Spring 6-29-2022

Smart City Digital Transformation Journey: An Investigation of Stage Models

Amitrajit Sarkar

Smart City Digital Transformation Journey: An Investigation of Stage Models

Amitrajit Sarkar

Department of Business and Digital Technologies,
Ara Institute of Canterbury, NZ
E-mail: Amit.Sarkar@ara.ac.nz

Abstract

Growing interest in e-Government raises the question about the developmental stages of e-Government services. This paper describes the transformation of a city government supported by an active Smart Cities programme. The paper discusses the concept of Smart Cities and explains why Christchurch is uniquely positioned to take advantage of the opportunities offered by Smart Cities technology and approaches. We describe the Christchurch Smart Cities programme and the lean approach it is using to bring communities, innovation, and information together to create a better experience for people in Christchurch. Recent research in Christchurch demonstrates that implementation of foundation Smart Cities initiatives such as free Wi-Fi in the public realm is necessary for the successful uptake of e-Government services across all areas of society. This paper confirms the developmental stages of e-Government services using Christchurch City Council as a case study. Interviews with Christchurch City Council officials and managers responsible for implementing and managing these initiatives offer insights into how Christchurch City Council is becoming a more efficient, effective, transparent, accountable, and collaborative city government. The themes identified in this study would be useful as a conceptual framework for researchers to evaluate and understand Smart Cities and e-Government initiatives and could serve as a roadmap for practitioners in planning future projects.

Keywords: Smart City Planning, Citizen Engagement, Smart Services, Online Services, IS Resilience, Decision-making, e-Governance

1.0   Introduction

The new millennium has seen the rise of cities as significant global players. In the words of Mike Bloomberg in 2012, then Mayor of New York city:

> "We're the level of government closest to the majority of the world's people. While nations talk, but too often drag their heels—cities act." Bloomberg, M. (2012)

With the arrival of the digital age, we are now truly living in a global village. Cities around the world are competing to attract the best and brightest people, innovative companies, advanced research opportunities, and experimentation of transformational technology that will make their city a desirable choice for people and business. With the rise of digital nomads as well as organisations that are not just willing, but eager to relocate in order to gain competitive advantage, it is necessary that cities present themselves as innovative and sustainable 21st century cities; ideal locations to live, work, and play. Governments are committed to deploying city-wide initiatives that

transform their 20th century ways of working into 21st century technology and approaches, or 'Smart Cities'. They are using information and communication technologies (ICT) to implement e-Government solutions and services that make it easier for citizens and businesses to interact. Implementation of Smart Cities initiatives that remove barriers through democratisation of data and information and create meaningful visualisations that engage citizens and promote participation in democracy necessary for the successful uptake of e-Government services across all areas of society.

In this paper, we adopt the view that Smart Cities have more innovative, efficient, and effective government, and we use the concept of Smart Cities as a basis for transformation and innovation in city government. The combination of both Smart Cities and e-Government initiatives assist in the improved efficiency and effectiveness of governance processes, while creating a better experience for citizens. We illustrate this assertion through a case study of Christchurch City Council in New Zealand.

We begin with a literature and methodology review that recognises the necessity for a common frame of reference for understanding the developmental stages of e-Government. Our study describes the relevance of Smart Cities technology and approaches as a basis for transformation and innovation in city government. We discuss the range of definitions of Smart Cities by sector (government, business, and academia) and summarise the recurring themes in these definitions. We then outline the main components or systems that make up Smart Cities and discuss how city governments cut through these definitions to embrace Smart Cities concepts that make their cities a desirable place to live, work, and play.

We explain why Christchurch is uniquely positioned to take advantage of Smart Cities technology and approaches and how Christchurch has become a magnet for innovation from across the world. We summarise the features of the lean programme that has developed *Smart Christchurch*, and how this programme is necessary for the successful uptake of e-Government services across all sectors of society. We then compare Christchurch City Council's e-government initiatives with the e-Government stage models and confirm the underpinning perspectives, concepts, and metaphors.

2.0   Literature review and methodology

A number of developmental stage models of e-Government have been proposed as guidelines for policy instrumentation and further research by numerous international organisations, consulting firms, and academics since the year 2000. However, till now, the e-Government stage models found in the literature differ from each other as each takes different perspectives and uses somewhat different metaphors Nam and Pardo (2011). This presents various challenges, not only in understanding different research results, but also in planning future actions for e-Government development. In the sections below, we review a common frame of reference for understanding the developmental stages of e-Government that will be used to compare with the Christchurch City Council Smart Cities and e-government initiatives.

2.1 Common frame of reference for e-Government stage models

Two types of themes are identified as part of our literature review on stage models:

1. Operational/technology; associated with technology and operational characteristics of government
2. Citizen/service; relating to the services of government towards citizens which include transaction, interaction, participation, and democracy.

2.2 Anderson and Henriksen's progressive growth model

We have used Anderson and Henriksen's progressive growth model (Lee, 2010), which describes the process from cultivation, through extension and maturity, towards revolution. It should be noted that they used 'activity centric applications' as well as 'customer centric' applications as separate dimensions in explaining the developmental stages of e-Government. Various stages of Anderson and Henriksen's progressive growth model explained in detail in table 1.

Model Stage	Description
Cultivation	This stage describes the horizontal and vertical integration in the initial phase of e-Government. Their description of cultivation continues with the use of the intranet and limited citizen service. This stage is more focused on internal computerisation and promotion of benefits within the organisation, limited to the siloed internal functions of government.
Extension	This stage can be described as the provision of personalised web user interfaces for customers (both citizens and businesses). It is emergence of the integrated e-Government system extending towards the customer.
Maturity	The merging of the intranet and internet in order to streamline customer service processes in connection with the internal operation of the government.
Revolution	The last stage can be characterised as data mobility across the organisation and its applications and platforms.

Table 1.   Anderson and Henriksen's progressive growth model stages

2.3 The stage metaphor model for government services

This common frame of reference as shown in Figure 1 will assist administrators in terms of planning for structural and organisational changes on top of technological advancements, even when this kind of jump is planned (Lee, 2010). The details of the Metaphor stages as shown in figure 1 are explained in detail in table 2.
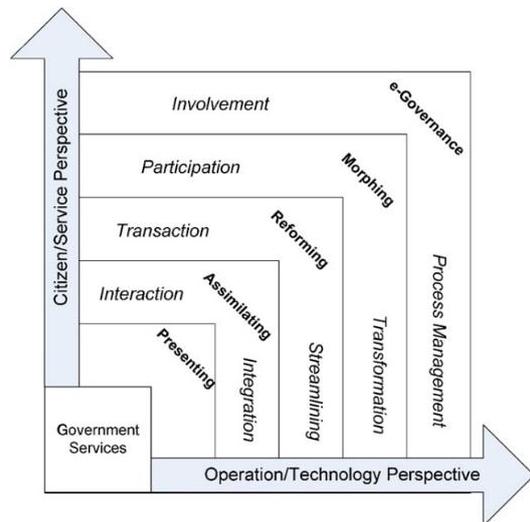

Figure 1. **A common frame reference for e-Government stage models (Lee, 2010)**

Metaphor Stage	Description
Presenting	The presenting stage metaphor denotes simple presentation of information.
Assimilating	The assimilating stage metaphor consists of interaction and integration and refers to the assimilation of basic computing ability (processes and services) with real world situations. From the perspective of citizen and service, assimilation means the emergence of interaction-based services while scattered information sources and applications are being integrated.
Reforming	The reforming stage refers to the reformation of business processes of government (streamlining). Modifying their business processes to work with the underlying information technologies and systems, and the reformation of how they conduct their business with citizens (transaction), to make them more efficient.
Morphing	Morphing refers to the changes of the shape and scope of processes and services that take place both in the information space and in the real world, to make them more effective.
e-Governance	E-Governance is the last stage of e-Government development. Once the morphing of services and operations are in progress, the standard of government and governance begins to change. Ideally, citizens will be able to get more involved in political and administrative decision-making while these decisions, technologically and operationally, would be implementable almost real-time with reconfigurable process management facilities. In this regard, involvement and process management goes hand in hand.

Table 2. **Stage Metaphor Model**

2.4 Streamlining and process management as requirements for transformation

The concept of 'streamlining' appears in many descriptions of transformation such as:

- Re-engineer existing processes by reducing bottlenecks and intermediaries
- Improve customer service by removing any problems the user is facing
- Transform the current operational processes to provide more efficient, integrated, unified, and personalised service

As transformation implies an in-depth refurbishment of actual government operations, streamlining can be a phase that exists prior to the actual transformation, and be defined as correcting unreliable processes which may not be adequate for information technology and systems. Process management is placed as the final phase of e-Government. Transformed services are subject to changes due to external factors such as legislative changes. Processes and related e-Government systems need to be easily reconfigurable so that these changes can be implemented without undue complexity (Lee, 2010). The alignment of themes/dimensions to e-Government stages is represented below in figure 2.
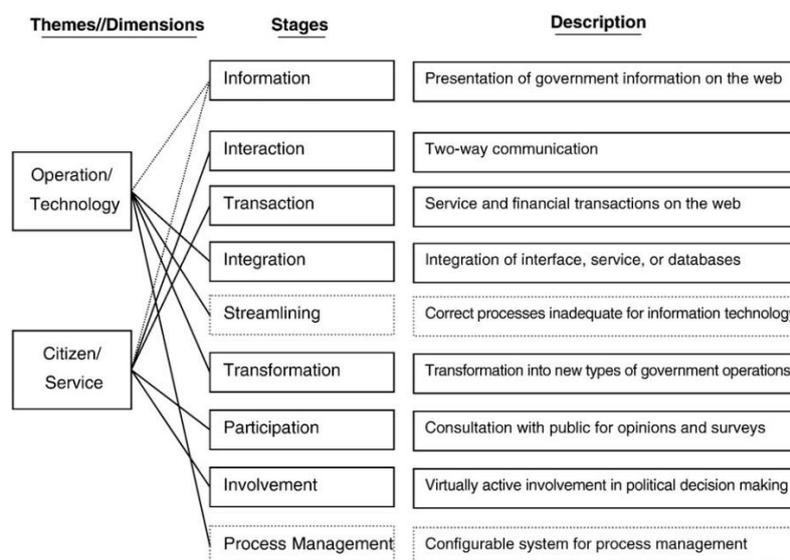

Figure 2.   The alignment of themes/dimensions to e-Government stages

3.0   Case Study Method

This study uses case study methodology to understand why and how a social phenomenon of interest occurs (Yin, 2009). The method helps develop preliminary understanding. Given the emergence of online services such as contact centres and the lack of academic research on these services, case study methodology is an appropriate approach to conducting this exploratory research (Yin, 2009). This study is also inductive so that it contributes to building new understanding. This section describes the data collection and case analysis used for this research.

3.1   Data Collection

In order to identify the applicable interview participants, purposive sampling was employed because of the relative newness of the research theme. This sampling technique is needed to identify and target individuals who could provide important information to understand the social phenomenon (Yin, 2009). The Mayor of Christchurch City Council as an initial informant was asked to recommend others who have sufficient information and knowledge in various aspects of council operation and strategy. Interview participants were selected to avoid redundant knowledge and maximise new knowledge discovery. Interviewees from different levels and functions include executive-level officials (the Mayor and Chief Information Officer), senior managers (Smart Cities Programme Manager and Chief Resilience Officer), Smart City Programme Manager and Project Co-ordinator and representatives of other service departments related to the Christchurch Smart Cities programme and e-Government service delivery.

From May 2020 to March 2021, the author conducted 12 semi-structured interviews with city government officials and managers with responsibility for managing and operating the city of Christchurch's Smart Cities Programme and ICT initiatives. Each face-to-face interview lasted approximately one hour, and additional information was collected through follow-up email or telephone communication. Data was collected using the protocol developed by the multinational 'Smart Cities Service Integration' research team, which aims to explore the processes of smart city initiatives and their impacts on cities, people, and city governments. The study of Chourabi et al. (2012) provides a conceptual background of the interview protocol. This protocol established criteria for case selection including a focus on service provision, transportation, and human services. The protocol suggests that selected cases must have a service integration component that crosses the boundaries of agencies within a city. The Christchurch Smart Cities programme and the *My Council* digital transformation programme met the selection criteria for this protocol as they are direct service delivery projects with a focus on city-level service integration.

3.2   Case Analysis

Interviews were transcribed and analysed following an inductive logic approach and using grounded theory techniques. Employing a qualitative analysis software tool (NVivo), we did a systematic iterative process of joint coding and analysis to minimize personal bias. Grounded theory refers to theory that is developed inductively from empirical data, and the grounded theory approach is a method of

using empirical data without predefined theories to generate or discover a theory (Glaser and Strauss, 1967).

For this research, coding refers to a process of labelling, separating, compiling, categorizing, and organizing qualitative data (Glaser and Strauss, 1967). Descriptive codes are used so that interview transcripts were coded in sentence or multi-sentence chunks. Glaser and Strauss (1967) suggested the four stages of grounded theory analysis as follows:

- Codes: identifying anchors that allow the key points of the data to be gathered
- Concepts: collections of codes of similar content that allows the data to be grouped
- Categories: broad groups of similar concepts that are used to generate a theory
- Theory: a collection of explanations that explain the subject of research

4.0   Defining Smart Cities

The term Smart Cities has become common parlance within government, business, and academia. Yet there is no agreed-upon description of what 'smart' implies in the context of a city. In fact, these three sectors tend to focus their definitions differently. Academia concentrates on the functional improvements that Smart Cities can make to infrastructure such as waste management and energy use. Governments focus on how Smart Cities can improve a citizen's experience, and business focuses on the economic value of smart technology in the city.

Several working definitions of a smart city can be found in the literature. They share some features as well as have some distinctive features. For example, while Nam and Pardo (2011) view a smart city as one performing in a 'forward-looking' way, the Natural Resources Defence Council contemplates 'smarter' as more efficient, sustainable, equitable, and liveable. Harrison et al. (2010) conceptualise a smart city in a technological sense as instrumented, interconnected, and intelligent. Similarly, Washburn et al. (2010) see a smart city as intelligent, interconnected, and efficient.

In table 3 and 4, a sample of Smart Cities definitions from both the academic and business sectors are provided below. (Slaughter, 2018).

Title and author	Definition
(Lazaroiu & Roscia, 2012)	"The smart city is a new way of leaving and considering the cities. The optimization of available and new resources, as well as of possible investments is required. The achievement of smart city objective can be reached through the support of various information and communications technologies. These can be integrated in a solution considering the electricity, the water and the gas consumptions, as well as heating and

	cooling systems, public safety, wastes management and mobility." – (p. 326)
(Höjer & Wangel, 2014	Definition for a "Smart Sustainable City": "A Smart Sustainable City is a city that ─ meets the needs of its present inhabitants ─ without compromising the ability for other people or future generations to meet their needs, and thus, does not exceed local or planetary environmental limitations, and ─ where this is supported by ICT." – (p. 10)
(Eteszadzadeh, 2016)	"Smart City 2.0 can therefore be described as follows: It is a community aimed at individual and urban (self-) preservation comprising all groups of human urban stakeholders. Their behaviour (including production and consumption) is completely geared to the urban goal system jointly developed by all of them on the basis of the city's meta-goals (sustainability and generalizability). They are committed to their diverse community goals, champion their sovereignty as consumers, residents, and humans, as well as the protection of their city's natural environment and wildlife. To achieve this, they employ technical facilities to a great extent, but do not allow technology to expand uncontrollably, dominate urban life, or acquire decision-making authority." – (p. 53)

Table 3.   Smart Cities definitions from the academic sector

Organisation/author	Definition
Cisco	"Today's cities face a variety of challenges, including job creation, economic growth, environmental sustainability, and social resilience. These issues, and others, can be mitigated through the adoption of scalable solutions that take advantage of information and communications technology (ICT) to increase efficiencies, reduce costs, and enhance quality of life. Cities that take this approach are commonly referred to as Smart Cities, or Smart+Connected Communities (S+CC.) While there may be many dimensions to consider when defining a smart city, at a simple level, it refers to a meticulously planned city that relies on IT as an enabler to solve many of its problems - from the use of sensors to smart grids and data analytics that allow city infrastructure and services to meet city problems and citizen demands efficiently and reliably." (p. 4-5)
Siemens	"The current general opinion can be summarized as follows: a city is smart if it makes use of the "Internet of Things" and other intelligent systems to use its resources more efficiently and thus improve the lives of its citizens and enhance its own competitiveness. Fields that are relevant to this concept include energy, transportation, industry, and public administration. In addition, a smart city must be able to combine a host of different systems into a coherent whole; thus system integration is the order of the day."
HP	"The smart city leverages diverse information and communication technologies to enable better business processes, help control costs, drive toward carbon neutrality, and encourage citizen interaction. This forward-looking city works to promote a healthy economy, attract people and businesses, help reduce environmental impacts, and make it easy for citizens to participate in political,

economical, cultural, and social activities." – (p. 1)

<p style="text-align:center">Table 4.   Smart Cities definitions from the business sector</p>

4.1 Smart Cities and the practical approach from city governments

Despite the differences in these definitions, city governments around the world understand the outcomes that Smart Cities are seeking; they are embracing the Smart Cities concepts and are defining what that means in their own context.

City governments have endeavoured to make their cities a better place for people to live, work, and play since they were formed. At its essence, the various Smart Cities definitions are describing a city's commitment to using 21st century technology and approaches to create a better experience for their citizens. Governments, like other professionals in the Smart Cities field, recognise that it is both unnecessary and unhelpful to spend undue time and energy on precise and universally agreed definitions.

> "Let's not overcomplicate this, please. Like we did with sustainability, we don't need a decade-long process of redefinition of what smart cities is, or isn't. Yes, interpretations can change over time, and it's important to evolve. But at its core, the smart cities movement is about applying technology and data for good (Beck, 2018).

Seven critical infrastructure components and services Forrester Research's white paper	Eight Components of a Smart City Chourabi et al. (2012)	Six categories of Smart City evaluation indicators Nam and Pardo (2011)
• City administration • Education • Healthcare • Public safety • Real estate • Transportation • Utilities	• Technology • Management and organisation • Governance • Policy • People and communities • Economy • Built infrastructure • Natural environment	• Economy (competitiveness) • People (social and human capital) • Governance (participation, transparent governance, the functioning of the administration) • Mobility (transportation and ICT) • Environment (natural resources, environmental protection, sustainable resource management) • Living (quality of life, cultural facilities, health, safety)

<p style="text-align:center">Table 5.   Smart Cities Categories</p>

5.0   Smart Christchurch: catastrophe becomes a catalyst for opportunity

Among all the cities in the world, Christchurch is uniquely positioned to take advantage of Smart Cities technology and approaches. The catastrophic quakes that occurred in Christchurch in 2010-2011 took 185 lives, resulted in 90% of the CBD removed, wrecked countless homes, and devastated millions of dollars of city infrastructure above and below ground. This has resulted in Christchurch being both New Zealand's oldest city and its newest. For Christchurch Mayor Lianne Dalziel, the disaster drove ambitions to adapt quickly to future disruptions and the city responded to this need by the creation of their Smart Cities Programme.

> "I realised that I needed to know a lot more about the opportunities that would arise from the disaster, in order to help us recover and be better than we ever were…it's this capacity to adapt and thrive in a new environment...an opportunity to do things you didn't think you could do before. We're sending a message to central government that as a city, we want to be a bit of a test bed for new technology (Rashdi, 2017)."

Christchurch has undertaken a massive programme to strengthen its old infrastructure and building stronger and more resilient infrastructure. Crucially, following the earthquake, the city has much better data on its underground infrastructure.

> "We know more about our underground infrastructure than any other city in the country. That really enables us to plan so much more sensibly for the future (Rashidi, 2017)."

5.1   The Christchurch Smart Cities programme

The Christchurch Smart Cities programme was initiated in 2016 to carry out rapid proof of concept projects that make Council's vision a reality:

> *A city of opportunity for all…open to new ideas, new people, and new ways of doing things – a city where anything is possible* (Rohaidi,2017).

As highlighted by the interviewees, the programme uses 21st century technology and approaches to connect communities, innovation, and information, creating a better experience for people in Christchurch. They achieve this through:

- aggregating and visualise real-time data
- open data, open platform, open city
- removing barriers to access
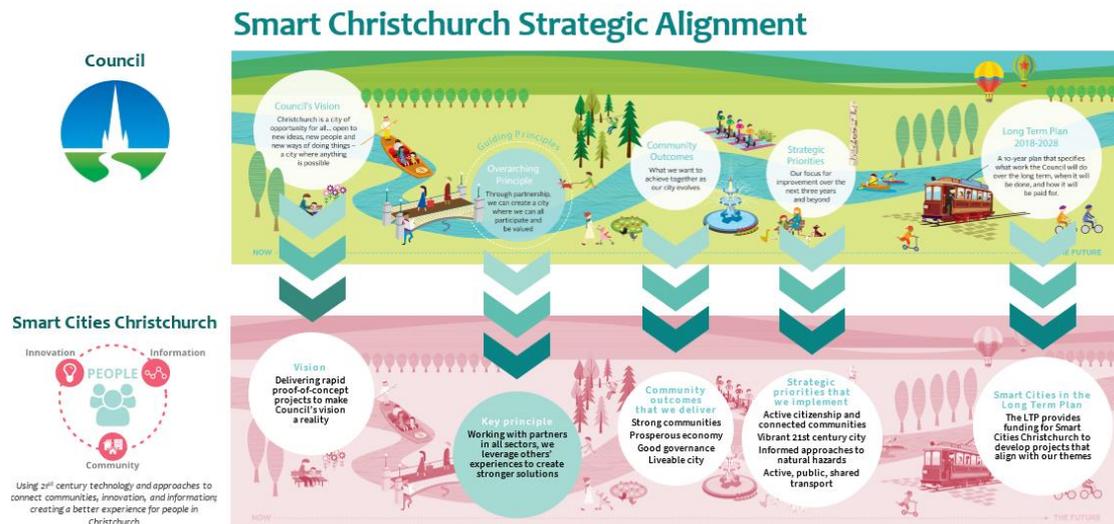- Inspiring fresh thinking.

Figure 3. **Smart Christchurch Strategic Alignment**

As depicted in the figure 3, the Christchurch Smart Cities programme is designed to be lean and efficient and has limited resources with regards to funding and people. This strategy promotes active collaboration, and the team works effectively with partners in all sectors, leveraging others' experiences and funding opportunities, to create stronger solutions for Christchurch. Since their inception, the Christchurch Smart Cities programme has entered more than 20 partnerships that include start-ups, local and national companies, global organisations, national funding opportunities, tertiary institutions, local and national government organisations, as well as representatives in the community/volunteer sector.

Their projects cover a variety of initiatives ranging from the creation of their *Christchurch SmartView* web-app that aggregates real-time data about Christchurch city, development of sensor solutions that are transforming their city operations and public services, and a world-first seismic monitoring initiative that enables Christchurch to have a wealth of precise real-time data enabling defendable decisions in the event of another significant earthquake.

The Christchurch Smart Cites programme is committed to creating sustainable innovation at an organisational and city level and has designed its initiatives to be shared with other cities in New Zealand and around the world.

This is demonstrated by the programme offering the source code for *Christchurch SmartView* on Github. This allows cities around the world to pick up the *Christchurch SmartView* code and populate it with their own city data. In addition to this, several

other initiatives are being co-funded by central government with a view to deployment across New Zealand.

Research conducted on the *Christchurch SmartView* web-app has shown that 89% of respondents indicated they would use the web-app to access information about Christchurch with 59% reporting that they would be inclined to add information for others. 51% of respondents were interested in Christchurch *SmartView* 'a great deal' or 'a lot', 38% indicated they would use it 'a moderate amount' or 'a little', and no respondents indicated they would not use it at all (Slaughter, 2018).

As mentioned by the interviewees, foundation Smart Cities projects such as free public Wi-Fi are still attractive to city residents. Not only is the service of great benefit to the public (particularly students, tourists, and digital nomads), but free Wi-Fi enables access to core digital and social services (including city and central government, health, news and events, recreation, social networks) regardless of a person's ability to pay for connectivity costs. The data from free Wi-Fi can also be used to provide information on pedestrian movement and dwell times that is used by city and event planners as well as developers. In a recent Christchurch survey, 93% of respondents indicated they would use the free Wi-Fi service in the city, with 58% of respondents reported they would use free Wi-Fi 'a great deal' or 'a lot', and 38% indicating they would use it 'a moderate amount' or 'a little'. Of particular interest to Christchurch, 55% of respondents reported that free Wi-Fi would be an incentive to come into the city (Slaughter, 2018). Implementation of Smart Cities initiatives that remove barriers through democratisation of access to digital data and information and create meaningful and engaging visualisations and interactions with citizens, promote participation in democracy, and are necessary for the successful uptake of e-Government services across all areas of society.

5.2   The emergence of the digital age and the impact on city governance

Interviewees echoed, the New Zealand community is rapidly maturing to a high level of technological sophistication. Ownership and use of conventional computers may have reached a plateau, but the rapid uptake of tablet devices and smartphones connected to the internet, are fundamentally changing the ways that people want to interact with the Council – how they obtain information, request, and pay for services. 87% of New Zealand's total population is now online and 70% use the internet every day (Christchurch City Council, 2016). This is a growing trend, reflected in the fact that almost all under 40s are online, and the aging generation is one of the fastest

growing adopters of those not already online. In working towards the community outcomes, influenced by population growth and demand, city governments face the challenge of making decisions that prioritise resources to deliver the best mix of services at the right level and in a sustainable way. The key challenges and opportunities that have been prioritised by Christchurch City Council are summarised below in table 6, as gathered from the interviews with the city council officials.

Key Issue	Description
Increased citizen expectations for online services	Citizens regularly use online-services to interact with their bank, airline, retailers, central government and other business. It is this level of consumerisation that increases the expectations of today's citizens to access Council services; using their channel of choice, from any location, at a time that is convenient to them.
Information governance	Making information open and accessible to all is relatively new to Council. Therefore, there is a need to adopt a robust information governance structure and principles to actively drive adoption of an open data strategy for the organisation.
Protection of privacy of information	While providing greater transparency through open data initiatives and an expansion of online services, it is critical to retain the privacy of citizen-specific data and protection of commercially sensitive information. Council is continually managing and reviewing processes and systems for the management, access, and control of such information whilst allowing open access to public information.
Consumerisation of IT changes expectations from Council business units	The exponential increase in the use of smart mobile devices and the ease in which Cloud service offerings can be obtained, has changed the expectations of IT in the corporate world. However, while business units can readily acquire consumer like IT services from the cloud, this approach does not reflect the sensitivity and security of information, not does it consider integration to Council systems or the level of support that may be required in the future. Moving from being the internal technology delivery capability for Council, the IT department is now positioning itself as a services broker; providing faster time to market with the appropriate service delivery (including cloud), integrating with Council systems, while safeguarding Council assets (information and systems).
24x7 operations	The increase of digital and online services and the provision of a 24x7 contact centre, increases the level of support required to deliver IT services to the customer facing lines of business, requiring upgrading and expanding core IT infrastructure and implementing new services to support 24x7 operations. Similarly processes and staffing requires review to support the extended service hours.

Table 6.   Smart Christchurch Service Prioritisation

5.3   Transforming citizens' interaction with Council through digital transformation

Figure 4 describes that with the increased citizen expectation for online services, and the drive for more efficient and effective service delivery, the Council identified that a

significant transformation was required to achieve the outcome of making Council simple and easy to interact with. This organisational transformation of cumbersome manual/walk-in/paper-based transactional services to streamlined customer-centric process available online has been named *My Council*. Whilst this is a whole of council change, the programme is led by a programme manager located in the Citizens & Customer Services team (outside of IT). The programme manager is supported by the Council's IT team who have aligned their Investment Roadmap to provide the core systems and enhancements, and the Council's Continuous Improvement team, who have been leading the organisational process improvement required to deliver the streamlined processes and service improvements necessary before migration to the IT systems required for full digitisation.


What is My Council?

What does success look like for Christchurch citizens?

Figure 4.   Smart Christchurch My Council Programme Roadmap

The first end-to-end service in the *My Council* programme to complete the digital transformation is the Customer Request area in mid-2018. This required extensive business process improvement which occurred in advance of the migration from the Council's legacy request management system to a cloud-based ERP system with full customer self-service online functionality. Customer request services that are prioritised are described in table 6 below (SAP News, 2018).

• Report a Water Issue (interruption to service, flooding) • Report a Water Pressure System Issue • Request Water Connection Request Security or Access • Report and issue with Trees, Grass or Weeds • Report Maintenance Issue • Report Graffiti • Make a payment	• Report a Vehicle or Road Hazard Issue • Report a Missing / Damaged Wheelie Bin • Report Missed Bin Service Request Drainage Plans • Request Assistance from an Animal Officer • Report a Pothole • Report Litter	• Request a Bin Exchange (Downsize/Upsize) • Request an Upgrade to Wheelie Bin Service • Request an Assisted Wheelie Bin Service • Request New Bin Service • Report an Odour, Insect or Pest Issue • Give feedback or a suggestion • Report an Animal Issue

<p align="center">Table 5.   Prioritised Smart City Services</p>

The *My Council* roadmap is demonstrated in the graphic below.
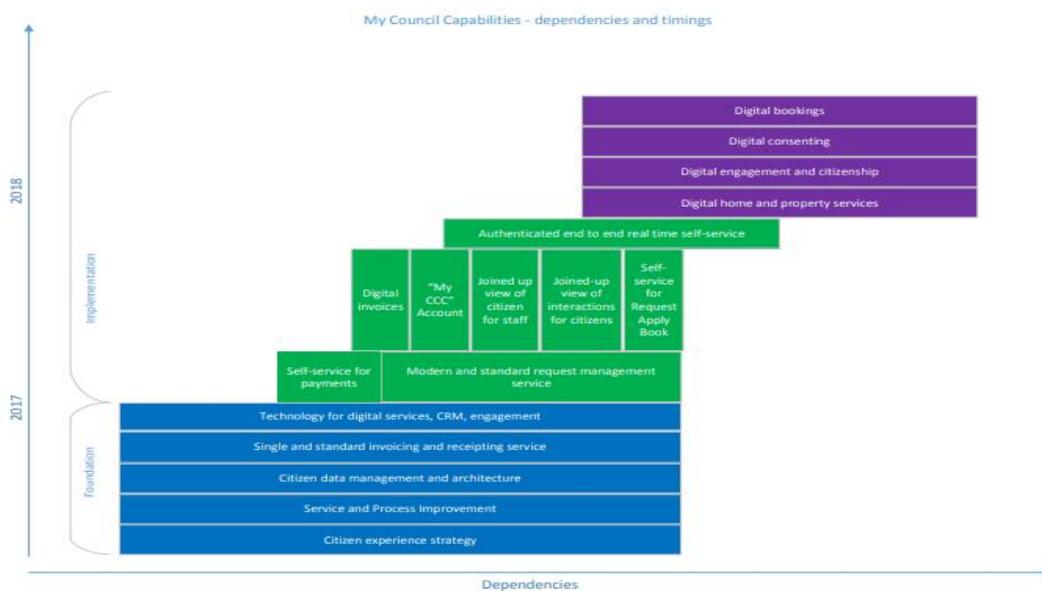
5.4   Council's digital transformation journey aligned to e-Government models

The main customer channels for the Christchurch City Council are their website and contact centre, both of which continue to meet or exceed their availability targets. The tools and technologies that underpin the organisation's services (desktop devices, network and infrastructure, and business applications) are delivered and available at levels that meet or exceed current targets. However, as the Council and the wider community grapple with the costs associated with recovering from the earthquakes in 2010-11, leveraging investments in information technologies to deliver online services has become a key component for delivering more efficient and cost-effective services to the community.

Performance data provided by initiatives such as *Online Services* (the migration of all building-related activity to the online channel) and *My Council* are credited with making the process of service delivery more transparent to the public which promotes

a stronger sense of accountability. Institutionalising interdepartmental collaborations emerged from the interviews as a critical capability in advancing through the e-Government stages described below. From the start of our research in 2016 to the time of writing this paper, the authors observed the Christchurch City Council navigating through Anderson and Henriksen's progressive growth model and a direct mapping to Lee's stage metaphor model for government services (both models are described in section two).

1. Lee's Stage Metaphor Model

Stage	Council case study description
Presenting	At the start of our research, the Council's web channel was predominantly used for information-only content. The Council had recognised that there was further work to be done to make that content easy to find, relevant to the customer, and support community engagement objectives. A programme of work was underway to make improvements to their external website. This fits Lee's description of the Presenting Stage.
Assimilating	Council had successfully implemented tactical digital processes and services aligned with real-world demand such as such as their online *Rates Finder* functionality (still the most popular page in the Council website). This is an example of the integration of disparate information sources and applications described in Lee's Assimilating Stage.
Reforming	To mitigate the risk to the customer with continued tactical initiatives, the Council embarked on a strategic exercise to define Council's customer and community operating model (enabled by IT). The Continuous Improvement (CI) team became the lead unit for the streamlining of business processes using Lean6Sigma (LSS) methodology. During this stage, Council's executive leadership team, supported the CI team's request to mandate the use of a process storage and mapping system across the organisation. Prior to this initiative, The Consenting and Licensing area had embarked on a bold programme of work to put all of their building-related activity online, *Online Services*. This involved the creation of a repository for all of their processes and a service-based process improvement team who modified processes as necessary to enable this digital transformation to take place. These initiatives align to Lee's Reforming Stage.
Morphing	The Council then fully transitioned their organisation change from tactical initiatives to an end-to-end strategic digital transformation programme, *My Council*. This focused on Council's large-scale, complex business problems and improved processes and services in preparation for the digital migration. This is described in Lee's Morphing Stage.
e-Governance	The initiation of the *My Council* programme sees increased involvement from citizens with the Council. The programme introduces the ability to be able to implement end-to-end real time self-service for citizens and enable reconfigurable process management facilities through their systems. The programme will also implement digital engagement and citizenship. This aligns with Lee's e-Governance Stage.

2. Anderson and Henriksen's Progressive Growth Model

Stage	Council case study description
Cultivation	In the mid to late 2000s, Council undertook a major programme of work to put the internal building blocks in place necessary for future digital transformation. This work included an ERP implementation of their rating system, payments, invoicing and debt management, assets, and the beginning of their work to create a single view of their customer. The implementation of integration that is limited to the internal operations of the Council

	aligns with Anderson and Henriksen's Cultivation Stage.
Extension	Tactical initiatives such as the implementation of Council's fully online funding and grants application process, their online *Rates Finder* functionality, and the digitisation of property files demonstrates Council's extension to customer-focused services that has been described in Anderson and Henriksen's Extension Stage.
Maturity	With the significant increase in the volume of consents in Christchurch as a result of the 2010-11 earthquake series, the Council transitioned their first end-to-end service area (everything related to building activity) online. *Online Services* is a web-based service that allows the customer to submit all building-related application documentation online, track applications, avoid scanning fees, and reduce application processing time. The intranet and internet were effectively merged in order to streamline customer service processes in connection with the internal operation of building-related services. This describes Anderson and Henriksen's Maturity Stage.
Revolution	With the success of the *Online Services* initiative described in the Maturity Stage, it was recognised that continued piecemeal development could result in an inconsistent and potentially frustrating experience for citizens as different areas of Council migrated to digital services. This could result in the creation of multiple customer databases and cause unforeseen process, data, and integration complexity.
	The initiation of the *My Council* programme sees the realisation of data mobility across the organisation and all its applications / platforms. This aligns with Anderson and Henriksen's Revolution Stage.

5 Discussion

Christchurch is reinventing itself as a test-bed for sustainable innovation and has attracted a significant number of exciting initiatives to the region including trials for both ground-based and flying autonomous vehicles, a transport mobility lab in their 'residential red zone', and research opportunities at tertiary institutions for both the Antarctica and Mars programmes. Pockets of innovation are emerging all over the city, with the Council-owned Christchurch International Airport leading autonomous electric shuttle vehicle trials and a partnership with e-commerce giant Alibaba which has the potential to generate $1 million a week in sales to Chinese consumers through the introduction of Alipay. In addition to leading-edge Smart Cities initiatives such as the ones listed above, Christchurch Smart Cities programme is implementing foundation Smart Cities projects such as free Wi-Fi and the Christchurch specific web-app, *Christchurch SmartView*. Projects like these are necessary for the successful uptake of e-Government initiatives such as *My Council*, across all areas of society. Successful interaction from the citizen's perspective requires integration of Council operations with technology. Without this integration, seamless interaction would not be achievable. In this regard, both integration and interaction represent the 'assimilation' of informational processes and services with real world ones.

During the Reforming Stage, Council was streamlining their processes, thereby reflecting the characteristics of the 'information space' as distinguished from

characteristics of real-world situations. From the operations and technology perspective, re-engineering or streamlining of services and processes have been conducted to enable the technology to effectively deliver transactions on the citizen and services side, thus resulting in increased efficiency. As the reformation of real-world processes and services progresses, 'morphing' of services and operations tend to follow as these two worlds are being intertwined, resulting in a change of the business model of government itself. As a result, routine services are delegated to computers and networks through assimilation and reformation, the tasks of government officers are transformed into more knowledge-based duties and service-oriented tasks that more directly address citizens' needs. This is the in-depth transformation of government business itself.

Finally, involvement on the citizen's side necessitates responsive configurability of service processes in terms of component technologies and operational components. Thus, the metaphor for the last stage is titled e-governance. This is the stage in which Council is currently poised. The processes of administrative and political services can be reconfigured in near real-time based on citizens' involvement in decision-making of the government, using the full capability of advanced information and communication technologies that contribute to the development of *Smart Christchurch*.

6 Conclusion

Christchurch City Council has demonstrated strong support for their Christchurch Smart Cities programme and made significant investment in their online service delivery space. This support and investment are helping Christchurch to realise its vision of becoming:

> *A city of opportunity for all…open to new ideas, new people, and new ways of doing things – a city where anything is possible.*

Regarding their e-Government initiatives, from the content analysis, two themes are apparent: operation/technology and citizen/service. The relationship between phases of each theme indicates five separates, but interrelated, metaphors: presenting, assimilating, reforming, morphing and e-governance. Our case study of Christchurch City Council has clearly demonstrated that it has gone through stage one to stage five in terms of implementing e-Government related technologies and systems. They have relied on concepts from earlier stages such as interaction, streamlining, integration,

and transaction as well as presentation, and these components are not only technological but also organisational and citizen related. Anderson and Henriksen's progressive growth model (Lee, 2010), which describes the process from cultivation, through extension and maturity, towards revolution, has also proved useful as a tool for analysis. Once again, our case study of Christchurch City Council has clearly demonstrated that it has progressed through the model to reach the revolution stage.

With the e-Government initiatives now reaching the revolution stage of growth, these improved Council platforms will facilitate *Smart Christchurch* to use 21st century technology and approaches to connect communities, innovation, and information, creating a better experience for people in Christchurch. The Christchurch Smart Cities programme is already implementing initiatives that promote city efficiency, resilience, and effectiveness. Through *Christchurch SmartView*, they are putting real-time information in people's pockets that helps them make choices about which rivers to choose for recreation, or the least congested road to take to their destination. Citizens now know much more about the city's environment, the river and air quality, fire risks and recent quakes, at any given moment. Other ways that *Smart Christchurch* is promoting a healthier environment include improvements to the city's resilience in the form of water level monitoring to indicate flood risk, and a city network of seismic sensors that will make Christchurch the most densely seismically monitored urban environment in the world.

The final word goes to Mayor Dalziel who is aware that developing Christchurch as an ideal location for Smart Cities goes beyond implementing smart technology and utilising data more effectively.

> "A smart, resilient city would not be possible without citizen participation. All of these things are absolutely dependent on cooperation and working together. Governments can't do things for people. They can do things with people, but [if] the people aren't there with you, making these things happen, they just simply won't (Rashidi, 2017)".

References

Beck, A. (2018). Smart cities, in essence. [online] Available at:
 https://anz.smartcitiescouncil.com/article/smart-cities-essence; [Accessed 15 7
 2018].

Christchurch City Council. (2016, July 1). Public Participation in Community and
 City Governance and Decision making. Retrieved from
 https://www.ccc.govt.nz/: https://www.ccc.govt.nz/assets/Documents/The-
 Council/Plans-Strategies-Policies-Bylaws/Plans/Long-Term-
 Plan/ActivityManagementPlanPublicParticipationInDemocraticProcessesCity
 GovernanceAndDecisionMaking.pdf

Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., Pardo,
 T. A., and Scholl, H. J.(2012). Understanding smart cities: An integrative
 framework. In Proceedings of the 45th Hawaii International Conference on
 System Sciences (pp. 2289–2297), January 4–7, Maui, Hawaii, USA.

Glaser, B. G., & Strauss, A. L. (1967). The Discovery of Grounded Theory: Strategies
 for Qualitative Research. Chicago: Aldine.

Harrison, C., Eckman, B., Hamilton, R., Hartswick, P.,Kalagnanam, J., Paraszczak, J.,
 and Williams, P. (2010).Foundations for Smarter Cities. IBM Journal of
 Research and Development, 54(4), 350–365.

Lee, J. (2010). 10 year retrospect on stage models of e-Government: A qualitative
 meta-synthesis. Government Information Quarterly, 27, 220-230.

Nam, T. and Pardo, T. A. (2011). Conceptualizing smart city with dimensions of
 technology, people, and institutions. In Proceedings of the 12th Annual
 International Conference on Digital Government Research, June 12–15,
 College Park, MA, USA.

Natural Resources Defense Council. What are smarter cities?, Available from
 http://smartercities.nrdc.org/about.

Rashidi, N. (2017, 06 30). After the quake: How Christchurch is bouncing back.
 Retrieved from GovINsider: https://govinsider.asia/innovation/christchurch-
 lianne-dalziel-earthquake-resilience

SAP News. (2018). Citizen engagement key to Christchurch's digital transformation.
 Wellington: SAP. Retrieved from
 https://news.sap.com/australia/2018/11/07/citizen-engagement-key-to-
 christchurchs-digital-transformation/

Slaughter, H. (2018). Generating actionable intelligence and meaningful data from a
 Smart Cities project.

Washburn, D., Sindhu, U., Balaouras, S., Dines, R. A.,Hayes, N. M., and Nelson, L.
 E. (2010). Helping CIOs Understand "Smart City" Initiatives: Defining the
 Smart City, Its Drivers, and the Role of the CIO. Cambridge, MA: Forrester
 Research.

Yin, R. K. (2009). Case Study Research: Design and methods (4th ed.). Thousands
 Oaks, CA: Sage.