it's absolutely key to sustainability” (Direct stakeholder)

- **The programme has demonstrated clear benefits from central and local government working together, with central government acting as a catalyst for change.** Not only did the involvement of LINZ facilitate the ‘acceptability’ of the programme early on, but the design of the programme also required relationships to be forged across local government, and between local and central government, enhancing the programme’s effectiveness by more efficiently sharing learning. As detailed in section 3.2 (Efficiency), different projects have been able to leverage off each other, ‘lifting and shifting’ learnings, technology or other artefacts (such as project/programme documentation). Those directly involved in the project agree that this would have been unlikely to have happened without the programme, and in some cases whole programmes of work may have never been initiated. The evolution and expansion of the programme to include three cities (from the original proposal to work only Christchurch) also proved to be an excellent development, and exemplified the clear benefits of a more joined up approach to efficiently and effectively leverage benefits. The involvement of LINZ in a role of coordination and oversight was also considered helpful. Their ‘objectivity’ or ‘agnostic’ position meant the governance approach was deemed to be generally fit-for-purpose. It has also meant that the learnings of this programme can be more widely disseminated (and therefore have greater impact), than if the programme had been coordinated and delivered only at the local government level.

“Having central government support this is also very big because we are just too small a country to muck around on this too much. So actually being able to have a forum and a medium to leverage lessons from Wellington or Auckland or Christchurch back to the other cities is huge! And the fact that LINZ have actually offered some money which the cities have matched, which I think is the right thing to do, is absolutely setting up the foundation for this. Otherwise you wouldn’t get this.” (Direct stakeholder)

“(It’s) cutting edge stuff. It’s all about people who can see the vision, and chip away till people hop on board. But is this the right thing for local government and central government to be doing?... this has been a positive learning experience...[and] I’ve seen the benefits of working that way. I’ve only got positive feedback on the way it’s worked in terms of the relationships. But that is difficult to explain to others...it’s a hard story to sell. How do you define that a little bit better?” (Direct stakeholder)

- **The ‘tripartite’ funding model was highly successful.** Funding for nearly all these projects involved financial contributions from the local government, central government, and the private technology partner. As detailed above, not only did this funding approach help to ‘spread the risk’ of failure and facilitate the involvement of some cities, stakeholders also highlighted the fact that when everyone ‘had skin in the game’ that this tended to result in people working more effectively together.

“It absolutely cements the collaboration. And that is the key thing. We don’t want to be doing this in isolated silos and we absolutely need to have a collaboration between public and private. So has it stimulated [learnings], there is no doubt.” (Direct stakeholder)

There was also an unplanned but clear benefit of having the same technology partner involved across several projects. As highlighted above this did not come about due to a focus on a particular technology, but a clear focus on outcomes that happened to be shared across multiple councils. This resulted in clear benefits to the councils, but also for NEC that has been able to develop the KITEs from a proof of concept project into a commercial product.

- **The programme has highlighted the future potential for collaboration between central and local government.** Whilst the projects within this programme of work involved only the local government at an operational level, Wellington’s wider programme of work with the Safer Cities Living Lab has highlighted the growing relevance of collaboration between central and local government (and other organisations) working together, by bringing together data sets, and also sharing the information (analytics) that emerge from these smart sensing technologies to deal with public service issues.

“So [this] evidence based decision-making...we have collaborations with the Police and other agencies, they need our eyes and ears, and if they don’t get input from us, they’ve got to guess...So what we have here is true collaboration.... they need us, so why wouldn’t we collaborate?” (Indirect stakeholder)

“The problem with local government and central government, you’ve got to put up a business case, get justification, and get 99 people to sign it off, and prove its cost effective and prove a ten year cost of ownership calculation... you’ve got so many hurdles to jump through that it impedes the speed and agility and uptake and adoption of new thinking and new ways of working. [So] what we end up doing is we keep doing what we we’ve kept doing the last decade because it’s easy and we have a budget for it, it’s not new, there is no risks. But with Smart Cities we can take a risk, we can do a proof of concept, we can make a mistake and find it doesn’t work, but boy do we learn when we make a mistake, and when we learn – bang – everyone can take advantage of those successes.” (Indirect stakeholder)

- **Local government, and New Zealand generally, represents an excellent ‘test case’ or incubator for smart sensing technology projects that could be more widely applied across the country and globally.** Stakeholders both directly and indirectly involved with the programme saw the huge potential for testing the application of these smart sensing technologies within the ‘safety’ of the local government setting before applying these more widely (e.g., within central government agencies, or globally). Several stakeholders referred to New Zealand’s reputation for being an excellent ‘test case’ for technology, and opportunity which they felt we should be capitalising on.

“We are at that critical point where something has to happen. We can’t just sit back and wait...it’s happening across the world. The use of data and the use of technology to improve public services is going to happen.....it has to, so I think there will be programmes going forward because New Zealand is too good a playground for this, we are too good a test case....and New Zealanders are early adopters for this stuff.” (Indirect stakeholder)

*“We have a sandpit, and quite a unique sandpit. We need to take advantage of it!”
(Direct stakeholder)*

- **Ensuring privacy considerations are clearly and transparently built into any smart sensing technology will be key to their acceptability by the public.** Within the Smart Cities programme of work, most technologies were still in the ‘test’ phase, with limited visibility to the wider public. However, learnings from Wellington City’s Living Lab has demonstrated the importance of not only explicitly considering the privacy implications, but also being honest and transparent with the public regarding the implications of this. This open and honest approach has led to shift in media coverage from sensationalism (such as references to ‘big brother’) to more balanced and considered reportage.

The Smart Cities programme has also given visibility to the issue that other data sets when in isolation are anonymised, but in aggregate could lead to the identification of individuals. Whilst this was not a concern or issue facing the projects with the Smart Cities programme, the programme has provided a useful vehicle to surface these wider considerations, the implications of which will need to be considered and ‘owned’ by government policy somehow. Finding ways to engage the wider public into the ‘conversation’, as their engagement in the technology long term is one of the key outcomes and benefits of smart sensing technology will also be critical.

- **A key limiting factor for LINZ leveraging this programme of work more widely has been the absence of a clear ‘home’ within government for policy, governance, and oversight in the collection and use of data and ‘big data’ and associated technology.** While LINZ had the responsibility for delivering this programme of work, they currently have no ongoing role in this general area. Stakeholders felt that LINZ was a good home for the programme, given the fact the agency has a strong customer focus and already had strong linkages with local government via their mandated functions. However, LINZ’s small size and lack of a future mandate for this work has left the programme of work vulnerable, with a considerable risk that the relationships, learnings, and wider indirect benefits that have arisen from this programme will be lost or not fully capitalised upon. This would appear at odds with the intent of the BPS seed fund.

*“You need that central place that has the public sector articulation of that...this is a topic that comes up regularly [overseas]...it’s a topic that peaks interest...we are seeing a lot of interest in the solutions, so we see this as something of international significance”
(Indirect stakeholder)*

This programme has also highlighted a broader challenge, in that there is a general lack of coordination or direction in this emerging area of smart technology and its application and use by public agencies. Whilst some direction has been provided by government regarding data and open data, currently there is a vacuum for the ownership and oversight for smart technology (that then provides data). Given the clear benefits both individually (to individual agencies) and collectively, a more ‘collaborative’ approach to developing and using smart sensing technology in order to deliver better public services deserves attention.

- **A lack of a transition pathway poses a significant risk to fully realising the benefits of pilot programmes such as this.** The Smart Cities programme has been highly successful, demonstrating tangible benefits at local government level, but also highlighting a number of opportunities that could be capitalised upon by others at both central and local government level. Whilst pilot programmes are by definition of a finite length, where the programme is clearly demonstrating benefits, including a transition pathway into the programme’s plan, makes good sense. In the Smart Cities programme, their BPS funding bid had no scope for this. Whilst there will be the development of a Strategic Assessment, decisions and actions arising from this are likely to be months and potentially more than a year away (e.g., developing budget bid). This leaves the programme’s ability to fully capitalise on its benefits exposed, exacerbated by the fact LINZ has no current role to play under its current mandate to steward the programme into any future phase. This leaves the programme in a situation where it has clearly demonstrated a contribution to the goals of the Better Public Service Seed Fund goals, but with little opportunity (currently) to embed these.

“[we don’t want a] wake littered with data use projects that fell over. That’s not a good look...the public’s not going to like it and internationally it’s not going to look good.”
(Indirect stakeholder)

Local government wellbeings

Economic Growth Risk Managed Sustainable Future Social Cohesion Increased Equity

Improved economic wellbeing Improved social wellbeing Improved environmental wellbeing Improved cultural wellbeing

A seamlessly engaged and involved public
More resilient and prosperous communities (people, education, commerce, culture policy...)
More efficient and sustainable use of resources (water, air, energy, materials) ...
Better quality and more effective services (energy, water, transport, building...)
More user-friendly infrastructure (land, roads, buildings, communication technology, utilities...)
Sustainable natural environment (topography, environment, resources...)
 The New Zealand experience informs smart cities developments internationally

Outcomes

Public buy-in to the idea of smart technology
 Increased opportunities for public to actively engage in the use of smart technology
 High quality and appropriately informed data governance
 Responsibility for governance and oversight of smart technology clarified
 Behaviour change (ways of working) in the public and private sector
 Development of a clear operating business model for Smart technology solutions
 Grow our international reputation as a smart nation
 Privacy considerations are better considered in Smart Cities and other similar projects
 Better detection and response to physical and social environmental issues
 More efficient and effective management of assets over their life-cycle
 Clearer understanding of what 'smart cities' means
 Improved collaboration between local government and central agencies and other organisations
 Enable new research and development opportunities
 Support and investment in Smart technology solutions

Outputs

Better informed decision-making
 Solutions are turned into production and Proof of Concept projects transition to operational deployment
 Operational readiness: scalable and sustainable solutions ready for deployment elsewhere
 Lift and shift transferability of smart city solution: the technology and the approach (including learnings)
 Data transformation (turning data into information)
 Generation of quality data (fit for purpose, accessible, meaningful)
 Successful deployment of the concept
 Apply learnings back into production

Activities

Build and test the concept
 Capture, review, and share learnings
 Stakeholder engagement
 Ongoing communication to socialise the concept and solution
 Manage relationships (via 'champions')
 Procurement support

Inputs

Fit for purpose governance model
Collaborative way of working
 A champion
 Supportive technology partner
Supportive leadership (mandate to innovate and acceptance of failure)
 Clear use case
 Appropriate and fit for purpose technology
 Supporting technology communication networks/ infrastructure (e.g. broadband)
Supportive strategies, policies and guidelines (including ethics, privacy, procurement)
 Learnings/experience from elsewhere
 Accessible data sources
 Sufficient time, funding, and right people

Collaborative way of working together – Intercity partnerships and community of practice

Key
Bold italics – critical success factor
 Solid green – strong positive evidence
 Solid green + solid orange outline – strong positive evidence, but some challenges also encountered
 Hatched green + solid orange outline – positive evidence but some challenges also encountered
 Hatched green + hatched orange outline – positive evidence but a few challenges encountered
 Green outline – emerging positive evidence
 Hatched green outline – suggestive of positive evidence
 Black hatched outline – not applicable to all projects

Figure 3. Smart Cities programme outcomes model, October 2016.

4. Overall programme performance ‘snapshot’

As described in 2.1.2, the outcomes model diagrammatically reflects the Smart Cities programme, from the inputs it required, the activities completed, details on the process of building, testing, and deploying smart technology solutions for Smart Cities projects. It also gives a more detailed representation of the actual or likely outcomes needed to realise the benefits of smart cities. As such the model can be treated as a brief roadmap or guide to implementing smart technology solutions elsewhere in New Zealand, including the outcomes (benefits) they can lead to (realise).

This model has been colour coded using a traffic light system to give a ‘snapshot’ of the programme’s performance Figure 3 highlighting areas of progress and achievement. Gradations of colour illustrate where evidence is emerging (green positive, orange where challenges or problems were encountered). A brief summary of the programme performance in reference to the model is provided below, however the reader is also encouraged to refer to the body of the report for a more details (particularly sections 3.2 and 3.3).

4.1. Inputs

Most inputs were in place and several inputs were identified as critical success factors or critical enablers. These are illustrated in bold italics. A summary of key messages (particularly the challenges) that emerged from this area are summarised below.

- Time was a key constraint for many project managers, who were all managing several other programmes of work in addition to their Smart Cities projects.
- Having the right supporting infrastructure proved to a key barrier in some instances (causing delay) for several projects, in particular civil engineering (e.g. accessing and getting power to poles to place KITEs). Some challenges were foreseen, but they were greater than anticipated.
- A lack of clear supporting procurement guidelines was a key barrier that most projects faced or had encountered. In one instance, the 3D Asset and Non-Asset Management project, this been a key contributing factor to very lengthy delays in getting started (initiated in late October 2016).
- Support from leadership and executive management was a critical success factor. Whilst all projects were able to secure this, in some cases this did not happen without extensive lobbying and support from influential champions. In several cases this was also key in ensuring procurement processes could accommodate the approval of these projects, as was having a clear use case rather than a technology driven solution.
- The governance structure of the programme was regarded overall as fit for purpose, however it became apparent as the programme progressed that the original rationale for have one project manager representing each city made sense initially, it made less sense later. The structure resulted in the exclusion of one of the project managers from the governance group. This may have led to some inequity in information flows, as it is likely they missed opportunities to be engaged in discussions in that forum that all other project managers found extremely valuable.
- Governance of the programme was overall regarded as fit for purpose, providing the right level of oversight and flexibility for these ‘proof of concept’ projects. However, several stakeholders highlighted that they felt there may have been a lack or late focus on the ‘what next’ questions, including instructions or guidance in forging linkages with other similar programmes of work or interested/related agencies.

4.2. Activities

Most activities were completed without issues, with the exception of procurement support which has proven more challenging. Key messages for this section are:

- Overall the building and testing of the proof of concept projects has been completed very successfully, with the key exception being the 3D+ Asset and Non-Asset Management project, where project work has only commenced in October 2016.
- Procurement has been a key challenge. Whilst most cities and projects have been successful in working with procurement teams to obtain the right support (often via or with assistance from key 'champions' in leadership positions), the exception is the 3D+ project where accommodations have been much more difficult to secure, leading to extended delays (due to, for example, requiring a publicly tendered process).
- All other activities have, for the most part, been completed successfully. Constraints around time have resulted in some limitations around effectively capturing all learnings, and there have been some lost opportunities in developing strategic relationships and forging links with other central government stakeholders to share learnings and explore the 'what next' questions.

4.3. Outputs

For those projects that have proceeded, progress has been extremely positive. Key messages for this section are:

- Projects that have kicked off have all successfully deployed their concepts, including the 'building' of integrated solutions such as the smart city backbone, CCOC, and testing different sensors to feed data into this system. Key delays included challenges dealing with civil engineering, and finding the right sensors for water quality testing.
- Data is being generated by sensors, however for the water and air quality sensors some issues with the data (regarding calibration) are still being worked through. There are no concerns regarding these issues and they are in the process of being resolved.
- Where sensing data streams are fully functional, these are now being used and transformed into useful analytics, particularly in Wellington and Christchurch.
- Data and information is already influencing or informing some decision-making, and other data 'users' also expressing a strong interest in accessing and using these data and information streams.
- Learnings from the proof of concept projects have been captured and applied within and across the solutions, particularly those involving NEC, leading to refinements to the solution, and the development of the KITES, a new innovation now being commercialised by NEC.
- Planning to operationalise the proof of concept projects is underway in CCC, WCC, and Panuku Development Auckland, and have also demonstrated that key building blocks of what has been tested as part of the Smart Cities programme could be adopted by other agencies including other local councils or other government agencies.

4.4. Outcomes

There is emerging evidence of the Smart Cities programme contributing to a number of outcomes. There is likely to be ongoing contribution to these and additional outcomes beyond the life of the programme, however it is too early to gather evidence of this. Key emerging findings are:

- A better understanding of those involved in the programme of the importance of and mechanisms to consider privacy effectively in these kinds of projects.
- Early evidence that proof of concept air and water quality sensors projects are leading to better and faster detection of environmental quality issues.
- An emerging understanding of what smart cities means based on concrete examples emerging from these proof of concept projects (and other related projects, such as the Safer Cities projects in Wellington).
- Development of a strong, positive, productive set of relationships between LINZ, local councils, and private enterprise (in particular NEC), demonstrating a successful way of working together based around constructive mutually beneficial partnerships.
- Exploration of new research and development opportunities within tertiary institutions, as well as development of new technology by the private sector, particularly sensors that can be 'plugged in' to the flexible sensing platform (KITEs).
- Investment by technology partners (including NEC global in their Wellington office as a centre for Smart City technology development), as well as interest in developing smart technology solutions by other private sector organisations.
- International interest in Smart Cities projects in New Zealand (Auckland, Wellington, and Christchurch), including the uptake of some of these in Australia (deployment of KITEs).
- Emerging understanding of what future operating business models might look like that revolve around public-private partnerships that are based on principles of mutual benefit rather than a traditional service model. However, there is also a recognition there is still much work to be done for this to be clarified further.
- Changes to the 'traditional' ways of working by LINZ and the local government organisations involved, both in ways of working together, but also ways of working in collaboration with the private sector that better reflect the mutually beneficial (rather than transactional) working relationship.

5. Evaluative judgements

Overall evaluative judgements have been made on the programme's performance against the key evaluation objectives. Judgements have been made against a four-level scale, and include a statement regarding the level of confidence we have in this judgement, based on the strength and quality of the evidence available. A simple rubric that describes what 'good' looks like for each of these areas was used as to 'benchmark' performance to ensure the judgements were fair and transparent.

5.1. Relevance

Overall the Smart Cities programme is **highly relevant**, a judgement we have **high confidence** in. While some project managers involved in the Smart Cities programme faced challenges initially in being able to effectively communicate and 'sell' the concept, once clear operational examples emerged support and interest in the pilot programmes including their expansions or establishing new initiatives grew rapidly. There are numerous examples from all cities involved (as well as for NEC, the main technology partner) being invited to speak at, participate in, or contribute to international forums. There have also been delegations visiting the New Zealand cities involved, as we are seen as leading the world in how to operationalise the concept of 'smart cities'

5.2. Efficiency

Overall the Smart Cities programme has been run **efficiently**, a judgement we are **highly confident** in. All key stakeholders involved in the programme reported that overall the programme was well designed and delivered. The key reasons for not judging the programme as highly efficient were due to some inconsistencies in some programme documentation, some issues around effective communication within the programme, limited linkages being forged with related or potentially interested agencies and initiatives at the programme level resulting in limited visibility of the programme, and a failure to capitalise on some opportunities presented to the programme. Although these issues have had no material impact on the efficiency of the individual projects, they have limited the programme's ability to run as efficiently and therefore as effectively as possible.

5.3. Effectiveness

Overall the Smart Cities programme has been **highly effectively**, a judgement we are **confident** in. Although there were some disappointing failures to capitalise on opportunities presented to the programme (e.g. catalyst projects), and limited visibility of the project by agencies and initiatives that could influence the transition and future of this area of work more generally, the results the programme of work has achieved justifies a judgement of highly effective. The gains individual projects and the collection of projects together enjoyed from having a shared technology partner (NEC) that was highly flexible, adaptive, and committed to the success of the projects is a key contributing factor to this overall judgement.

5.4. Impact

Overall the Smart Cities programme emerging impacts are **good**, a judgement we are **confident** in. The programme has contributed to the achievement of a number of outcomes, including the commercialisation of the KITE technology, growing global interest in what is happening in New Zealand, creating opportunities for other third parties, and contributing to the wider body of knowledge on the successful application and use of smart sensing technology. At this early stage in the programme's 'life' a stronger positive judgement is not possible, as not enough time has passed for impacts to emerge.

5.5. Sustainability

Somewhat sustainable, a judgement we have **confidence** in. Sustainability refers to the extent to which the outcomes of the programme; in this case not only the ongoing use of the pilots themselves, but work in Smart Cities more generally; continues. The sustainability judgement is based on findings at two levels – local and central government.

For local government ongoing work in Smart Cities looks to be relatively sustainable, as there is a strong commitment and interest in the pilot programmes, and in Wellington and Christchurch, clear pathways are in place to establish systems and processes internally to continue work in this area. Strong interest from other councils further cements the likelihood Smart Cities initiatives will continue to grow, building on lessons learned already.

However, at central government level there remains a lack ‘ownership’ over the concept of Smart Cities. This puts the longer-term sustainability of the programme at considerable risk as it officially ends. The implication is that from January 2017 there will be no agency mandated to take the learnings forward and see them shared and applied more widely, *or*, to cultivate and maintain the constructive relationship framework developed via this programme between both the local government agencies and between central and local government. Whilst an argument can be made that if the relationships were particularly positive between the local government agencies, then they could be motivated to establish their own network of relationships this approach would suffer two challenges. First, those involved in the programme highlighted the value having an objective ‘other’ agencies acting in a coordination role was helpful. Not only from a logistics and resource perspective, but more in the value of having a party who couldn’t be perceived as bias in any particular direction, as well as the credibility this provided. More importantly, a lack of engagement from central government level means there is an increased risk of uncoordinated and un-informed work as these technologies are taken up by others. This is in contrast to what represents an efficient and effective ‘better’ public service.

Overall this leaves the prospects and outcomes at a central government level unsatisfactory given the clear learnings highlighted by this programme – and the implications these have highlighted.

5.6. Cross-cutting – privacy

Overall the Smart Cities programme has done an **effective** job to ensure privacy concerns have been considered in the programme, a judgement we are **highly confident** in. The Privacy Commission was brought into the programme at an early enough stage to ensure that any privacy issues had been thought through, and was given full visibility across the projects. Placing privacy concerns at the front and centre of the projects made sure that these issues were front footed. The programme has also helped to highlight the increasing role of the concept of ‘social licence’ and the importance of engaging the public early. Some of the documentation on privacy and learnings could have been strengthened, and although this has not had a material impact on the programme, this is a key reason for only rating this as effective.

Future programmes would benefit from incorporating privacy explicitly into their application process, and also incorporating privacy into regular reporting (e.g., monthly project reports). Sharing the linkages and learnings more widely to other related projects and initiatives would also have enhanced the programme’s effectiveness in building valuable learnings on this critical issue.

5.7. Lessons learned

Overall the programme has done an **effective** job in capturing lessons learned, a judgement we are **highly confident** in. The programme explicitly incorporated evaluation into the programme entire life-cycle, and established a comprehensive and systematic approach to efficiently capturing programme information and learning during the life of the programme. This included the production of four evaluation reports, which have identified a wide range of valuable learnings, across time and overall. This would justify a judgement of high effective, however an overall judgement of 'effective' has been made because the sharing of these learnings has been limited. Invitations were made to some interested or related stakeholders to the evaluation workshops held during the programme and the investment logic mapping sessions, but encouraging attendance from a wider range of stakeholders would have assisted in achieving greater visibility of the programme, and consequently sharing learnings more widely.

There remains an opportunity to undertake a more explicit communications exercise to systematically share the learnings. Given this was a key objective of the programme, a failure to do this would not only be disappointing for the stakeholders involved (a concern already reported by stakeholders, both direct and indirect), but would represent a substantial 'cost' to all those who have invested in the programme due to the lost opportunity for others to benefit from what has been learned here.

6. Overall conclusions and recommendations

6.1. Overall conclusion

Overall the Smart Cities programme has been extremely successful, testing a portfolio of proof of concept projects that are now generating 'smart' information that will enable the cities to more efficiently and effectively manage their cities, via better quality information delivered in 'smart' ways.

There has been strong interest in the programme both nationally and internationally, particularly in the flexible sensing platform (KITE) technology developed by NEC New Zealand and tested in all three cities in the programme, with the replication of the technology already underway in Australia.

A key success of the programme has been the involvement of one technology partner across three of the sets of projects. Whilst this was not at the explicit direction of the programme (cities all submitted their own project applications) this has enabled the delivery of a highly efficient and effective suite of projects that have clear 'lift and shift' potential, between the cities themselves and elsewhere.

The benefits that have arisen from this programme; involving a spend of \$970,000 on the projects, and in-kind investment of \$1,500,000 from the councils and approximately \$640,000 from private sector technology partners have been substantial, and clearly meet the objectives of the Better Public Service Seed Fund to which is to speed up development of initiatives and innovation, reduce transaction costs and administrative burden of cross-agency collaboration, and remove disincentives for lead and early adopter agencies.

The largest risk to the programme, Treasury (as funders), and New Zealanders (as tax payers and ultimate beneficiaries of Smart Cities solutions), will be a failure to effectively capitalise on the clear strategic benefits this programme of work can offer in delivering better quality data, better decision-making, and better services and outcomes overall. Although this programme was framed around smart *cities*, the relevance of what has been tested here applies to any agency providing a public service (government, not-for-profit, private), regionally, nationally, and globally.

Whilst there has been a Strategic Assessment completed as part of this programme of work, there has been no transition plan in place to build on the success of this programme. At a minimum establishing a mechanism to share the achievements and learnings of the programme as widely as possible will assist in creating a 'critical mass' to carry the learnings forward.

Given the level of international interest in smart cities, and smart technology in general, (including what New Zealand has undertaken) there is a compelling case to establish a transitional arrangement where Smart Cities (in its broadest interpretation) is given a temporary 'home' within central government. This will provide a central place to field inquiries, and ensure a coordinated 'New Zealand-Inc' approach can be taken and also ensuring learnings are built upon rather than mistakes unintentionally repeated. It also provides a central point where inquiries can be managed, in conjunction with New Zealand G2G (where appropriate).

The Smart Cities programme has provided a unique opportunity for local and central government, private and not-for-profit enterprise, and the public in general to understand in concrete terms opportunities presented to us by emerging technology and the future 'digital world'. It has also highlighted that to make the best use of these technology, organisations from all spheres are going to need to accommodate and develop new ways of working together, reflecting a different operating model where 'business' is based on partnerships of mutual benefit rather than traditional transactional approaches.

6.2. Recommendations

To maximise the benefits of the programme four key recommendations have been made, detailed below.

1. **Develop a clear plan to communicate and share the learnings of the programme, to both the ‘operational’ and ‘strategic’ audiences at both local and central government level.** The learnings from this programme have relevance at both a technical or ‘operational’ level (i.e., other organisations delivering public services) but also strategic learnings regarding how to best coordinate, manage, and provide oversight from a central government perspective (also see recommendation two).
 - a) Convene a forum with invitations to share the learnings of the programme, and discuss the implications of the experiences to-date. The invitation should be as wide and inclusive as possible (local and central government, private and not-for-profit sectors). Face-to-face interaction is likely to be the best initial method to share the learnings. Hosting/supporting a wider community of practice would also enhance the likelihood learnings can be shared widely (also see recommendation four).
 - b) Develop specific collateral (short guidelines or ‘tip sheet’ based on key learnings) for key issues such as privacy and procurement based on the experience here (reviewed by project managers and the privacy commission as appropriate). A brief overview of the critical success factors identified by this programme would also be useful.
 - c) Share the learning with the Information Group, and then with the Business Growth Agenda group to consider the learnings and implications of the programme (see below, recommendation two).
2. **Work to clarify the right ‘home’ for the ownership and oversight of this type of programme and related initiatives.** This includes the application and use of smart sensing technology and managing ‘big’ data. Communicate the findings to the government Information Group, with a recommendation that the programme’s learnings are also shared with the Business Growth Agenda group. This would be with a view to discussing and identifying a more strategic response to this emerging area (that combines technology, data, and privacy considerations). Having a central point in government will also make it easier to coordinate a ‘New Zealand-Inc’ response to interest in what has been done to the global audience.
3. **Recommend to Treasury that any continuation of the Better Public Service Seed Fund has a more explicit consideration on transitioning successful programmes.** This will ensure the value of any investment made can be capitalised on as efficiently and effectively as possible, where new or different approaches are demonstrating clear benefits. This may include a decision point half-way or two-thirds the way through the programme that triggers a transition processes so these decisions are not made too late in the process. This could also include having residual funding that can be accessed if a clear case can be made to shepherd a successful programme of work until a more permanent state can be establish.
4. **Identify a mechanism to transition this programme of work.** Although not currently mandated to carry this work on, LINZ identifying a mechanism to continue supporting (at least) the current group, with the potential to expand and grow linkages with other organisations and initiative to develop a wider community of practice. Maintaining a virtual space for learnings to be logged and shared (such as a scaled down version of the Evaluation Hub) would be an efficient capture mechanism. A semi-regular (e.g., every three-four months) face-to-face semi-structured discussion forum would ensure lessons continue to be captured in a more scaled back but fit-for-purpose manner. Discussions with the current project managers on an equitable strategy to resources is recommended.

Appendices

List of appendices

- A. Original evaluation questions
- B. Project maturity framework
- C. Project profiles
- D. Information sheet and consent form
- E. Wider stakeholder survey and summary of responses
- F. Citizens Voice – data collection guidelines and paper data collection form
- G. Evaluative rubric

Appendix A: Baseline Evaluation Questions

Evaluation Criteria	Evaluation questions
<p>Relevance – The extent to which the LINZ Smart Cities project met a clear need identified by stakeholders.</p>	<ol style="list-style-type: none"> 1. What was the intent of project? Did it change? 2. What assumptions were made? To what extent did they change (and in what ways). 3. How well understood was the project by key ‘external’ stakeholders (e.g., policy makers)? Why, Why not?
<p>Efficiency – The extent to which inputs were transformed into outputs in the most optimal way.</p>	<ol style="list-style-type: none"> 4. What were the components of the project? How well were they implemented? Was anything missing? 5. Were the governance and project management arrangements ‘fit for purpose’ for this type of agile project? 6. What contextual factors influenced the implementation of the project?
<p>Effectiveness & Impact¹⁴ The extent to which the immediate objectives were achieved.</p> <p>The extent to which the project resulted in changes both positive and negative, intended and unintended, direct and indirect.</p>	<ol style="list-style-type: none"> 7. Did this approach work for LINZ? 8. Has this stimulated investment in the ‘Smart Cities’ area that wouldn’t have happened otherwise?
<p>Sustainability – The extent to which the changes are likely to endure/last.</p>	<ol style="list-style-type: none"> 9. What is the likelihood these projects will continue in future without additional funding? 10. What needs to be in place for this to happen?
<p>Lessons Learned – What lessons can be learned that can inform decision on similar or related projects/programmes or policies.</p>	<ol style="list-style-type: none"> 11. Has the project leveraged investment or resources from third parties? 12. What lessons can we learn about the assumptions that were made (e.g., can we identify systematic ‘errors’ in the assumptions made). 13. Has this project acted as a catalyst in other areas (e.g., adoption of common platforms)?

¹⁴ Impact may be removed from the evaluation framework if it is collectively agreed to be too difficult (i.e., too early) to report on. We recommend this decision is made near the end of the project, once data availability on this area is clearer.

Appendix B. Project maturity framework

Improved lives for New Zealanders through safe and better use of data

Treasury Higher Living Standards:

Economic Growth

Risk Managed

Sustainable Future

Social Cohesion

Increased Equity

The four wellbeings (local government):

Improved economic wellbeing

Improved social wellbeing

Improved environmental wellbeing

Improved cultural wellbeing

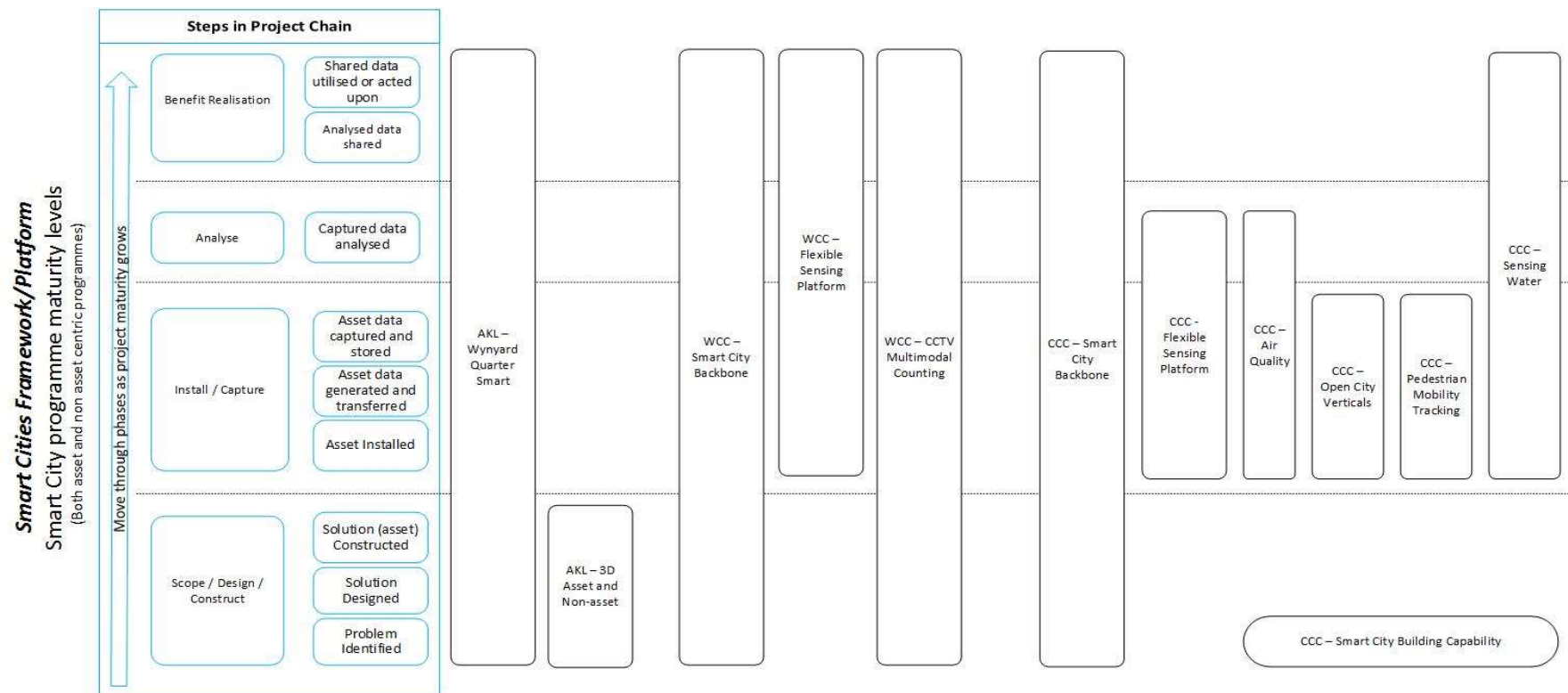
More resilient and prosperous communities
(people, education, commerce, culture policy...)

More efficient and sustainable use of resources
(water, air, energy, materials...)

Better quality and more effective services
(energy, water, transport, building...)

More user-friendly infrastructure
(land, roads, buildings, communication technology, utilities...)

Sustainable natural environment
(topography, environment, resources...)



Appendix C. Project profiles

<p>City: Auckland Project Manager: Dr Viv Heslop Project Name: Wynyard Quarter Smart (WQS)</p>	
Area	Summary of findings
<p>Summary of project (what was intended)</p>	<p>WQS is using a methodology to capture, integrate, analyse and interpret data relevant to Wynyard Quarter to enable better strategic and tactical decision-making that supports delivering on Waterfront Auckland’s and Auckland Council’s sustainability aspirations and visions. The essence of WQS lies in using technology to collect and analyse more data, more frequently across more sites and more areas. This technology enables communication to and engagement with a wide range of audiences, including managers, users, public, urban research, planning and policy professionals. This enables greater transparency as well as a desired change in behaviour and resulting performance improvement.</p> <p>Panuku Development Auckland is committed to leading the way in the application of smart city approaches to allowing the organisation to report on progress with implementing sustainability, and to then using that data and information to drive performance improvements for built assets and to support behaviour change initiatives.</p> <p>There is interest from a number of organisations in testing sensing and metering approaches in order to understand performance of assets – including the stormwater network, monitoring of environmental quality and utilising the information for engagement and communication with the public and using smart city approaches to drive the transport mode shift which underlies future development of the quarter.</p> <p>The Wynyard Quarter Smart suite of projects includes:</p> <ul style="list-style-type: none"> • Lysaght building: as part of the redevelopment of the Wynyard quarter, the Lysaght building has been transformed into a shared business space. Water and electricity monitoring systems were installed in the building. These sensors have successfully been displaying live electricity and water usage since they were installed in May 2016. The dataset that the building creates will give a powerful snapshot of how and when water and electricity is used throughout the building. • Multi-modal vehicle tracking: this project sought to use technology and systems that have been deployed in Wellington CBD to track and count pedestrian, cyclist, car and other methods of transport. The equipment and back-end were installed in June. This has allowed the spatial map to go live on the WQS website, including presenting real time data of pedestrian and cyclist counts. • Sensing water: this project sought to install tryptophan sensors in the Westhaven Marina to monitor, detect and display water quality. The sensors are currently undergoing testing. The testing has taken some time, as there are a few bugs in the sensors that need to be re-engineered, as well as a trench needing to be dug to accommodate for the sensor being underwater at all times.

Progress against Maturity levels:	This programme is currently at three different levels of maturity. Due to the nature of the projects involved in the WQS programme, this has been a necessity, as each of the projects has separate timelines.
Scope/Design/Construct	Water Sensors: this project is currently at the install/capture phase. The implementation plan for the sensors has been created, with bugs currently being worked out with the technology. There are some time intensive activities that will need to occur to get the sensors up and running, specifically digging a trench in the Westhaven marina to allow the sensors to be under water at all times.
•Install/Capture	Multimodal counting: this project has reached the Install/Capture phase. The CCTV cameras have been installed and are currently recording. The backend analytics are currently being set up. Once these analytics and 'backend' data capture systems are installed, this will allow the project to progress to the next phase.
Analyse	- N/A
Benefit Realisation	Lysaght building: this project has completed the maturity cycle. The sensors have been installed, backend set up with live utilities usage data being displayed on screens in the building itself.
Key successes	The key benefit realisation for WQS has been the sharing and displaying of live utilities usage, and live pedestrian and cycle counting to and from the Wynyard Quarter area. This data will be able to set a benchmark for electricity and water usage in council buildings – which will lead to more efficient usage of utilities. The pedestrian and cycle data will be able to provide a clear picture of how many people are travelling to and from the area, at what times, and whether there is a need for better or more efficient access to the Wynyard Quarter area.
Challenges encountered	Schedules for both the water sensors and multimodal counting have been pushed out due to testing of devices and implementing backend analytics. These are issues which can take unexpected amounts of time to work through, as the technology and techniques being used are brand new.

City: Auckland Project Manager: Ken Renz Project Name: 3D+ Asset and Non-Asset Management	
Area	Summary of findings
Summary of project (what was intended)	<p>The 3D+ Asset management project aims to provide an interactive user experience by delivering accurate 3D (asset) visualisation focussing on asset management and asset information through the full lifecycle.</p> <p>The range and diversity of assets within the Auckland Council Group currently requires a complex process and supporting systems landscape.</p> <p>Creating an aggregate asset view and a single ‘version of the truth’ will create significant benefits for all stakeholders.</p> <p>This project seeks to outline how appropriate asset visualisation is a critical enabler of asset (lifecycle) management, providing benefits across lifecycle states and ensuring existing process and IT systems investment is leveraged.</p>
Progress against Maturity levels: Scope/Design/Construct	<p>This project was delayed due to the need to go back to market for a solution provider. This was necessary as the provider who was originally contracted to produce the unique system went into receivership. The vendor has now been selected, contracts signed, and development is underway. A working solution is expected by March 2017.</p> <p>Although the project has been set back because of the need to go back to market, this has not changed the intent or outcomes of the project.</p>
Install/Capture	- N/A
Analyse	- N/A
Benefit Realisation	- N/A
Challenges encountered	<p>The critical challenge faced in this project was the bankruptcy of the initial technology partner contracted to create the visualisation tool. This had significant impact on the delivery schedule for the project – the collapse of the technology partner required the project to go back through the council procurement process and then to market.</p>
Key learnings	<p>Engaging early with the procurement teams, and creating a collaborative way of working with the procurement teams.</p> <p>Pushing the understanding that this is proof of concept work – which shouldn’t have to go through traditional procurement processes.</p>

City: Wellington Project Manager: Tim Packer Project Name: Smart City Backbone	
Area	Summary of findings
Summary of project (what was intended)	<p>Leveraging a proven platform developed and deployed as part of European Union driven Smart-Cities initiative, Wellington City Council and NEC have deployed a Wellington based instance of a Smart City Backbone known as the Cloud City Operation Centre (CCOC). The CCOC provides the underlying technology required to enable a Smart City. The CCOC is the analytical backend and aggregation tool that allows sensors to send useable data back to a 'home.' The CCOC also holds the potential to be rapidly rolled out to any other town or city that wants to engage in similar sensing projects or programmes of work.</p> <p>The City owners and Smart City initiative consortia gain a model environment that will demonstrate the concepts and technologies involved and applicable for any number of developing Smart City scenarios that will facilitate social, economic and environmental benefits.</p> <p>By utilising the European platform, the Smart City Backbone has gained from the collective intellectual property and lessons learnt from European stakeholders. The CCOC provides a low risk high innovation environment that has so far provided robust and demonstrable data to review and recommend future investment opportunities in Smart City and Smart Nation.</p>
Progress against Maturity levels: Scope/Design/Construct	<ul style="list-style-type: none"> - N/A
Install/Capture	<ul style="list-style-type: none"> - N/A
Analyse	<ul style="list-style-type: none"> - N/A
Benefit Realisation	<p>This project has moved through the maturity phases and is now at Benefit Realisation. The CCOC is the driving tool behind the Smart Cities programme and is now at a level where data is being captured, stored and processed.</p>
Key successes	<p>The key benefit from the CCOC platform is the ability to visualise and distribute real time data to council stakeholders, and eventually the wider public. This is now being demonstrated through the analytics dashboard, which shows what sensors are where, what data they are producing and key indicators for those sensors.</p>
Challenges encountered	<p>The rollout of the KITEs had some scheduling issues, which primarily involved civil engineering processing times to get the KITEs installed up onto power poles and other locations throughout Wellington City.</p>
Key learnings	<p>Engaging with civil engineers earlier in the development of the CCOC would have saved some time during the rollout phase. However, this was a minor scheduling issue, and the progress made on the project in its early phases accounted for this slippage time.</p>

City: Wellington Project Manager: Tim Packer Project Name: Flexible Sensing Platform (Wellington)	
Area	Summary of findings
Summary of project (what was intended)	<p>The challenge for every city approaching the idea of ‘Smart Cities’ is that is hard to predict what sensors will be required in the future, and where they will need to be located. On top of this issue, every time a sensor is required to be deployed, a discrete civil engineering exercise is also required to cater for that sensor deployment. As more and more sensors are required the costs go up.</p> <p>In response to these challenges, Wellington City Council and NEC have developed a prototype for a flexible sensing platform. Similar in theory to a USB hub for a computer - the flexible sensing platform (KITE) provides flexibility and ease of integration for future sensing in a Smart City while lowering the overall cost and overheads of deployment.</p> <p>The flexible sensing platform will lower the barriers and costs of deploying sensing facilitating social, economic and environmental benefits.</p>
Progress against Maturity levels: Scope/Design/Construct	<p>- N/A</p>
Install/Capture	<p>- N/A</p>
Analyse	<p>- N/A</p>
Benefit Realisation	<p>This project has moved into the benefits realisation stage of project maturity. The flexible sensors, and the methods used distribute data have been developed, tested and are now moving into productionising. The data collected will soon be able to be used by Wellington City Council, and the wider public, to create a better understanding of how the central city functions in real time. The key goal of more informed decision making stems from the use of this data.</p> <p>The KITE’s have been rolled out along Courtney Place, and are currently being rolled out to Cuba Mall, Manners Street and the Railway station.</p>
Key successes	<p>The creation of the working KITE platform has been a major success from the entire programme of work. These devices are able to capture, process and distribute real time data back to the CCOC platform – with the ability to measure the following data:</p> <ul style="list-style-type: none"> • Air quality • Water quality • Pedestrian mobility • Waste management • Parking • Street lighting • Solvent detection • Graffiti detection
Challenges encountered	<p>As this was a pilot programme, testing proof of concept technology, there were some slight scheduling delays regarding testing Wi-Fi and Bluetooth data integration from the KITEs to the CCOC platform. These types of delays are standard in technology based projects.</p>

City: Wellington Project Manager: Tim Packer Project Name: CCTV Multimodal Transport and Pedestrian Counting	
Area	Summary of findings
Summary of project (what was intended)	<p>Wellington City Council and NEC have created a new method for multimodal transport and pedestrian counting. The technology leverages CCTV feeds and machine learning to deliver counts by transport mode. This information can then be utilised to better determine capacity, utility and demand of the City Transport Assets providing the potential for higher precision network asset management plans. This projects seeks has developed an interface on which information from the counting platform is utilised by the Smart City Backbone.</p> <p>The information from NEC’s counting platform has the potential to save cities a significant amount of money as higher precision planning decisions can be made on roads and cycle ways. This project seeks to make that information more accessible and readily leveraged through an open interface into a Smart City backbone and other users.</p>
Progress against Maturity levels: Scope/Design/Construct	<p>- N/A</p>
Install/Capture	<p>- N/A</p>
Analyse	<p>- N/A</p>
Benefit Realisation	<p>The Multimodal project has reached the Benefits realisation stage – the project was delivered in May 2016 after analytics and testing were completed. The CCTV feeds are being presented in the CCOC.</p>
Key successes	<p>Using ‘machine learning’ algorithms and techniques to utilise existing CCTV feeds has created a working system which feeds live data into the CCOC platform. This system has been live since May 2016, and has been feeding good, usable data into the system.</p> <p>Using techniques developed from the CCOC project created efficiencies, especially regarding creating interfaces for the project to display atop of the CCOC platform.</p>
Key learnings	<p>Working off techniques developed for the CCOC meant this project was delivered ahead of schedule, and has been collecting and storing information since May. The shared learnings across this project and the CCOC have created significant efficiencies for this project.</p>

City: Christchurch Project Manager: Teresa McCallum Project Name: Smart City Backbone (Christchurch)	
Area	Summary of findings
Summary of project (what was intended)	Installation of the Christchurch instance of the Cloud City Operations Centre (CCOC) which will provide a platform for displaying data from the KITE and POC sensors to be displayed as well as data from other sources such as traffic, cycling, water level, etc. In addition to displaying the data, we will deliver predictive analytics where appropriate.
Progress against Maturity levels: Scope/Design/Construct	- Completed
Install/Capture	- Completed
Analyse	- Completed
Benefit Realisation	This project is displaying KITE data and the business intelligence analytics back end are producing reports on environmental and traffic conditions.
Key successes	This project delivered a working CCOC under schedule and is displaying KITE & traffic data, with a predictive analytics for the traffic data.
Challenges encountered	As the development of this platform is in Spain, the New Zealand requirements for version upgrades that included API functionality were less of a priority than other customers' requirements. Getting the KITE data to display correctly on the CCOC has been a challenge. Early on in the project, we gave a login to an executive level sponsor. As the CCOC is still in the proof of concept / prototype stage this caused credibility issues for the programme
Key learnings	Do not provide access to the CCOC to people outside of the programme / project team as the data is not always, consistent, accurate or displayed in a meaningful way as the various POC projects come online.

City: Flexible Sensing Platform (Christchurch) Project Manager: Christchurch Project Name: Teresa McCallum Funding received:	
Area	Summary of findings
Summary of project (what was intended)	<p>This project leveraged the technology implemented in the Wellington Flexible Sensing Platform proof of concept project.</p> <p>As Christchurch evolves towards becoming a 'Smart City', the requirement for generating new data from more sensors will grow exponentially. Deploying the NEC sensor array allows Christchurch to plan for sensor deployments ahead of time, without knowing exactly where and what type of sensing will be required. The flexible sensing platform will be deployed on traffic light and street light poles through the CBD and suburbs as required for the deployment of the Christchurch POC projects and will be able to accept all sensor types and connect them through any number of wireless or wired technologies in a common format..</p>
Progress against Maturity levels: Scope/Design/Construct	- Completed
Install/Capture	- Completed
Analyse	<p>This project has moved to the Analyse phase, with data being produced and sent to the Smart City Backbone.</p> <p>The first tranche of KITEs were installed at selected sites throughout Christchurch as required for the pedestrian mobility, Smart Block, and Air Quality POCs., The next tranche of KITE locations will further enhance the pedestrian mobility POC.</p>
Benefit Realisation	- TBA
Key successes	<p>A critical success was the strong support from CCC traffic and street lighting teams as well a very constructive relationship with the contractor installing the KITEs. This has ensured a smooth KITE implementation in Christchurch.</p> <p>Christchurch has the distinction of being a one of only five international gateway cities to the Antarctic. Enhancing Christchurch's status as a gateway city will become a focus for Christchurch as well as the national government over the coming years. Recently an Antarctic technology roadmap was developed and the Christchurch Smart Cities programme has provided an early response which includes extending our KITE implementation to Antarctica – the vision is that Antarctica is seen as a suburb of Christchurch. This intention could only be acted on because the NEC Smart Cities team have responded in an incredibly positive way to modify two KITEs for use in Antarctica; one on Scott Base and the other on Arrival Heights. Kudos to NEC for responding in such a positive way when a curveball like that is thrown.</p>
Challenges encountered	<p>Dealing with commercial property owners for the installation of the pedestrian flow POC was challenging given building owners, leaseholders, and property managers involved. This caused delays in getting permission to install KITEs for the pedestrian mobility POC.</p>

Key learnings	<p>Support from internal units and partner agencies are crucial for proof of concept projects where the method for achieving POC outcomes will change based on practicalities.</p> <p>Be prepared to respond quickly as assumptions are proved to be incorrect</p> <p>Political support is useful when trying to get responses from leaseholders / property owners etc. – use all tools in the toolbox.</p>
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City: Christchurch Project Manager: Teresa McCallum Project Name: Air Quality	
Area	Summary of findings
Summary of project (what was intended)	<p>In most cities today there is reliance on a small number of tactically deployed high cost weather stations which provide the baseline for city wide air quality monitoring. With the development of smart, cheap sensing equipment, there is an opportunity to achieve far greater granularity of key air quality measures in a cost-effective fashion</p> <p>Using the KITE Flexible Sensing Platform and KITE motes, dozens if not hundreds of air quality measures and associated analytics can be collected and presented through the CCOC to city stakeholders and subject matter experts for early warning of health issues and management.</p> <p>With this POC, we will calibrate cheaper PM10 sensors to the eCan air stations with the view to proliferating these sensors across the city. By using low power sensors, energy harvesting and low power radio networks, new air quality sensors can be rapidly deployed throughout the city with minimal civil engineering/infrastructure and associated overheads/prerequisites.</p>
Progress against Maturity levels: Scope/Design/Construct	- Completed
Install/Capture	- Completed
Analyse	This project is at the Analyse phase – there are currently two air quality sensors that have been deployed at sites in Woolston and St Albans and the data from these PM10 sensors are being calibrated with ECan’s (Environment Canterbury) air quality stations.
Benefit Realisation	- TBA
Key successes	This POC was enabled by strong collaborative links with eCan who gave permission for installation of KITEs at their monitoring stations and are working with NEC to achieve a quality calibration result.
Challenges encountered	Calibrating the PM10 sensors to the air quality station sensors is a challenge because our PM10 sensors send raw data, whereas the eCan stations aggregate data and send an average.
Key learnings	The rapid nature of our requirements and initiation phase saw a misunderstanding between the programme and the business of what this POC would deliver. We were several weeks in before this misunderstanding was cleared up. I think this was exacerbated by a strong pre-conceived idea from the programme of what was required for this POC.

City: Christchurch Project Manager: Teresa McCallum Project Name: Open City Verticals “Smart City Block”	
Area	Summary of findings
Summary of project (what was intended)	<p>This Smart City Block proof of concept will deploy and integrate a range of sensors across several city verticals (street lighting, waste management, water metering, car parking and drain sump levels) in one or more defined areas within Christchurch. Some critical information has been integrated via the KITE flexible sensing platform into the Smart City Operations Dashboard. The information will also flow through to an open source street lighting Control Management System (CMS).</p> <p>One of the key outcomes of this proof of concept is the ability to unbundle several vertical city services; street lighting, waste management, drainage, and car parking, so that cities are not constrained to investing in single use case vertically integrated products.</p> <p>This ability to unbundle facilitates the city’s freedom of choice to select the best and most cost-effective solution components and lowering the total cost of ownership to the city for Smart City technologies. Leveraging common enabling technologies such as mesh networks, IOT gateways, backhaul services and cloud platforms ensures investments are directed at technology that can interoperate as part of a future smart city.</p>
Progress against Maturity levels: Scope/Design/Construct	<p>This project has several distinct areas of work – as such, each of these is at a separate level of maturity, as each requires different technology and has different timelines.</p> <p>Smart lighting: light controllers have been tested by NEC, locations have now been identified and are ready to be installed.</p> <ul style="list-style-type: none"> • Drain level monitoring: this project has not had any progress yet. • Water Metering: sensors have been identified and are currently being tested. • Parking sensors: a mocked-up unit has been developed, tested and is waiting for accessible parks to be identified for deployment. • Rubbish level monitoring: testing and site identification for bin sensors is underway, with self-compressing units being explored.
Install/Capture	<p>City Vital Signs: several KITEs have been installed throughout Christchurch to monitor CO² levels, barometric pressure, noise, luminosity and air temperature. This information is currently being presented in the Christchurch CCOC.</p>
Analyse	<p>- TBA</p>
Benefit Realisation	<p>- TBA</p>
Key successes	<p>Several KITEs have been placed around the city and are collecting city vital signs. The data that these sensors are producing is now displayed in the CCOC.</p> <p>Excellent collaboration with the CCC lighting manager who has allowed controllers to be installed in his current smart lighting trial.</p> <p>This POC encapsulates the purpose of this NEC Smart Cities solution – great to have this requirement clearly articulated and focusing the principles of how we develop and grow Christchurch as a smart city.</p>

<p>Challenges encountered</p>	<p>Providers of proprietary systems are reluctant to unbundle their solutions (e.g. parking solution providers). The downside to this is that the proprietary solutions have mature software such as parking enforcement and payment apps and proven sensors but they are struggling with the concept of unbundling their solution to work in with an established sensor gateway network – insisting instead of duplicating a rollout of their own sensor network. Their insistence on delivering an end-to-end solution eliminates some mature, ‘local’ providers.</p>
<p>Key learnings</p>	<p>Issue an expression of interest to providers outlining very clear parameters / requirements that MUST be met to respond. This will eliminate the pitching of mature solutions from providers that indicate they can work within the parameters but subsequently do not want to work in an open and unbundled environment.</p>

City: Christchurch
Project Manager: Teresa McCallum
Project Name: Pedestrian Mobility Tracking

Area	Summary of findings
Summary of project (what was intended)	<p>Pedestrian mobility tracking will employ new sensing techniques and analytics on the KITE flexible sensing array and Cloud City Operations Centre (CCOC) to provide real time people counting and crowd flow visualisation across the city.</p> <p>This capability can provide new information to city stakeholders that will improved their understanding of the real time day-to-day patterns of city residents and visitors. The capability has the potential to provide information for retailers, event managers, the tourism industry, city administrators, planners, and the social agencies who provide day to day support for our citizens and to emergency coordinators responding to stress or shock events. We believe there are numerous other benefactors that with an adequately scoped proof of concept (POC) can be further qualified.</p>
Progress against Maturity levels: Scope/Design/Construct	<p>This project is still in its initial stages, as there have been challenges communicating with the right stakeholders. Building lease holders have not been willing to participate in the project at this stage. KITEs and Wi-Fi sensors will be placed in revised locations to reflect the decisions of those building lease holders.</p>
Install/Capture	<p>-</p>
Analyse	<p>-</p>
Benefit Realisation	<p>-</p>
Key successes	
Challenges encountered	<p>There have been challenges with installing sensors in a multi-tenanted environment like the Restart mall. Ideally, one location for sensors would make better sense. This has meant a change of scope and schedule for the project.</p>

City: Christchurch
Project Manager: Teresa McCallum
Project Name: Sensing Water

Area	Summary of findings
Summary of project (what was intended)	<p>The key concept in this project is the ability to report in real time on a city dashboard the level of Christchurch City’s urban waterways.</p> <p>Current wet weather monitoring is largely manual and problematic as flooding events are hard to predict and can occur any time of the day. Alarms raised are often too late to avoid impacts to the community. The capability proposed to deploy in this initiative is along flood-prone Dudley Creek in Christchurch, part of the Flockton Basin. This will provide real time situational awareness of the waterway level and provide valuable data on which to better plan and predict possible events. There is also the requirement to inform or involve the affected community (via push text messaging or access to a dashboard) so that they have a greater sense of involvement and control around wet weather flooding events.</p> <p>This proposal seeks to implement a proof of concept (POC) that will see a combination of smart sensing, data collection and presentation technologies on the KITE Flexible Sensing Platform and Cloud City Operations Centre (CCOC) to achieve near real time awareness of water levels.</p> <p>This project was rescoped after discussions with NIWA (National Institute of Water and Atmospheric research) and CCC (Christchurch City Council). The CCC has recently deployed a water monitoring programme – thus the need to rescope the project. Instead of creating water sensors and installing them in the Flockton Basin area, the CCOC has been redesigned to be accept the data being produced from the CCC water sensing project, and funds have been diverted to create a publicly accessibly data set that would focus on the Dudley Creek area.</p>
Progress against Maturity levels: Scope/Design/Construct	<p>-</p>
Install/Capture	<p>-</p>
Analyse	<p>-</p>
Benefit Realisation	<p>A basic dashboard has been created to prove the mechanism of collecting sensor data from an external feed and publishing it is possible using the CCOC. The next steps for the project are to collaborate with CCC and NEC to discuss a flood model and how to represent that model in an application.</p>
Key successes	<p>Feeding the NIWA data into the CCOC and creating a basic dashboard. This has been a key success as it has meant that the CCOC is capable of being fed external data, and is capable of wider integration.</p>
Challenges encountered	<p>Rescoping the project after discussions with NIWA and CCC has meant that new privacy issues with using NIWA data are being discovered. This has led to another rescoping of the Sensing Water project to focus on the Dudley Creek area.</p>

Appendix D. Smart Cities Information Sheet – Key Informant Interviews

Background

The LINZ Smart Cities programme is applying an adaptive, agile ‘fast fail’ approach to the use of new and existing sensing and information technologies. The programme’s intended benefits are firstly to improve lives for New Zealanders through *safe and better use of data*, as well as contribute to strengthening Treasury’s understanding of how it can support the development of a ‘Better Public Service’ via innovative approaches to infrastructure investment.

Evaluation has been embedded within the lifecycle of the programme. Following a phased approach, the evaluation has supported the programme to adopt a cycle of continuous learning and improvement, with three key data collection points. At the beginning of the programme (the ‘baseline’ – November 2015), the middle period (the ‘mid-point’ - March/April 2016), and at the final data collection period (the ‘end-point’ - August 2016) of the programme¹⁵.

The purpose of the final report is to tell the overall ‘story’ of the Smart Cities programme, which will inform the Strategic Investment Case and the Better Business Case. The report will encompass the initial intent, changes throughout the life of the programme and documents the critical lessons learned and evaluative judgements regarding the programmes performance.

Your involvement

You have been identified as someone who is either actively involved in this programme (e.g., you have project(s) funded by the Smart Cities Programme), or is a key stakeholder with particular interest in the programme; who has a valuable perspective to share.

The evaluation team would like to arrange an interview with you, either over the phone or face-to-face where possible. **The interview will seek to cover in broad terms the areas outlined in the evaluative questions below.** Depending on your depth of knowledge on the programme, the interview may spend more or less time in particular areas.

Please treat these questions as a guide to support your thinking, and as a general frame for the interview. As you review these questions you may also find it useful to refer to the outcomes model developed for Smart Cities Programme. This has been attached as a separate document for you.

The interview will last approximately 45 minutes. **If you have any questions or concerns** regarding the interview please feel free to contact Kara Scally-Irvine, Evaluation Team (Evaluation Consult), or Haydn Reid, Programme Director (LINZ).

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¹⁵ Evaluative information is also being collected via other mechanisms and time, in particular the progress reports each project is required to complete. These also form a source of information, but the baseline, mid- and end-points mark the three key evaluation reporting points.

Table 1. Evaluation criteria and evaluation questions for the LINZ Smart Cities programme.

Evaluation Criteria	Evaluation questions
<p>Relevance – The extent to which the Smart Cities programme met a clear need identified by stakeholders.</p>	<ol style="list-style-type: none"> 1. What was the intent of Smart Cities programme? Has it change? 2. What assumptions were made? To what extent did they change (and in what ways). 3. How well understood was the programme by key ‘external’ stakeholders (e.g., policy makers)? Why, Why not?
<p>Efficiency – The extent to which inputs were transformed into outputs in the most optimal way.</p>	<ol style="list-style-type: none"> 4. What were the components of the programme as a whole as well as individual projects? How well have they been implemented? Was anything missing? 5. Were the governance and project management arrangements ‘fit for purpose’ for this type of agile project? 6. What contextual factors influenced the implementation of the programme?
<p>Effectiveness & Impact The extent to which the immediate objectives were achieved, and the extent to which the programme resulted in changes both positive and negative, intended and unintended, direct and indirect.</p>	<ol style="list-style-type: none"> 7. What has happened as a result of these pilot project individually, and as a whole? 8. Has this stimulating investment in the ‘Smart Cities’ area that wouldn’t have happened otherwise? 9. Is the programme acting as a catalyst in other areas (e.g., adoption of common platforms)? 10. Has the programme leveraged investment or resources from third parties?
<p>Sustainability – The extent to which the changes are likely to endure/last.</p>	<ol style="list-style-type: none"> 11. What is the likelihood these projects will continue in future without additional funding? 12. What needs to be in place for this to happen?
<p>Lessons Learned – What lessons can be learned that can inform decision on similar or related projects/programmes or policies.</p>	<ol style="list-style-type: none"> 13. What can Central Government learn from this project in relation to programme’s collaborative approach, including working with local government and the private sector? 14. What has this programme highlighted that would inform what good governance ‘looks like’ for Smart Cities type initiatives? 15. What lessons can we learn about the assumptions that have made (e.g., can we identify systematic ‘errors’ in the assumptions)? 16. What lessons can be learned from the programme regarding how to effectively design and deploy Smart Cities solutions or similar/related projects and programmes in other local or central government agencies?
<p>Cross-cutting (Privacy) – what lessons can be learned from the Smart Cities programme regarding the effective consideration and management of privacy issues.</p>	<ol style="list-style-type: none"> 17. How well have privacy considerations been thought through during the planning and design of projects/technologies? 18. How well have privacy considerations been managed by individual projects and the programme as a whole? 19. Have privacy issues impacted on the achievement of the expected outputs and outcomes? 20. What impact (if any) does managing privacy issues have on the sustainability of these projects? 21. What other lessons can be learned from the programme regarding how to effectively consider the potential impacts to privacy in the design and deployment of Smart Cities solutions or similar/related projects and programmes?

SMART CITIES PROGRAMME 2016

Key Informant/Stakeholder Consent Form

Please read the statements below and circle 'YES' or 'NO'. If submitting electronically please delete, underline, or ~~strike through~~ accordingly.

1. I have read and understood the Information Sheet, and have had the details of the final report explained to me if/where required. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time. **YES / NO**
2. I understand that my participation is voluntary, that I may decline to answer any or all of the questions and that I may withdraw from participating at any stage. **YES / NO**
3. I agree to the interview being digitally voice recorded. **YES / NO**

Signature: _____ Date: _____

Name: _____

Appendix E. Wider stakeholder survey

Survey Questions

Questions	Response option(s)
Q1) What type of organisation do you work for/at:	- central government - local government - private sector - organisation
Q2) Have you or your organisation successfully deployed smart technologies in your organisation?	-yes -no
Q3) If yes, in what (please provide details)	-free text
Q4) What has worked well/been most successful from the use of this technology?	-free text
Q5) What challenges did you/have you encountered?	-free text
Q6a) Have you or your organisation considered the use/any other use of smart sensing technology?	-yes -no
Q6b) If yes, please provide details.	-free text
Q7) What concerns or issues have created potential or actual barriers in progressing the use of smart sensing technology in your area of work or organisation? Please respond to as many options as possible.	
Q7b) None	-yes -no
Q7c) Cost (actual or perceived)	-yes -no
Q7c) If yes, please provide further details.	-free text
Q7d) Managing privacy issues.	-yes -no
Q7d) If yes, please provide further details.	-free text
Q7e) Technical/engineering barriers (eg: civil engineering)	-yes -no
Q7e) If yes, please provide further details.	-free text
Q7f) Low/limited support from your executive team	-yes -no

Questions	Response option(s)
Q7f) If yes, please provide further details.	-free text
Q7g) Low/limited support from other key stakeholders (eg: key partner organisations, community, etc)	-yes -no
Q7g) If yes, please provide further details.	-free text
Q7h) Other (please provide details)	-free text
Q8a) Can you envisage future (next 1-3 years) potential application smart sensing technology in your area of work?	-yes -no
Q8a) If yes, please briefly explain	-free text
Q9a) Would you be happy for the Smart Cities evaluation team to contact you if they would like to follow up on any of your comments	-yes -no
Q9a) If yes, please provide your name and email address	-free text

Survey Results

Q1) What type of organisation do you work for?

- Private: 4
- Local Government: 2
- Central Government: 0
- Other: 3

Q2) Have you or your organisation successfully deployed smart technologies in your organisation?

- Yes: 3
- No: 6

Q3) If yes, in what way(s)? (Please provide details)

- Organisations have coordinated the implementation of smart devices for clients, including sensors on motorways, traffic signal CCTVs for other agencies
- Stakeholders have also built and implemented some devices

Q4) What has worked well/been most successful from the use of this technology?

- Providing real time, accurate data to inform the public about specific events
- Gathering the views and opinions of the public to inform infrastructure decisions

Q5) What challenges did you/have you encountered?

- Ensuring that projects are scalable, extendable and can be replicated
- New technology had to be developed, tested and implemented
- Finding the right team, with people who are open to collaboration
- Developing projects on shoe-string budgets
- Cost-benefit of implementing a project that supports infrastructure in isolation of other, wider applications

Q6a) Have you, or your organisation considered the use/any other use of smart sensing technology?

- Yes: 7
- No: 1
- Blank: 1

Q6b) If yes, please provide details.

- Environmental monitoring, specifically air quality and water quality
- Creating data sets that are open to the public, to offer better advice on travel times, environmental quality etc
- Using CCTV and other data to monitor and track travel times at specific locations

Q7) What concerns or issues have created potential or actual barriers in progressing the use of smart sensing technology in your area of work or organisation? Please respond to as many options as applicable.

Q7b) None

- Yes: 3
- No: 4
- Blank: 2

Q7c) Cost (actual or perceived)

- Yes: 5
- No: 3
- Blank: 1

Q7c) If yes, please provide further details.

- The technology doesn't exist yet, and needs to be developed
- Availability and accuracy of sensors
- Engaging with technology partners early enough to fully encapsulate the intention of the plan or programme
- Existing infrastructure systems are either not in place or are not sufficient to be operated as desired

Q7f) Low/limited support from your executive team

- Yes: 2
- No: 6
- Blank: 1

Q7f) If yes, please provide further details.

- Limited understanding of the value, a view that technology will not be able achieve the strategic goals.
- The need for use cases to justify an investment

Q7g) Low/limited support from other key stakeholders (eg: key partner organisations, community, etc)

- Yes: 3
- No: 4
- Blank: 2

Q7g) If yes, please provide further details.

- The ability to sell the value for money
- Finding financial support, even though there is enthusiasm for the concept
- Organisations are unwilling to invest in development of new technology – they want a working end product

Q7h) Other (please explain)

- Investment in current public consultation processes are unsuccessful, even though there is obvious benefit to moving towards capturing real-time data

Q8a) Can you envisage future (next 1-3 years) potential application of smart sensing technology in your area of work?

- Yes: 6
- No: 1
- Blank: 2
-

Q8a) If yes, please briefly explain.

- “Following the leader” – as more proof of concept projects demonstrate this type of technologies worth, it will become easier to sell to executives and the public
- Enabling stronger citizen engagement through the use of these new technologies through:
 - Education efforts in schools, specifically in understanding the technology and data involved
 - Healthcare, particularly leveraging off council led innovation schemes
 - Showcasing the current work being completed
- Creating public discussions around the use of smart sensors and the data they produce

Appendix F. Citizens' voice data collection guidelines

1. Get their initial agreement to be spoken to

"Excuse me, do you have a brief moment to talk about Smart Cities and some work we are doing in this area at XX council."

"Excuse me, I'm from the XX Council, do you have a brief moment to talk about the concept of 'Smart Cities' and some work we are doing in this area?"

"Excuse me, I'm from the XX Council, do you have a brief moment to talk with me about your views on the concept of 'Smart Cities' and some work we are doing in this area?"

2. Complete informed consent process

Key points and suggested starter script

We are collecting the views from public on the idea or concept of Smart Cities, including getting feedback on some pilot initiatives that are underway.

We only want your views and feedback, we will not be collecting any personal or demographic information

It involves answering four questions, and should only take about 5 minutes

You do not need to answer all the questions if you don't want to, and can stop at any stage

The information will be used as part of an evaluation of the pilot programme running in three cities, as well as our own review processes

Are you still happy to speak to me? Do you have any questions before we start?

3. Do the questions

4. When I say the phrase 'Smart Cities' what does this mean to you or bring to mind?
5. Now I'd like to ask you about the smart city initiative(s) we have been piloting in [your location]. **[explain your initiative(s)]** What is your initial reaction to these? *[prompts: is this interesting?, a great idea?, can you see how it would make a difference to you as a citizen/rate payer in [your location], or is its relevance completely lost on you?]*

6. Can you have a think about the idea of a 'Smart City' again. As a citizen of [X] are there other areas/issues/problems we are experiencing/facing here in **[location]** you would like to see as 'smart' solutions developed for? *[have some suggested areas/examples to prompt and get them to give a sense of priority – what would be most valuable? E.g., transport, or environmental sensing.]*
7. What sorts of risks or concerns would you want to know are being managed/addressed in our application/use of smart technology? *[again have some prompts ready to help their thinking, e.g., if camera are being installed]*

Do you have any questions?

Thank you very much for you time. It is much appreciated. Have a lovely rest of your day.

Ethnicity category (indicative, based on your perception)

- Maori/Pacific Islander
- Pakeha/European
- Asian
- Middle Eastern/Latin American

Age range (indicative, based on your perception)

- Young up to around 30 years of age
- Middle aged (thirties or forties)
- Baby boomer (fifties/sixties)
- Elderly (seventies/eighties/nineties)

Gender

- Male/female

City and Initiative

- Also note the city you're collecting for and the initiative(s) you've gathered information on.

Appendix G: Smart Cities Citizens' Voice paper data collection form

In bold is a summary of the question. The exact wording from the data collection guidelines are included at the bottom of the box in *italics* for your reference.

<p>Question 1. What does the phrase Smart City bring to mind/mean to them?</p> <p><i>When I say the phrase 'Smart Cities' what does this mean to you or bring to mind?</i></p>
<p>Question 2. What is their initial reaction to your specific Smart City Initiative(s)?</p> <p><i>Now I'd like to ask you about the smart city initiative(s) we have been piloting in [your location]. [explain your initiative(s)] What is your initial reaction to these? [prompts: is this interesting?, a great idea?, can you see how it would make a difference to you as a citizen/rate payer in [your location], or is its relevance completely lost on you?]</i></p>
<p>Question 3. What other opportunities/ideas do they have for the development or application of 'smart city technology'?</p> <p><i>Can you have a think about the idea of a 'Smart City' again. As a citizen of [X] are there other areas/issues/problems we are experiencing/facing here in [location] you would like to see as 'smart' solutions developed for? [have some suggested areas/examples to prompt and get them to give a sense of priority – what would be most valuable? E.g., transport, or environmental sensing.]</i></p>
<p>Question 4. What risks/concerns do they want to know are being managed/addressed?</p> <p><i>What sorts of risks or concerns would you want to know are being managed/addressed in our application/use of smart technology? [again have some prompts ready to help their thinking, e.g., if camera are being installed]</i></p>
<p>Any other comments/notes?</p>
<p>Ethnicity category (indicative, based on your perception) - circle</p> <p>Maori/Pacifika Pakeha/European Asian Middle Eastern/Latin American</p>

Age category (indicative, based on your perception) - circle			
Young (<30)	Middle aged (30s 40s)	Baby boomer (50s/60s)	Elderly (70s +)
Gender (circle)			
	Male	Female	
City/project			

Appendix H. Evaluative rubric

Evaluation Criteria	What does good look like
Relevance	<ul style="list-style-type: none"> • The proof of concept project(s) address clear problems (meet a clear need) • There is strong stakeholder support for the programme, including from executive/leadership of the organisation involved, and from relevant related stakeholders (could be internal or external to the organisation) • Options for future applications of the proof of concept or expansions of them are clearly identifiable
Efficiency	<ul style="list-style-type: none"> • The programme has been administered in such a way that has minimised delays or disruptions • Assistance has been provided when requested and this assistance has met the needs of the individuals requesting assistance • systems and processes have been fit for purpose and meeting the needs of the programme and the project managers
Effectiveness	<ul style="list-style-type: none"> • The anticipated benefits of the projects are being realised • The anticipated benefits of the programme as a whole is being realised • Further/additional opportunities to capitalise on the programme's work have been taken where possible and appropriate
Impact	<ul style="list-style-type: none"> • The projects and programme have contributed to additional outcomes that were not part of the original intent of the programme • The projects and programme have not resulted in any unintended negative outcomes wither with
Sustainability	<ul style="list-style-type: none"> • There is a clear pathway with the necessary resources in place (at project/city level and programme level) to allow the benefits to continue to be realised and/or built upon after the closure/end of the programme.
Lesson learned	<ul style="list-style-type: none"> • Learnings have been systematically captured by the programme • Learnings have been shared for the benefit of project stakeholders and other interested stakeholders
Privacy	<ul style="list-style-type: none"> • Privacy considerations have been well considered in all projects • Privacy related learnings have been identified and documented