

How Hackathons and Smart Cities Relate

TRANSPORT GROUP 2019 CONFERENCE - PRACTICE PAPER

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ABSTRACT

New Zealand is one of the first countries with a government using hackathons to harness open data to drive technology transport solutions, and to prepare a smart workforce in the transport industry with digital and data skills. The NZ Transport Agency (NZTA) hosted its first hackathons in 2018. The purpose of the transport hackathon held in September was to use data to improve access and create a more inclusive transport system through technology innovation. It did this by bringing together people with diverse skills, interests and perspectives; some including developers, service designers, and customer experience and engineers in one room over 48 hours to develop solutions for this problem.

This paper describes the novel hackathon-style engineering systems and its value as an agile process. A government led hackathon sets a culture for the wider transport industry to drive innovation through entrepreneurship through start-ups or public private partnerships, and intrapreneurship within companies using the agile approach.

While the main output of hackathon is innovative technology solutions, it also acts as a great educational tool to develop digital, data, design thinking and other social skills, all which are key to upskilling our workforce for the future of transport. It also helps foster creativity, co-design with the wider industry and co-creation with the transport users. This approach provides New Zealand with the tools to prepare our government, workforce and industry for smart cities.

The paper also highlights New Zealand's success through the NZTA 2018 All Access Hackathon. The calibre of innovation was outstanding, for example, one of the innovations highlighted at the 2019 hackathon, named Jaid, aims to improve access for vision impaired transport users through a voice activated service.

INTRODUCTION

New Zealand has been one of the first few countries with a transport government department using hackathons to help solve transport problems. Most of the transport problems New Zealand face stem from the effects of increasing urbanisation. Over half of the world's population live in cities, and more than two-thirds of the world's population will be urbanised by 2050 (UN World Urbanisation Prospects, 2018). New Zealand is no exception with the population in urban areas predicted to rise significantly. Using 2013 baseline population statistics, Auckland is predicted to increase in population by 48%, 43% in Tauranga and 41% in Wellington by 2038 (Statistics New Zealand). At this rate, the population increase will likely result in the emergence of megacities with overcrowding issues as well as increased traffic congestion and air pollution which will in turn affect health, wellbeing and quality of life (Junipers Research Global Smart City Performance Index).

As people migrate from rural areas to urban cities for better opportunities and income prospects, there is also a need to deliver on a city's promise of a good quality of life. The concept of smart cities has emerged as an approach to help solve these problems. This approach is to view cities as urban ecosystems that integrate digital technology, data, knowledge, resources and assets to become more responsive to users, improve city services, and make cities more liveable.

To understand the relationship between government run hackathons and Smart Cities firstly it is important to understand the role of a hackathon in the transport industry and, secondly, to understand how transport is incorporated in the smart cities approach.

THE HACKATHON SYSTEM IN TRANSPORT

Hackathons were first adopted by computer and software industry with a heavy focus on coding and computer programming particularly by start-ups and technology companies. They are now

being used by various industries to solve problems by improving traditional solutions or creating new solutions to help make for a better ecosystem. In the transport industry the primary purpose of a hackathon is to use the agile innovation process to define challenges in the transport industry (such as traffic congestion or increasing vehicle emissions) and develop solutions that provide value through an iterative process. This iterative design process is based on the principle “fail fast and learn fast” which allows a team to redefine the product offering.

A hackathon conducts Stage 1 of the agile innovation process. The process involved in Stage 1 is shown in Figure 1. This stage involves the formation of a cross-industry team, researching the customer need, defining a problem statement, opportunity investigation and ideation, developing customer personas, a product vision board, a user journey map to develop a low fidelity prototype and creating a pitch. Figure 2 shows an example of what is considered and documented for a user journey map.

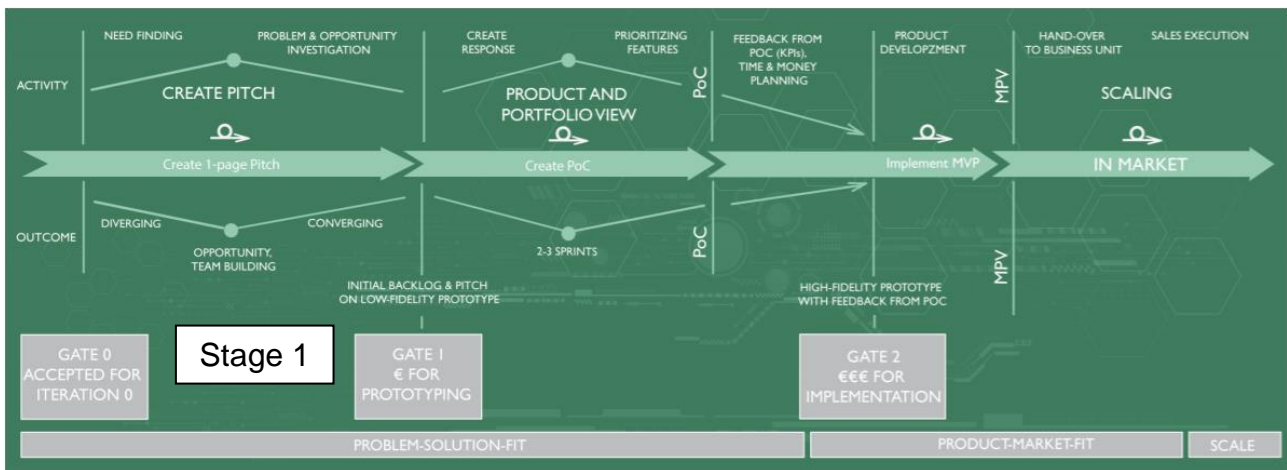


Figure 1: The agile innovation design process. Image courtesy of Deloitte (2017)

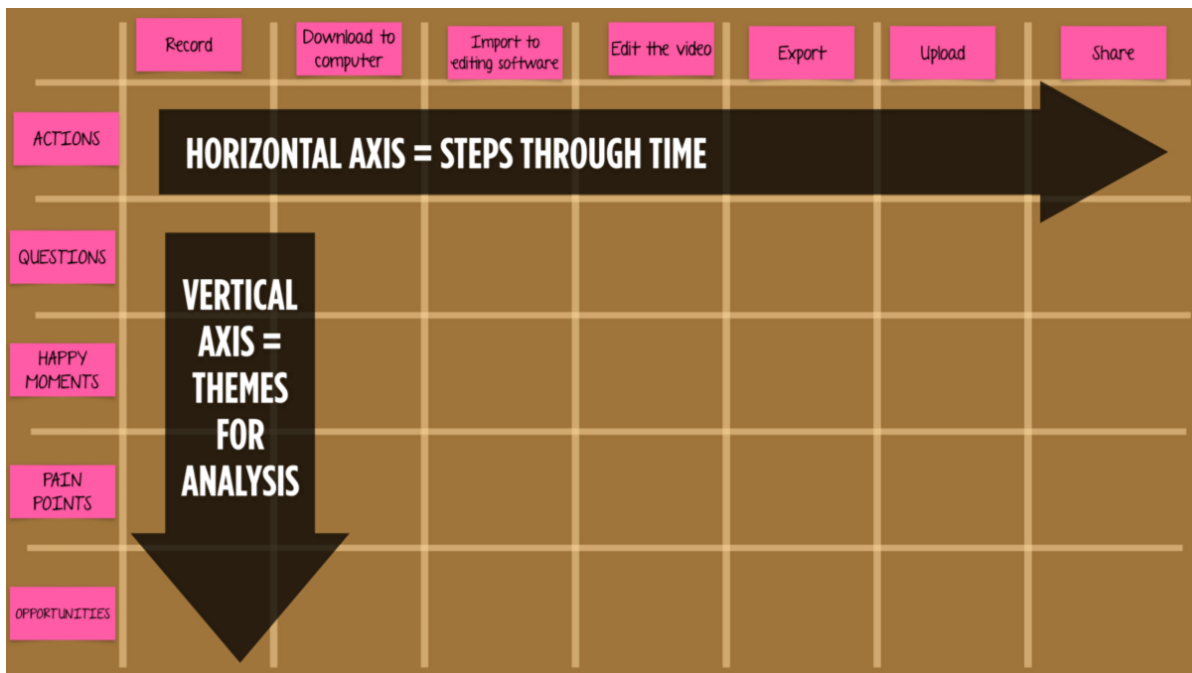


Figure 2: Example user journey map. Image courtesy of Medium author Harry Brignull 2016

A transport hackathon team is made up of a range of skillsets including design, technology and software developers, user experience professionals, ethnographers, service designers, behavioural psychologists, transport engineers and planners, urban planners, geospatial analysts, data analysts and transport customers. The team can then use the three C's Approach which applies creativity, co-creation and co-design into the engineering hackathon system. Figure 3 explains how each of the three C's are used in the hackathon system.

The three C's Approach for Smart Cities

Creative

- Creativity fuels innovation particularly in the idea generation stage and the business model stage. It is key to solving transport problems that will require innovative new solutions or improved traditional solutions

Co-design

- A team with members that have different types of expertise and experience creates an opportunity for a wider range of alternatives to be generated during the idea generation stage and business model development. By considering all aspects involved in the transport system it also helps makes for a more holistic design of the solution.

Co-creation

- A hackathon is driven by customer needs rather than jumping straight to technology and product development. The customer need should be captured well in the business case. It also highlights the need to understand customer behaviours and preferences to design fit-for-purpose solutions.

Figure 3: The Three C's Approach for Hackathons

SMART TRANSPORT FOR SMART CITIES

Transport is a key component of a smart city. Urbanisation brings an increase in city populations and therefore creates a challenge for a city to provide smart transport with good levels of mobility and accessibility. Smart city ranking approaches look at important elements of the smart city. There are four main smart city rankings that have been developed so far. They include the IESE Cities in Motion Index, Junipers Research Global Smart City Performance Index, Smart Cities Prospects published by Procedia Computer Science, and Easy Park Group Smart Cities Index.

The elements of a smart city ranking are called smart city indicators, which are developed using research and case studies of cities around the world. Table 1 lists all four of the main smart cities ranking systems and their corresponding indicators in each column.

IESE Cities in Motion Index	Junipers Research Global Smart City Performance Index [2]	Smart Cities Prospects published by Procedia Computer Science	Easy Park Group Smart Cities Index
1. Economy 2. Governance 3. Technology 4. Environment 5. Human capital 6. International outreach 7. Public administration 8. Mobility and transportation 9. Urban planning 10. Social cohesion	1. Mobility 2. Productivity 3. Public safety 4. Healthcare	1. Economy 2. Living 3. Government 4. People 5. Mobility 6. Environment	1. Transport and mobility 2. Governance 3. Innovation economy 4. Sustainability 5. Living standard 6. Expert perception

Table 1: Smart cities ranking systems and their indicators

In Table 1 there are several indicators that only appear in one or maybe two smart city ranking systems. This is because the concept of smart cities is still being developed and is likely to vary from city to city and country to country, depending on the level of development, willingness to change and reform, resources and aspirations of the city residents (Smart City Mission Government of India, 2018). Despite this, it is important to note that in Table 1 transport or mobility appears in all four of the ranking systems. This shows consensus that transport is a key indicator of a smart city.

THE SETUP - PREPARING FOR SMART TRANSPORT IN SMART CITIES

Smart cities can sometimes be seen as a futurist industry, with publications and media referring to connected vehicles and self-driving vehicles which may still be some time away. This can make it difficult to determine what can be done now to best prepare for such technologies. This section explains and outlines what is required to prepare for smart cities. It also explains how hackathons can be used as a tool to prepare for smart cities.

“The Setup for Smart Cities” is defined as the components required to prepare for smart cities. The recipe for the Setup includes three ingredients: a smart government, smart workforce and smart industry as shown in the Figure 4 below.

$$\text{Smart Government} + \text{Smart Workforce} + \text{Smart Industry} = \text{The Setup for Smart Cities}$$

Figure 4: The Setup is defined as the recipe for smart cities

Preparing a smart government

The characteristics of a smart government have been defined by Eden Strategy Institute and ONG&ONG Pte Ltd in the Top 50 Smart Government publication. These were determined through a survey conducted across cities that appeared a minimum of twice in the four smart city rankings mentioned above. Their methodology to develop the characteristics of a smart city involved identifying a suite of 10 key tools that mayors from these highly ranked smart cities have found effective in developing their smart city initiatives. These characteristics have been categorised into ten factors that should be considered by city governments that aim to transform into a smart government. Figure 5 describes each of these factors.

VISION	A clear and well-defined strategy to develop a “smart city”
LEADERSHIP	Dedicated City leadership that steers smart city projects
BUDGET	Sufficient funding for smart city projects
FINANCIAL INCENTIVES	Financial incentives to effectively encourage private sector participation (e.g. grants, rebates, subsidies, competitions)
SUPPORT PROGRAMMES	In-kind programmes to encourage private actors to participate (e.g. incubators, events, networks)
TALENT-READINESS	Programmes to equip the city’s talent with smart skills
PEOPLE-CENTRICITY	A sincere, people-first design of the future city
INNOVATION ECOSYSTEMS	A comprehensive range of engaged stakeholders to sustain innovation
SMART POLICIES	A conducive policy environment for smart city development (e.g. data governance, IP protection, urban design)
TRACK RECORD	The government’s experience in catalyzing successful smart city initiatives

Figure 5: Ten factors of a Smart Government. Image courtesy of (Eden Strategy Institute & ONG&ONG Pte Ltd, 2018)

Hackathons are a tool that can be applied in four of the ten factors to prepare a smart government. These components include support programmes, people-centricity, talent readiness, and smart policies. It does this by equipping and enabling smart governments. Figure 6 illustrates how hackathons can be used as a tool to prepare a smart government.

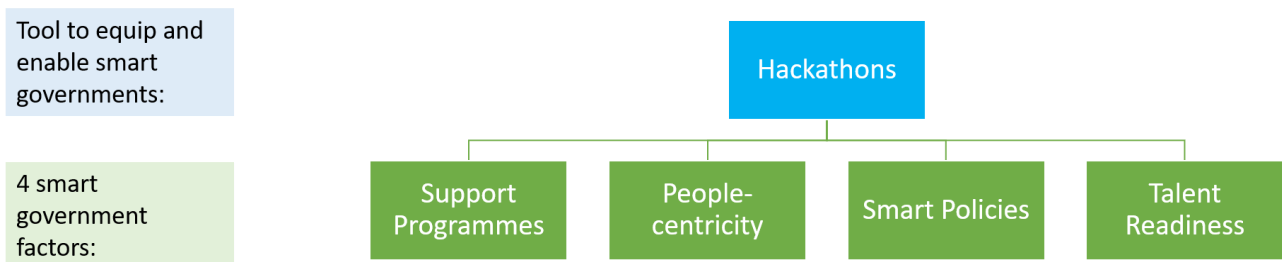


Figure 6: How hackathon is a tool used to prepare smart governments

For the support programme component, hackathons are a form of incubator that’s invites other players in the transport industry and other industries to be a part of solving NZ’s transport problems. This provides an opportunity for technology developers who may not have the platform to explore and co-design technology capabilities with the NZTA or engineering consultants. A government lead hackathon sets a good tone for a smart cities culture in the transport industry by driving innovation and allows them to have more authority on how the processes and delivery mechanisms for these solutions should function.

People-centricity allows for customer-centred design and co-creation. This relates specifically to the team structure on a transport hackathon which includes user experience, ethnographers, service designers, behavioural psychologists and transport customers. It is also a key component of stage one of the agile innovation process where customer needs are researched.

For the smart policies component, the implementation of a solution from a hackathon acts as a driver for change in policies or regulations to enable the adoption of that solution. This drives the government to set up processes and a governance structure that allows for future smart city innovation to be assessed, progressed and regulated. Without these elements in place the lost time due to an inefficient and undefined process and governance can result in a loss of benefits or savings. An example of this is LicenseMe, the winner of the NZTA hackathon hosted in March 2018, which has ignited the consideration of changes to licencing regulations.

For the talent readiness component, a hackathon provides an opportunity to equip the city's workforce including transport consultants and transport service providers with skills required for the future.

Preparing a smart workforce and industry

A hackathon is a tool used to equip a smart workforce with skills required for the future of work. Artificial intelligence and automation will transform the nature of work and job the landscape (Mckinsey Global Institute, 2018). The demand for advanced technological skills such as programming will grow rapidly as well as social, emotional, and higher cognitive skills, such as creativity, critical thinking, and complex information processing, and agile thinking which will also grow in demand (Mckinsey Global Institute, 2018). These skills required for a smart workforce are the skills practised and developed during a hackathon.

More governments are running hackathons, not only to solve problems but also to attract talented workers and provide a place to exercise and build those skills. This makes hackathons well placed to become part of the evolving education system and learning for the changing workplace. This is particularly relevant considering new research that places an emphasis on adaptive and life-long learning (OECD/CERI International Conference, n.d).

The additional benefits of a smart workforce are that it provides business opportunities within the smart industry. Existing companies with employees equipped with smart skills creates an opportunity for intrapreneurship. Programmes such as new venture accelerators have a similar purpose and function as a hackathon, which are tailored to fit into a company's internal approvals and financial processes. Transport companies can benefit financially by adopting such practices like new venture accelerators. The smart cities industry was valued at USD 442 billion in 2017 and is expected to reach a value of USD 1,226 billion in 2023 (Mordor Intelligence, 2018). While this includes the other areas of smart cities such as smart health, the size of the market value still provides a great opportunity to tap into new revenue streams in the smart transport sector.

It is also important to note that programmes such as new venture accelerators require buy-in and active participation from employees. Deloitte (2017) highlights the need for employees to become early adopters of the agile innovation process and the innovation culture to build a success agile team. Therefore, companies from having employees who have participated in hackathons are more likely to be receptive and active about programmes like new venture accelerators within the company.

EVIDENCE OF SUCCESS IN NEW ZEALAND

The NZTA All Access Hackathon 2018

New Zealand is one of the first governments using hackathons among the cities highlighted in the Eden Smart Government Study. This is evidence that NZ is conducting activities consistent with the smart city ranking indicators. The inaugural hackathons conducted in New Zealand lead by NZ Transport Agency in 2017 are consistent with the adoption and application of the factors outlined for smart governments. Therefore, it can be concluded that the NZ government is using the smart city and smart government ranking indicators in a way that helps direct strategic planning rather than purely as a tool to gauge their performance against other cities (Giffinger and Gudrun, 2010).

A good case study is the third-placed solution from the NZTA All Access Hackathon, Jaid. Jaid was created to address a need for vision impaired transport users who experience barriers when using public transport. This section of this paper uses team Jaid as a case study to show how the activities conducted by the team during the hackathon were based on applying the agile innovation process and the three C's approach, and how they developed skills required for the future.

Day one ran for five hours from 5pm to 10pm. The activities involved pitching the initial idea of using augmented reality as a potential technology to address the lack of access for disabled people. Team Jaid, a cross industry team of 6 professionals, was formed with collective expertise in transport engineering, human factors consulting, service designing, psychology and software development. The range of specialisations in the team leveraged the diverse expertise to co-design a solution.

The team was then assigned mentors including transport planners, data analysts, developers, graphic designers and user experience professionals. From there, team Jaid began market research to validate the initial idea of augmented reality and prove it addressed customer needs. This validation process provided evidence that the augmented reality approach did not address the customer's needs. The team then made the hard decision to let go of this technology and conducted another round of ideation to refine the problem statement and come up with a solution that addressed the customer need. This decision to pivot was evidence of applying the "fail fast learn fast" principle is part of the agile innovation process because it allows for the iterative design process.

Day two involved:

- Developing the business model canvas
- Interviewing potential customers to revalidate the customer need. Interviews conducted with a vision impaired woman revealed that while she loves using public transport, the suite of apps do not allow her to travel independently and confidently. This was a problem because it left her feeling isolated resulting in mental and physical health implications and an increased economic burden. Through the information learned from the interview, the team was able to create a customer persona and develop the minimum viable product (MVP) to cater to those needs.
- Developing a customer persona to determine the product offering for the MVP, as shown in Figure 7.
- Completing a user journey map.
- Developing a product vision board for the MVP.
- Defining the apps service features for the MVP.
- Developing a low fidelity prototype using the transport data made available by NZTA.
- Testing the low fidelity prototype with a potential customer. This was the application of co-creation as part of the three C's approach.
- Economic analysis to determine development costs and financial benefits. Figure 8 shows the potential benefits for those aged below and above 65 years old.
- Stakeholder analysis to determine potential partners and funding mechanisms.

All these activities were required to develop the pitch for day three.

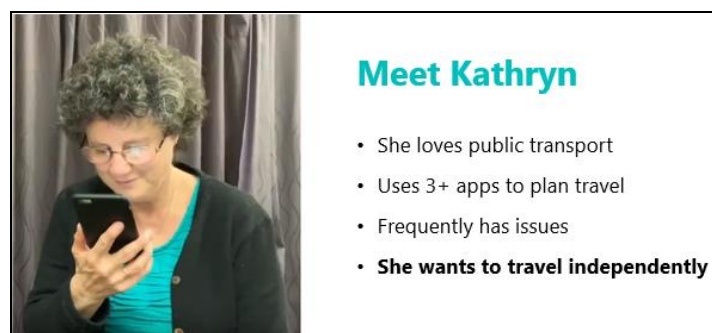


Figure 7: Customer persona for MVP

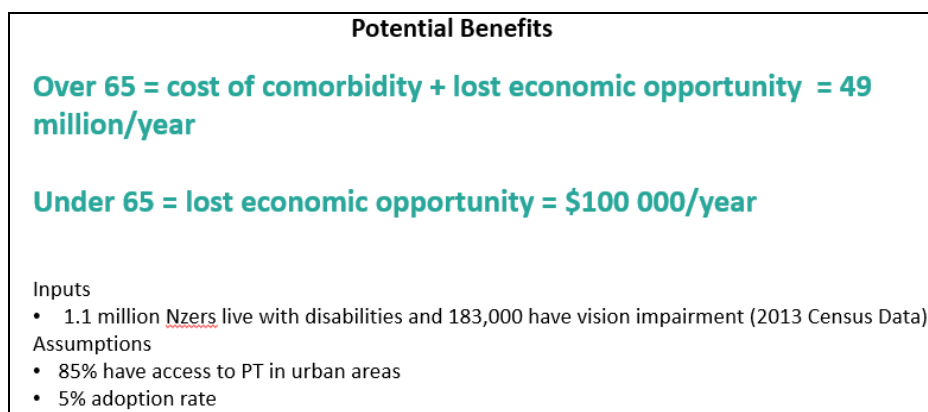


Figure 8: Potential benefits of the Jaid MVP

On day three, the output of the hackathon was a six-minute pitch to a panel of judges with backgrounds in disability services, NZTA subject matter experts, entrepreneurship and innovation consultants. NZTA provided judging criteria which helped structure the pitch. This involved demonstrating the impact, ability to implement, execution and experience. The pitched MVP was the mobile app called Jaid which helps vision impaired users with end to end trip planning and on-trip assistance.

CONCLUSIONS AND RECOMMENDATIONS

Hackathons are a great tool to prepare the government, workforce and transport industry for smart cities. The agile innovation process and team structure in a hackathon creates a successful blueprint of a mechanism that can be used to solve New Zealand's transport problems.

The New Zealand government is pioneering the way for transport hackathons which is resulting in several benefits including the following:

- The workforce can upskill themselves in areas required for the future of work.
- The workforce can use the skills developed from participating in hackathons and apply them in their existing workplaces to drive intrapreneurship.
- A government led hackathon gives the transport industry a blueprint of how to run hackathons in the transport industry.
- It sets up an example of innovation culture for the transport industry.
- It helps prepare the way for smart cities in New Zealand by creating a smart government, smart workforce and smart industry.

Recommendation: Government, workforce and industry should actively participate be a part of “The Setup for Smart Cities”.

To be a part of “The Setup for Smart Cities” the following actions are recommended:

1. Companies invest in intrapreneurship through programmes such a new venture accelerator programme, and explore how public-private partnerships could work successfully and bring value to all stakeholders.
2. Employers and the workforce should engage and participate in hackathons because it provides an opportunity to upskill for the jobs of the future. In doing so, it helps future proof one’s career when automation and artificial intelligence increase in the workplace.
3. The government continue to prepare themselves to be a smart government. This will allow them to develop and put processes, governance and structures in place to help deliver, regulate and govern the smart cities transport industry. This would particularly help to set up the structure for public-private partnerships to work in the industry. The government should continue running hackathons in the transport industry because it is a good tool to help equip and enable the government, workforce and industry for smart cities.

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