

# Data Analytics for Local Government: A Scoping Study of NSW and recommendations to enhance service delivery and customer experience

*Final*



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## Table of Acronyms

<b>Acronym</b>	<b>Meaning</b>
<i>AI</i>	Artificial Intelligence
<i>BI</i>	Business Intelligence
<i>CLG</i>	Centre of Local Government
<i>CRM</i>	Customer Request Management
<i>CSP</i>	Community Strategic Plan
<i>GM</i>	General Manager
<i>IOT</i>	Internet of Things
<i>IPPG</i>	Institute for Public Policy and Governance
<i>KPI</i>	Key Performance Indicators
<i>LGA</i>	Local Government area
<i>LIDAR</i>	Light Detection and Ranging
<i>OAIC</i>	Office of the Australian Information Commissioner

## 1. INTRODUCTION

The explosion in mining and processing of petabytes of information—also known as 'big data'—to gain insights into human behavior is completely transforming the world around us (Beresford, 2015). At every point of connection between government and people, data is created. This data is being generated at an unprecedented rate, from an exponentially increasing number of sources (Lowman, 2017). The advent of smart phones, new applications, sensors and the 'Internet of Things' (IoT) (Beresford, 2015) encourages and enables government to frequently record data on various touch points it has with the community.

Local governments currently collect large volumes of data based on their services and the information concerning their users and residents (Symons, 2016; Rogge et al.' 2017; Klievink et al., 2016). *Prima facie*, most local governments at present seem to be grappling with the single issue of how to develop and exploit the different data they hold whilst at the same time building the necessary analytical capabilities so they can head towards the goal of data-driven decision-making (Tat-Kei Ho and McCall, 2016; Klievink et al., 2016; Matheus et al., 2018). The benefits and challenges faced by local governments when trying to exploit their own data are considerable. Evidence suggests that councils are not currently utilising nor exploiting their use of data to its fullest potential (Gang-Hoon Kim, 2014).

It should be recognised that it is in the nature of local government to be uniquely positioned to leverage data for the benefit of their customers and their communities. First, as the tier of government operating closest to the community and providing a unique range of services to property and people, local governments collect data that is specific to that local area and can respond quickly to adapt to changing demands as represented in that data. This aligns with the principle of subsidiarity, which emphasises the normative foundation of local government resting in its knowing local requirements and governing with the wisdom (see Grant and Drew, 2017, pp 134-140). Second, the economic literature examining local government emphasizes that, in the absence of large economies of scale, efficiencies are inherent in

local service provision because local service provision can be precisely tailored (Grant and Drew 2017, pp. 136-140). Third, the existence of local government ‘constrains Leviathan’—or profligate and authority-hungry central government—by governing for the local level (Grant and Drew 2017, p. 141). Arguably, this is particularly important in the case of data capture and retention, where it is in the interests of the citizenry generally that data is not available to a central government, but kept locally.

To take the use of data analytics one step further and consider how it could be directly used to enhance customer experience is an area that will be investigated further. My intention is to investigate how data gathered can be utilised to better market and inform customers of council services and deliver information as required.

Imagine you are walking to your local park with your friend and two dogs, excited by the potential of a great afternoon, only to find disappointment as you are greeted by a closed sign. With data analytics all this could be avoided with notification by text or email in advance, informing you there would be an alternative park nearby and your afternoon would not have been spoilt. The data to do this is readily available, contained within a council’s names and address and animal registers, which could have been utilised to provide this simple service.

This study will explore one main type of evidence-based decision-making in two specific contexts: data analytics’ use in local government (focusing on NSW) and recommendations on how it can enhance service delivery and customer experience.

As an Executive Manager in charge of customer service personnel who directly report to my office, the idea of using data algorithms to better market and inform customers regarding Council services and the delivery of information as required, is very appealing. This would involve analytics which would recognise connections and patterns forming across Council’s data bases which would greatly improve customer interactions around requests for service,

events, etc. To the best of my knowledge, this approach is currently unheard of in local government.

This study presents a literature review which outlines the current environment of data intelligence and the tangible benefits local government could derive from data analytics in conjunction with the challenges and barriers faced by councils. Also examined will be how councils can use data to deliver efficient services and customer experience. Ethical and privacy ramifications from the collection and analysis of data are also discussed in detail.

The research design and methodology examines the framework under which the research was undertaken and the data collection and analysis methods utilised. Research findings are also discussed in detail, with research being undertaken across all councils in NSW to determine the current use of data analytics. This research identified there were particular councils which warranted further analysis to ascertain:

- How data analytics is being used to enhance customer experience or community engagement;
- What tools of analysis are used;
- What efficiency or cost savings have there been (if any);
- The major challenges with data utilization; and
- What strategies have been used to overcome these challenges

## **1.1 Ethics Approval**

Before commencing this in-depth research investigation into data analytics, an ethics procedure was adhered to closely in order to comply with the strict ethical behaviour of research at the University of Technology Sydney (UTS).

This method centered upon the finalising of a self-assessment tool constructed for this sole purpose and furnished by the Institute for Public Policy and Governance (IPPG) and the Centre for Local Government (CLG) at UTS.

The self assessment determined that the research needed an application that sought approval prior to being delivered through the IPPG and GLG Internal Ethics Program.

This study and the detailed documentation were finalised by the researcher and formally delivered by Dr Bligh Grant, Associate Professor, Politics, Policy and Applied Ethics at the UTS IPPG & CLG in August 2019.

## **2. LITERATURE REVIEW**

### **2.1 Methodology**

In the context of this study, the focus of the literature search was to gauge the current trends and uses of data analytics in local government. Topics such as sources of data, ethical and privacy implications, tools for analysis, challenges and barriers and ways councils can use data to drive efficiency in service delivery and enhance customer experience, will be covered in the review.

Criteria used to determine the selection of research included: the relevance of the research to the research question, the appropriateness of the study design to address the research question, the quality of the research in terms of its design, reliability and generalisability of the findings. The approach used involved extensive searches of on-line articles and papers, namely: *Public Administration Review*, *Harvard Business Review*, *International Research Journal of Engineering and Technology*, *Policy Studies Organization*, *Local Government Studies*, *Journal of Business Research* and *Methodological Innovations*. Other published literature was also reviewed using databases such as Google Scholar, UTS Library, SAGE Journals online, Researchgate, etc. To expand the review further, other 'public' literature was also sourced and included state and federal government websites, local government websites, IT company websites and media releases. Each piece of empirical research was subjected to a thorough review, using a standard framework and criteria to extract key information about the purpose, design, methodology, findings, and implications of the



article/paper. The searches resulted in seventeen (17) papers and books (empirical and opinion papers) being selected for evaluation.

The purpose of a literature review is to understand the results from previous studies that are closely related to the one being undertaken, to inform both methodology and results. It connects the study to a much larger discussion in the literature whilst addressing any short comings and extending prior studies (Creswell, 2014).

The scope for the literature review was not limited to Australian publications as there was merit in looking for best practice examples from overseas councils. Due to data analytics being a more recent phenomenon over the last ten years, on-going research using a range of terms such as 'data analytics' 'big data' 'local government' 'government' 'data intelligence' 'public sector' and 'smart cities' was explored which included the private sector and big business.

The findings from the literature review were analysed according to key themes that emerged. My aim was to find out how councils gather and put together existing data (tools of analysis), what efficiency or cost savings have there been (if any), how data analytics is being used to enhance customer experience or community engagement, the major challenges with data utilisation and what strategies have been used to overcome these challenges.

Local government collects enormous amounts of data ranging from waste collection, procurement, animal registrations, development applications and parking information. However, this can and does have the contradictory effect of councils being data rich but information poor (Phippen et al., 2011). Therefore, by using this data better and more effectively the question needs to be asked: how can Local Government use data for enhanced service delivery and customer experience? For councils that have not yet started down the path of leveraging big data and data science, the number one barrier is simply not knowing if the benefits are worth the cost and effort (Symons 2016).

## **2.2 Benefits of Data Analytics**

In a review of the literature, Pearson and Wegener (2013) assert that research has shown that 'early adopters' of big data analytics have gained a significant advantage over the rest of the corporate world. In examining over 400 large companies, they found that those with the most advanced data analytics' capabilities are far outperforming their competitors. Malomo and Sena (2016) also argue that when one looks at the experience of private sector companies, data exploitation can generate tangible benefits to an organisation which in turn has alerted policy-makers to the potential use of big data within the public sector. Research in the USA has shown a strong correlation between big data usage and a 20% growth in key performance indicators (Gang-Hoon Kim, 2014).

In addition, Malomo and Sena (2016) assert that the use of big data technologies across the public sector in Europe can reduce costs by 20% creating \$300 billion in savings (Malomo and Sena, 2016). This estimate is based on the assumption that data analytics can assist local governments to allocate resources based on areas that will have the greatest impact and have the ability to restructure services in a way that early prevention is prioritised to avoid the need for more expensive involvement.

The use of big data is more prevalent in the private sector due to the competitive nature of the industry compared to that of local government (Malomo and Sena, 2016). The massive capital investment required by traditional mass production systems and the use of data has thus far inhibited the flexible response needed to implement change in local government.

## **2.3 Tools for Data Analysis to Enhance Service Delivery**

Traditionally, local governments have on occasion suffered from a 'reactionary approach' when deciding when and where community needs are met (Malomo and Sena, 2016). However, councils currently have the ability to derive insights from their multifarious data to improve services and customer experience.

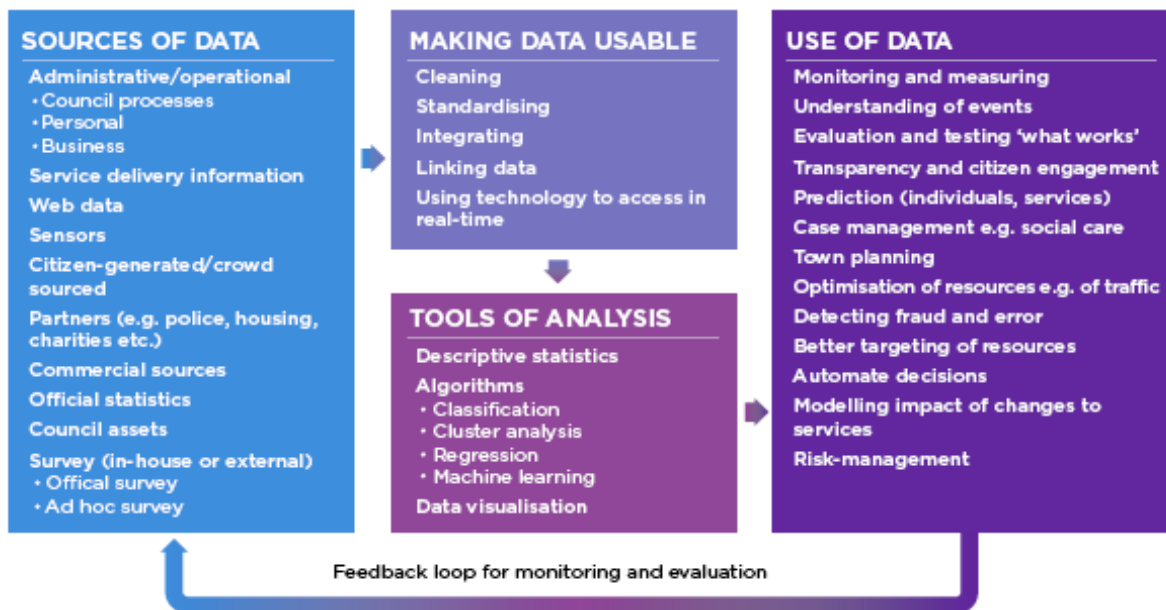


Figure 1: Typology of data available to local authorities (Symons, 2016)

Figure 1 identifies a framework which offers an overview of the various types of data available to local authorities, the tools of analysis and the data use-cases. This framework conducted by Symons (2016) identifies numerous sources of data that councils currently have or could have access to and how it can be used to improve service delivery. This, equipped with various tools of analysis, establishes a starting point for councils wanting to undertake analytics to drive decision making. Symons concluded that there are three (3) main types of tools that can be used to analyze existing council data (tools of analysis).

The first tool is *descriptive statistics* which are predominately used by councils presently. This comprises of basic math and statistics, such as percentages and ratios, correlations which show the relationship between two variables, and cross-tabulated statistics which enable the comparison of two variables (Symons, 2016).

The second tool is *algorithms* (also known as predictive analysis) which enable local governments to predict events in the community with greater accuracy leading to enhanced targeting of resources and prevention of public policy problems. These methods generally involve the use of algorithms. An interesting example of this use comes from the Mayor's Office of Data Analytics in New York. At the time, New York City faced a huge problem with

restaurants illegally dumping cooking oils in sewers causing extensive and costly damaging blockages in drains (Symons, 2016).

By analysing data on whether restaurants existing and operating within certain boundaries had implemented a service to remove their grease, they then mapped this collected data onto a specific geo-located data base which looked at where blockages were occurring. The City of New York authorities were then able to statistically pinpoint the likely suspects. This resulted in a 95% success rate in tracking down the restaurants which were dumping their waste illegally (Symons, 2016).

As another example, the City of Amsterdam's data analytics department researched levels of depression across the city using information gathered from insurance companies. It was able to connect data with the additional considerations which looked at the cost of treatment and discovered in some areas that residents suffering from depression were unable to reach a proportionate level of care to meet their needs. In part, the responsibility fell on the shoulders of the people because the data demonstrated they were resisting being treated or even acknowledging their disease. Armed with the facts, the city was then able to hone their response and dedicate more resources to education which resulted in overall boosted numbers of people receiving medical care (Fitzgerald, 2016).

Machine learning can also be used as part of predictive analysis as it allows for algorithms to be used to predict outputs based on previous examples of relationships between input data and outputs. Predictive analytics helps in understanding the likelihood of future events or the likelihood of failure. In the United States, councils are using machine learning in child welfare cases to better understand the relationships between one single child and others in the child event history to help inform case workers of children that are potentially at risk (Lowman, 2017).

*Data visualisation* is another tool which illustrates the art of communicating and making sense of data using images. Data visualisation can be both a form of presenting data and a

means of analysis, as many visualisations are interactive, enabling the user to interrogate data sets in novel ways and identify new insights. Data visualisation is a data science process which leverages many of the existing tools to uncover relationships, correlations and outliers in the data. Visualisation offers a traditional approach of making sense of data through visual means of coding and labeling including colors, shapes and movements. Data scientists will use visualisation to jump start their analytic process. Data visualisation can take many forms, such as interactive dashboards, interfaces, graphs, maps and video (Symons, 2016).

*Spatial Analysis* is a form of data visualisation which assists in understanding the relationship between variables linked to a location and patterns in a space. Spatial analysis includes techniques for analysing geographical activities and conditions using topological, geometric or geographic properties. Spatial analysis underpins Geographic Information Systems (GIS). Geographical trend analysis uncovers predictable or unusual patterns across time and space. Some examples of spatial analysis include geo-locating of public assets or infrastructure on a map. It supports the integrations of post codes and government economic data with a specific client's internal data to provide insights about quality of life. It can indicate certain behaviors and performance patterns such as finding the quickest routes between places for waste collection services. It can also flag outliers such as detecting and quantifying patterns in areas which have the highest prevalence of disease or poverty (Symons, 2016).

## **2.4 Emergence of Smart Cities and Data**

Local Governments in Australia have a great deal to learn from overseas councils, both in the UK and the US. However, the trend of 'smart cities' has ensured that data collection is developed to better understand the way data can and will shape how we interact and respond to communities' needs. According to Goldsmith and Crawford (2014), smart cities are by definition connoisseurs of big data. Big data can be beneficial to smart cities if crucial

information can be extracted and analysed. Data fulfills our needs and makes clear that data is endemic to every aspect of our lives. Data governs us, it gathers power in numbers and has always played a seminal role in our very existence.

IoT is a 'necessary technology' without which 'smart city' initiatives cannot exist. The 'things' of the IoT which included devices, sensors and applications, collect data that allows technological solutions to be effective (HEREmobility, 2019).

However in saying that, smart city initiatives need big data analytics to dissect this data into meaningful insights and essential solutions to optimise city interactions, quality of life and public infrastructure. IoT produces vast amounts of datasets that must be analysed and processed to implement smart city services. Big data platforms, part of the city ICT infrastructure, have to sort, analyse and process heterogeneous data sets gathered from IoT (HEREmobility, 2019).

For example, the Songdo district in South Korea is reducing noise pollution by attempting to eliminate garbage trucks altogether. New buildings have a smart garbage collection station whereby residents dispose of their rubbish which is separated into recycled and general household waste. The station is equipped with sensors that detect when it is full. The trash is automatically sent through high-pressure pipes directly to the recycling centre (Moustaka and Vakali, 2019). Other areas that utilise and benefit from smart city infrastructure include security, transportation, traffic congestion, and the environment.

Many challenges face the development, design and operation of smart cities using big data analysis. These can be related to availability of big data tools, costs, accessibility, representation, and real-time analytics (Susmitha and Jayaprada, 2017).

Susmitha and Jayaprada (2017) identify some key challenges for smart cities using big data. Firstly, smart city data is generated from many different formats and many different sources. There are many data formats which are unstructured (eg. Audio, Video, Server logs, etc.) which need to be classified and managed into structured formats using advanced database

systems. These require the use of complex data mining tools which are needed to handle the large size and complexity of such unstructured data.

Secondly, as a city's population growth increases, so does the data. If a population increases, rapid growth and change may occur which results in more data generation in terms of traffic, congestion, economic, pollution, environment, etc. The ultimate goal is to develop and deploy smart city applications to handle the growth in big data to return better results (Susmitha and Jayaprada, 2019).

## **2.5 Barriers with Data Utilization**

Generally speaking, there are various other barriers facing local governments in Australia which prevent them from implementing big data solutions successfully. Beresford (2015) suggests that the biggest single barrier for councils is the existing organisational culture. In addition, the lack of skills and understanding from senior leadership can contribute to a perception that investing in data analytics can be futile, costly and time consuming (Beresford, 2015).

The changes required often go into the 'too hard basket'. Management will have to present new job classifications with a different structure and uninterrupted career progression. Technical specialists will require integration into the existing teams either as full or part-time members. Work will be varied. On-the-job cross training and an emphasis on continual learning both technical and experientially based knowledge will become more valued. Managers who commit to strategic goals and high skills levels will achieve change.

The risks involved are often misunderstood and the benefits underestimated. For those who are sold on the benefits data analytics provides, it can and does require strong leadership and committed persistence to convince others that investing capital in big and open data is a worthwhile initiative especially given that at a local level the evidence on this kind of analysis remains totally unexplored (Beresford, 2015).

Malamo and Sena (2016) also go on to state that embedding big data technologies in an organisation is a complex process that requires support from senior management to embrace the change progression. Often it is commonly believed that the use of big data technologies simply implies a change in the way data is looked at and interpreted and therefore should not have an impact on internal processes or procedures.

Phippen et al (2011) stated that the structure of public sector organisations has traditionally been compartmentalised resulting in 'data silos'. Given this approach, it is difficult for councils to manage its data knowledge across the organisation. The key issue for councils is therefore to identify the extent to which existing service data could be used to develop an integrated model that would confirm and highlight connections across the organisation. Although data is usually collected separately by each division within a council, each area holds valuable information which contributes to big data analysis.

A case study by Fitzgerald (2016) on Amsterdam's Smart City Initiative found that a critical success factor for the analytics team was conducting a data inventory. The city had 32 different departments, which mainly operated in silos e.g. economic development with economic development and social services with social services. The inventory showed that Amsterdam had 12,000 different datasets and listed whether each dataset had an application program interface, as a measure of its accessibility. The case study reinforces that analytics does not have to be focused on big data to help cities be smarter. The analytics can use small data, as long as it points toward better ways to help citizens.

Cong and Pandya (2003) suggest that in order to change attitudes and shift an organisation's perception on data analytics, a data sharing culture needs to be created which includes raising awareness of the benefits that a data sharing culture can have and develop leaders who become 'data champions'. With any innovative change process, getting support from senior leaders is essential to creating a culture that is adaptable to change. The success of the Mayor's Office in data analytics uptake in New York has been attributed in



part to strong political leadership from senior figures in the city. When councils have the active support of senior staff, progress is easier especially when working within traditional silos (Symon, 2016).

The success of the Mayor's Office in New York in utilising Data Analytics started small, with uncontroversial projects which were easy to win support for. This helped overcome initial skepticism if the problems and issues addressed were salient to large numbers of people. Projects that were identified aimed not to change the activities by frontline staff but instead focused on what they already do but made easier and more efficient with better data (Symon, 2016).

Another barrier for councils in Australia in implementing advanced data analytics is the lack of sufficiently skilled staff in the sector. The skills needed require a combination of analytical and computing expertise, domain knowledge, business expertise, and communication skills (Malamo and Sena, 2016). Symons (2016) found that data scientists are in short supply within the private sector and a common theme with councils in the UK was that they were not able to recruit or bring dedicated data scientists or programmers from external organisations. Councils must develop forward thinking and realise that the true value of data analytics requires the emergence of a new type of role within local government.

Some councils currently have data analysts or social researchers only. However, in moving forward it has been suggested councils will need to consider creating 'data scientist' roles. Councils in the UK have attempted to overcome this skills shortage by fostering tech hubs within their LGA. By creating positive environments and facilitating networks for learning, councils are hoping to attract highly skilled graduates to the area, knowing data scientists ultimately means being the storyteller of information. Councils are also attempting to stimulate demand for data collection and skills training by educating small to medium business on how to use local data to their advantage (Symon, 2016).

## 2.6 Ethical and Privacy Implications of Data Analytics

Despite the clear potential benefits of data analytics and the role it can play in local government, it is an area that raises important ethical issues that must be taken into consideration. The single main issue when closely examining the benefits from encompassing data analytics is that the capabilities offered by technology in terms of extraction and manipulation and the processing of detailed personal information, cannot be easily resolved with what is perceived to be ethically and morally acceptable in this specific arena (Malomo and Sena, 2016).

Authorities regularly work together and share data in order to address community needs across jurisdictions. Therefore trust around data sharing is a continuing challenge for organisations who may be concerned that other entities may apply different standards of confidentiality and the repercussions if the data is misused (Beresford, 2015). Symons (2016) summarises these concerns by stating that despite these matters, they should not be a reason to ignore the untapped potential derived from this kind of work.

The recent advancements in data analytics technology has widened the gap between what is possible and what is legally allowed. In her discussion of *'Ethics for big data and analytics'* for IBM, Chessell (2014) asserts that computers are only waiting for three things: access to data, access to faster hardware and access to more advanced algorithms. Changing the balance of power between individuals and data collectors presents a gap where the ethical questions around what is acceptable are raised. Data access is a most powerful tool for manipulation. Data itself is not concerned with questions of morality and this has left it open to exploitation and abuse (Chessell, 2014).

Symons (2016) asserts that research carried out suggests that in many instances the ethical factors are a far more considerable challenge than the technical aspects of the analytics. As one interviewee explained: *'the ethical and information governance issues are really time consuming. The analytics are just a slither of the work'* (Symon, 2016, p16).

According to Thusoo (2016), the codes that create algorithms are not objective. Algorithms hold value judgments, making decisions on methods, and these preferences are based on how to deal with tasks according to social, cultural, legal rules, or personal persuasion. These fundamental judgments imposed on users are not visible in most contexts. However, behind any software that processes data, is the raw data that can be seen in one way or another. What is not seen is unseen value judgments that drive the decisions about what data to show and how. These judgments are in fact made by someone on our behalf (Thusoo, 2016).

Becker (2019) also goes on to emphasise the loss of autonomy in the digital age and the impact it has on privacy. The prevalent use of algorithms to track citizens' behaviour and data allows people to be manipulated as they are not aware they are being 'observed'. This has a direct impact on human behaviour. Becker (2019, p. 309) concludes that 'despite the fact that a loss of privacy does not necessarily involve a loss of autonomy, in the digital age when privacy is under threat, the independence of individual decisions is typically also compromised'.

As stated previously, data analytics in local government relies heavily on sharing of data among different departments and applications. Consequently, privacy has become a significant concern with the public. Furthermore, the expansion of big data analytics has helped obtain and associate data, making privacy breaches even simpler. However, current legislation in Australia does cater for privacy concern (Dey et al., 2018). The *(Federal) Privacy Act 1988* regulates the handling of personal information about individuals. This includes the collection, use, storage and disclosure of personal information. Within the Act, thirteen (13) privacy principles are stated which govern the standards, rights and obligations around: the collection, use and disclosure of personal information; integrity and correction of personal information; and the rights of individuals to access their personal information (Office of the Australian Information Commissioner, 2019).

Based on these principles, the Office of the Australian Information Commissioner (OAIC) developed a guideline which aims to assist organisations understand the relevant key concepts when considering data analytics and privacy as well as outlining how the Australian Privacy Principles apply to data analytics.

Three main areas were identified as being relevant to the use of data analytics in local government in respect to enhancing service delivery and customer experience. Firstly, councils can only collect information *'which is reasonably necessary to pursue your legitimate functions and activities'* (Office of the Australian Information Commissioner, 2019). The OAIC stipulates that whilst this does place restrictions on what data may be collected, it should not be a barrier for analytics. The intention of the principle is to operate objectively and practically by allowing organisations to collect personal information that is reasonably necessary (from the point of view of a reasonable person) to pursue its legitimate functions or activities.

It recommends that organisations should 'map' what they expect to discover by processing that data and then evaluate whether the personal information is relevant and not excessive, in relation to its legitimate functions and activities (Office of the Australian Information Commissioner, 2019).

Secondly, organisations need to notify the individual regarding the facts and circumstances and the purpose of the data collection. Privacy notices need to be as clear as possible stating that analytics may be conducted on personal information for the purposes of determining which services residents may be interested in (Office of the Australian Information Commissioner, 2019).

Thirdly when organisations wish to use individuals' personal information to tailor direct marketing communications they must get consent from the individual that their personal information will be used or disclosed for direct marketing. If consent is granted, organisations

must allow an individual the ability to 'opt out' of communications (Office of the Australian Information Commissioner, 2019).

If you were to take the closed park scenario mentioned in the introduction and apply it to the above-mentioned privacy principles, it would appear that councils could offer that specific level of service to the community as long as the information gathered is reasonably necessary to pursue their legitimate functions or activities. Privacy consent would need to be given and an opt out option also included.

The *Privacy Amendment (Notifiable Data Breaches) Act 2017 (Australia)* amends the *Privacy Act 1988* to introduce mandatory 'eligible data breach' notification provisions for entities regulated by the Privacy Act. However, the Act only applies to Australian Government agencies and private sector organisations with an annual turnover of more than \$3 million. This fact is very interesting as there is no guarantee that a company with less than \$3 million in annual turnover would not be affected by a breach in data. In fact, security resources may not be a high priority compared to a company with a higher profile (PWC, 2017).

## **2.7 Linking Data Analytics to Customer Experience**

Customers today have big expectations. They expect organisations will meet them where they are and provide what they want. Councils will have to identify what data they are capturing about their residents and what analytics they can leverage to improve the customer experience. They can then respond to the experience in a timely, targeted, and tailored approach directed to specific needs (*Harvard Business Review*, 2018).

A survey conducted by *Harvard Business Review* formulated conclusions on the most imperative factors required to establish a basis for real-time customer interactions. They include the ability to apply insight at the right time; accessible and usable data; the ability to predict, optimise, and forecast using trusted algorithms; and organisational support for experimentation. The survey also went on to state that Customer Request Management

Systems (CRM), predictive analytics, social media monitoring, content management systems, and marketing operations management are the technologies and capabilities essential to their real-time customer efforts today and into the future (*Harvard Business Review*, 2018).

Grossfeld (2018) states that in terms of customer analytics, there are three types which drive success in this area. Firstly, as described previously, descriptive analytics are the standard type of customer analytics which summarise raw data into easily understandable and explicit analytics. They provide an insight into the past to “describe” what has happened. In a Local Government context such data includes customer orientated KPI’s, Customer Request Management Systems statistics, Customer Satisfaction Surveys and feedback machine data as an example. Management benefits the most from descriptive customer analytics as it allows them to recognise trends which assist in creating strategies for future events.

Secondly, predictive analytics involves algorithms providing insights of what can be expected in the future commonly referred to as “forecasting”. With the huge amounts of information resulting from big data analytics, these forecasts have the ability to be accurate and crucial to an organisation’s success. They can also fill information gaps that descriptive analytics might miss (Grossfeld, 2019).

Thirdly, prescriptive analytics are the most recent form of customer analytics; they are something of a progression of predictive analytics. These AI-powered analytics provide advice on potential outcomes. It simply describes what has happened thus providing the edge needed to answer further questions. Essentially, they predict what will happen while recommending how those outcomes can be achieved. In regard to customer service it provides data on how customer service teams can deliver the optimal customer experience (Grossfeld, 2019). The self driving car is a perfect example of prescriptive analytics, but in terms of customer experience it is a new concept.

Overall, by using data algorithms my intentions are to investigate how data analytics can be used to better market and inform customers of council services and deliver information and services as required. Essentially, the goal is to achieve optimum value in the utilisation of public resources by empowering councils to have greater proactive engagement with the community. This should ultimately lead to a higher regard for councils and create public value. Data usage is not a trend that will go out of style. It is a key component in service delivery.

Local Governments currently collect large volumes of data based on their services and the information concerning their users and residents. Most local governments are at present grappling with the single issue of how to develop and exploit the different datasets they hold whilst at the same time building the necessary analytical capabilities so they can head towards the goal of data-driven decision making. The benefits and challenges faced by local governments when trying to exploit their own data is vast. It has been suggested that most councils are not currently utilising nor exploiting their use of Big Data to its fullest potential. The barriers often repeated are conflicted by the presence of the existing workplace organisation culture, structural data silos and other contextual factors.

### **3. RESEARCH DESIGN AND METHODOLOGY**

#### **3.1 Research Framework and Methodology**

Research is about investigation, learning about something new and different or acquiring facts based on information from history. It can often be likened to the beginning of a journey of exploration. Research represents a component of a miniature feasibility study. It is the vehicle that provides the intended reader with a clear understanding of the process that creates added value and how the process contributes to the success of the research (Mertens, 2019). The aim of this researcher is to provide evidence-based facts demonstrating how local government can utilise data analytics to support and enhance the delivery of service and add a new dimension to customer experience and satisfaction.

The following section will examine the framework under which this research was undertaken and the data collection and analysis methods utilised.

### **3.2 Research design**

Philosophical ideas/paradigms are often concealed in research. Nevertheless, they still affect the way in which research is performed. At its core, these ideas act as a general philosophical orientation regarding the nature of research (Creswell, 2014). The form of beliefs and attitude held by the researcher determines how the approach to the research. Post positivism, Constructivism, Transformative and Pragmatism paradigms are based on an adaptation and extension of paradigms discussed by Lather (1992) and Guba and Lincoln (2005) (Mertens, 2019).

The research design involved a mixed methods approach which is defined as a 'class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study' (Johnson and Onwuegbuzie, 2004 p. 17). In this study, a combination of semi-structured interviews in conjunction with document analysis (resulting in statistical data) was used to assist in substantiating the research question.

The guiding assumption regarding pragmatism is that it is generally considered as the philosophical partner for the mixed methods approach. It provides predetermined assumptions regarding knowledge and inquiry which establishes the mixed methods design (Johnson and Onwuegbuzie, 2004).

### **3.3 Research Methods**

Qualitative and quantitative methods of research such as semi-structured interviews and document analysis were used as data gathering tools which are predominant in the pragmatic paradigm. This paradigm supports mixing assumptions, approaches and methods of data collection and analysis. Pragmatism is orientated towards solving practical problems



in the real world rather than being constructed on hypotheses about the nature of knowledge (Creswell, 2014). My aim was to research and obtain multiple insights and perspectives into firstly, do councils use data analytics to enhance service delivery and better understand the customer experience and then secondly, how they are achieving this. The important area for exploration is the *how*, therefore warranting methods that ideally extract detailed explanations or examples from respondents in Local Government.

#### *Method 1 Document analysis*

Document analysis is a qualitative research method which involves a systematic procedure for reviewing and analysing documents. It requires data be studied and interpreted in order to facilitate meaning, gain understanding and develop empirical knowledge (Bowen, 2009).

This method of research presents advantages, such as there being no hindrance from the observer and that there is a consistency and 'exactness' to the data being collected (Bowen, 2009).

Using public records, which were included in the process in this study, is considered the most common form of document analysis. This method is efficient in collecting research information, particularly when the documents can be collected from online sources (Bowen, 2009).

The document analysis in this study focused solely on NSW Councils' documents and strategies that specifically outlined any reference to data analytics. This was accomplished primarily through reviewing individual Council websites and searching for terms such as 'ICT', 'innovation', 'digital transformation', 'smart cities' and 'data analytics'. A list of all 128 Councils in NSW was obtained from Local Government NSW (LGNSW). Each of those individual Council websites were searched and examined closely for the use of the above terminology.

The research question was used as a framework to identify salient components of the relevant documents that were germane to the topic, predominantly data analytics for Local Government. Firstly, I identified within the appropriate documents the councils' positions on data analytics. Specifically, I was searching for the reference to data analytics including any mention of future goals which would indicate a formal transition heading towards a change in direction or a general discussion around data analytics arising from the 'smart cities' movement. From this research, the results were presented by grouping councils according to the Australian Categorisation of Local Governments (Capital City, Metropolitan Developed, Regional Town/City, Fringe, Agricultural, and Remote).

The findings identified that councils in the Capital City and Metropolitan Developed categories were the ones that predominantly identified data analytics as being a key strategy. From this observation, councils with the most comprehensive knowledge centered on data and analytics were summarised in detail as part of the findings. It was also determined during research that several western Sydney councils, whilst not having individual strategies, were referred to in the City Western Deal which basically outlined open-data principles.

This research set the scene for the semi-structured interviews as information was able to be gathered and collated allowing for interviews to be held with those councils that had adopted data analytics in some form.

#### *Method 2      Semi-structured Interviews*

The intention of the interviews was to draw together the firsthand experience of data analytics utilisation within the government sector. I discovered, via the document analysis in the first instance, the relevant organisations that have demonstrated data analytic capabilities and was therefore able to derive effective savings and historic efficiencies during the process.

Three (3) large metropolitan Sydney councils were contacted and participated in the interviews.

The prospective interview participants were emailed a brief overview of the project and the expected outcomes via the attached Project Information Sheet (Appendix 1). The required consent form was also included (Appendix 2). A signed consent was received before each interview commenced.

At the start of each interview the participant was reminded of the purpose of the study and that the research was being carried out in accordance with the UTS research policies.

Approximately one hour was allocated for each interview and conducted via video conferencing. The interview participants were reminded that they would have a chance, prior to publication, to assess any text used in the published report to confirm their comments were interpreted correctly.

### **3.4 Findings**

Data collated through analysis, literature and interviews was evaluated with important key points identified across the three methods. Similar ideas, themes and logical facts were distinguished to build connections which linked back to the overall objective of the research in question. Organising data around themes would assist in building a common understanding of the key connections and present a coherent summary of all the data gathered during the design research (Pfw.edu, 2019)

The insights and themes identified were then used to compare and contrast similar ideas identified in the literature. A logical process was followed which includes:

- Gather literature and data from the interviews that addresses the research question
- Review literature and interview data: describe, summarise, analyse, and identify key concepts

- Synthesize literature and interview data: compare & contrast, critically evaluate, interpret, in order to draw conclusions (Pfw.edu, 2019)

## 4. PRESENTATION AND ANALYSIS OF FINDINGS

This section presents an analysis and summary of the research findings which comprises of document analysis and semi-structured interviews. The results are presented and analysed with the support of selected interview excerpts.

### 4.1 Document Analysis

Research was undertaken to determine the level of involvement of all 128 councils in NSW regarding data analytics. The table below is broken into the Australian Categorisation of Local Governments. From this the councils which had the most comprehensive grasp of data analytics are summarized below.

Definition	Size	Total
<b>Capital City</b>	Not applicable	1
<b>Metropolitan Developed</b> Part of an urban centre > 1,000,000 population	Small (S)	0
	Medium (M)	3
	Large (L)	1
	Very large (VL)	7
<b>Regional Town/City</b> Part of an urban centre with population <1,000,000 and predominantly urban	Small	1
	Medium	3
	Large	0
	Very large	1
<b>Fringe</b> A developing LGA on the margin of a developed or regional urban centre	Small	0
	Medium	3
	Large	0
	Very large	1
<b>Agricultural</b>	Small	0
	Medium	0
	Large	1
	Very large	1
<b>Remote</b> Situated in a remote locality.	Extra small	0
	Small	0
	Medium	0

	Large	0
	<b>Total</b>	<b>23</b>

Table 1: Summary of Councils whose strategies identify data analytics

As indicated in the table above, 23 out of 128 Council's (18%) in NSW identified data analytics in a strategy or plan. The results also indicated that metropolitan councils have predominantly developed strategies which demonstrate how they intend to use data analytics in some form. These strategies are summarized below.

### **City of Sydney**

The City of Sydney Digital Strategy is a comprehensive document which details how the City of Sydney Council will creatively use data analytics to improve the performance and operation of systems and infrastructure. Data brings insights. Their ultimate goal is for the city to move from static, largely one-way communication with communities to two-way people-centered digital communication that will help improve and prioritise operations. The council recognises that to archive and analyse so much potentially relevant data leads to quick answers and an extremely agile approach to transformation (City of Sydney, 2019).

They have relatively clear actions which identify how they will achieve this by strengthening their capability to analyse data – and their ability to feed the insights gained from that data into improving products and services. They also state they will engage with innovators and data users about how to use data better, and how to improve and maintain open data. Council intends to develop big data capabilities because big data delivers additional types of data such as customer journey information. Council wants to explore data integration, concurrency, governance and self-service capabilities as these tools empower their users to explore data on their own (City of Sydney, 2019).

The City places a strong emphasis on the role open data plays in enhancing transparency and accountability in their community. The city through <https://data.cityofsydney.nsw.gov.au/> shares a considerable amount of research data with the public. Their aim is to see an expansion in the use of this data across the city through analytics. They also touch on the

moral and ethical issues that arise from providing machine-readable open data despite the fact it may be used advantageously for predictive analytics. This challenge is addressed through legislation and the City's data governance strategy (City of Sydney, 2019).

The City of Sydney will continue to use data analytics to address traditionally complicated issues regarding information needs. However, clarity about what factors influence its use needs ongoing careful consideration. They understand the practical use of data analytics is contingent on many factors which may hinder or enable opportunities for data to be unlocked which will lead to information flow and sharing (City of Sydney, 2019).

### **Northern Beaches**

The Northern Beaches Council in their Digital Transformation Strategy identifies anticipating customer needs as a main priority thus ensuring in the long term, making residents lives 'simpler'. Endeavouring to enhance customer experiences, the Council hopes to achieve this outcome by allowing residents to subscribe and receive real time alerts consisting of information relevant to them and their current activities. With this type of specific data analysis, classification will be easier than clustering techniques. Council will also create a dedicated business analytics function internally to manage and analyse information about the services they provide to the community.

They also plan to partner with state governments to reduce the number of transactions residents will need to perform. As an example, council intends to introduce automatic parking permits or replacements when a new vehicle is registered in the council area (Northern Beaches Council, 2018).

Another goal entails providing access to Council's open data aiming to encourage start-ups and other developments to create value-adding apps and services for residents. Council recognises the essential ingredient is communication with their residents. Council intends to be open about their gathering of specific information and how it will be processed, refined

and transmitted as a single coherent message to their valued stakeholders in an open collaborative process.

Northern Beaches recognises the danger that data abuse and exploitation can pose. While moving from paper to digital has improved many practical methods of processing, data can still go missing or deteriorate and the Council understands the significant human influence on collecting and storing data (Northern Beaches Council, 2018).

### **Canterbury-Bankstown**

Canterbury-Bankstown's Smart City Roadmap outlines how data and technology can be utilised to improve the lives of residents, workers and visitors to their council area and identifies what is required to create a thriving, dynamic and real city of the future. Council recognises that data analytics is a relatively new discipline in local government. As a result, they do not expect their residents to know and encompass the subject material easily nor immediately grasp how useful it is for Council into the future (Canterbury Bankstown, 2018).

Their aim is to translate data into meaningful information to assist both government and the community to therefore make more informed decisions. Various 'smart' upgrades to infrastructure will be undertaken resulting in data collection across various services such as buildings, transport and open space. Council foresees an opportunity to advocate using data for future projects and for proving that people today have to be data-literate. Council is aware insight into consuming data analytics or learning something new is generational. However, the advantage of increasing the probability of new ideas emerging far outweighs any disadvantages (Canterbury Bankstown, 2018).

Canterbury-Bankstown feels strongly about the use of data for continued improvement. Successful data initiatives will lead to superior efficient services and the introduction of smart infrastructure usage monitoring. To facilitate the ongoing usage of monitoring, a proportion of staff will have to be technical specialists and subject matter experts with expertise in acquiring, analysing and supporting data (Canterbury Bankstown, 2018).

They currently identify opportunities to review existing Council services and activities to determine where and how smart technology and data can provide the biggest benefit. A data audit has been identified as being necessary so Council can prioritise which data should be specifically made open and accessible to residents. They also aim to build a 'data lake' and IoT platform to assist in managing current and future data. As a first step towards utilising data to improve services, the Council is endeavoring to understand end to end connections between:

- Data generation through IoT devices;
- Transfer of data through appropriate network infrastructure;
- Automated collection of data via network servers;
- Anonymising data in accordance with their privacy policy;
- Management of data through appropriate applications;
- Intelligent search and discovery functions to give Council easy access to impactful data (Canterbury Bankstown, 2018).

Canterbury Bankstown also aims to develop a public dashboard presenting key information on the organisation and the city in general consisting of transactional data, performance data, citizen satisfaction with services, city outcomes and quality of life response data.

Like other councils mentioned previously, Canterbury Bankstown addresses the risks involved with managing and analysing vast amounts of data through development of policies and strategies on data management, data platforms, data privacy, data access, data security, data sharing and interoperability requirements. The need to protect against linkage attacks while maintaining data accuracy for legitimate applications requires caution to maintain the Council's reputation (Canterbury Bankstown, 2018).

At the conclusion of instigating various strategy initiatives, Council has voiced a cautionary note advising that the capacity of data to solve every single problem can sometimes be overstated. They elaborate further by stating data might on occasions, oversimplify the



complexity of a single issue or problem and that in certain circumstances data can fail to interrogate what lies behind the outputs. However, the Council feels confident good governance will affect the use of evidence in decision making which, in turn, is likely to influence the use of data analytics (Canterbury Bankstown, 2018).

### **Parramatta Council**

Parramatta's Smart City Master Plan highlights the importance data provides in its ability to measure, process, analyse and inform people regarding a current issue and the state of play whilst being used simultaneously in planning and predicting a desired outcome. Council recognises the information contained in the world of analytic tools allows for the increased ability to draw insights and identify hidden patterns within big data (Parramatta City Council, 2015).

They place the importance of a data repository in the same category as basic 'utilities' such as water, power, gas and transport. They identified Parramatta Council will need to have well structured, well-managed technology systems that use open standards based structured datasets. Council understands and is therefore constantly improving their presentation, self service capabilities, accessibility of diverse data sources and the analytic capabilities they provide to residents as value add on. In this context, Council will provide, to residents and industry, information which has the capability of being published and openly accessible via online web services to businesses, residents, researchers and others who need to make informed decisions relating to their work and daily lives (Parramatta City Council, 2015).

Parramatta Council easily describes and encompasses the advantages data analytics initiates and how rapid use technology provides the ability to easily recognise changing trends and rapidly attend to forecasts thus supporting informed decision-making. Council's digital initiative has been developed in a culture of simplification with fewer layers, fewer processes and fewer decision points. Like other councils mentioned previously, Parramatta will use an open data approach as an effective means of increasing efficiencies,

communicating information and ultimately stimulating both economic growth and development within an enterprise environment. They also plan on hosting 'hackathons' in order to solve problems using real data sets of Government-based data (Parramatta City Council, 2015).

### **North Sydney**

North Sydney's Smart City Strategy declares they will use data to 'improve North Sydney as a place to live, work, study and visit' (North Sydney Council, 2019, p.4). They further elaborate by stating data has helped Council to gain insights and provide clear direction to better understand local practices in order to develop specific innovative solutions to challenges and improve the way Council does things. Council understands what techniques have worked and will continue to work well as the problem's size grows. In summary they recognise the importance of having a broad understanding of analytic models which deliver achievable outcomes. They list six key priority actions that currently take place in order to build digital maturity which include:

- Review the Information Communication and Technology Strategy
- Migrate Council's data centre
- Explore open platform options for Council's website
- Ongoing review of Council's Information Security Architecture to enhance cyber security provisions
- Prepare a Data Sharing Policy to improve data collection, sharing, analysis and decision making across Council
- Collaborate with universities and other industry and government stakeholders to provide open data for local hackathons and app building events/programs (North Sydney Council, 2019)

North Sydney Council is currently exploring ways in which data and analytics can solve their unique challenges associated with a growing CBD and high-rise developments whilst

remaining open to a new world of possibilities and change. They desire to eliminate on-going damage control issues and ultimately seek to improve operations at a fundamental level and lay the groundwork for further growth, efficiencies and cost saving outcomes (North Sydney Council, 2019).

At the basic level the Council seeks to have deeper insights into how its decisions impact residents' experience. To understand the customer journey, what they looked for and why they made their decisions is at the forefront of detecting subtle but important signals. Council's bottom line priority matrix is to use the full force of the organisation in capturing the potential of their big data initiative (North Sydney Council, 2019)

### **Liverpool**

Liverpool City Council as part of their implementation framework set out in their Innovation Strategy aims to be a modern leader that has *'the back-end data systems in place that lead to better lives for the people who live, work and play in Liverpool'*. They aim to do this by ensuring data policies and standards are regularly reviewed and that technology systems have the ability to exchange and make use of information. This affirmation, as a result, presents a valuable outcome which states that *'Data informs Liverpool City Council's decision-making business as usual'* (Liverpool City Council, 2019, p.27).

Council continues to evaluate their data collection strategy and currently utilises all available data to build a deep understanding on the issues that impact the lives of residents. They look at external factors and the production of products, introduction of services and information which will assist in raising the standard of living in their LGA. Council's goal is to collect more data and as much data as is possible from as many sources as possible in order to complete a clear customer picture in ways not thought previously possible (Liverpool City Council, 2019).

Liverpool sees the importance of having data available on an open platform to be used by stakeholders across the LGA. This platform aims to be responsive to community needs in

the future. They will also establish data sharing protocols in addition to the relevant data sharing policies as they recognise customer data is one of their most important assets. Council desires eventually to have available fast data in a high velocity climate requiring immediate reaction and problem solving in real time. The recognition and benefits of acting on data in real time and storing this information for later use will hopefully eliminate the classic problem of staff searching for a needle in a haystack (Liverpool City Council, 2019).

### **Randwick**

Randwick Council's Digital Strategy sets out its journey to build a smart city management platform that will collect data from numerous sources, handle real-time data analytics and have the ability to visualise this data through maps, charts, and graphs for the community. It gives a practical example of how this could be achieved by digitising certain Council infrastructure. If a gross pollution trap (which stops storm water pollution entering the waterways) is full it could send an alert to a monitoring system, display the alert on a map and create its own service request through Council's Customer Relationship Management System (CRM) (Randwick City Council, 2018).

They also elaborate on the importance of using the data in more user-friendly ways such as using location intelligence or displaying the data. This will allow Council to become 'smarter' and make more informed decisions about where to better target service delivery and how to increase efficiencies that can then have a benefit to their community. Randwick recognises that their current tools may limit and affect the ability staff will have to use and harness the full potential of data analytics. Their ultimate goal is to be equipped with sophisticated data analytics tool features to complete the type of activities that need to be done around methods of managing, analysing and exploiting information knowledge (Randwick City Council, 2018)

Like many other councils previously mentioned, Randwick will also be opening up their data sets for innovative use by industry, government, and other non-government entities. Making

this available on their website will be seen as ‘an important improvement in service delivery’ (Randwick City Council, 2018).

### **Waverley**

The Smart Waverley Strategy identifies key smart city principles that revolve around data’s role in transitioning towards a smarter, more connected community. These principles include:

- Improving data-driven decision making through greater access to real-time information
- New strategic partnerships focused on analysing shared data
- Evidence based (data driven) decision making
- Making relevant information to the community more accessible digitally including spatial mapping and data (Waverley Council, 2018).

They also state that new and existing data will be connected to a single data platform and made open and machine readable. Their intention is that members of the community can access and interpret up-to-date information. Key actions in this area include:

- New data platform – integrates data from a variety of sources, analyses and shares data securely
- Sensors and assets – integration of all data to facilitate real-time monitoring, reporting and data analytics for access by Council and the community
- Security – appropriate architecture to protect community data and IT assets
- cloud services – continue expansion of Council systems to improve delivery of community services
- expand the digital infrastructure platform across the necessary areas that support online services and IoT
- Business Intelligence tools – accessible dashboards and reporting for each business unit to respond to community enquires (Waverley Council, 2018).

Waverley intends to partner with innovators to support data analytics that 'moves Council into a new era of evidence-based decision making and problem solving'. They understand information sharing and connectivity is considered a valuable resource and will influence the ability of Council to use analytics. Waverley believes data analytics underpins the progress toward the smart city's agenda and that coordination across a constellation of active groups is critical for councils that want to employ data correctly. Insights gathered from data analytics will enable them to better plan for the future and ensure the LGA remains a great place to *'live, work and play'* (Waverley Council, 2018, p.27).

Waverley increasingly aims to support the growth of innovation jobs by creating an Innovation Hub linked to local industry. This will be accomplished by fostering relationships with innovators at universities and professional networks to build on opportunities in smart technology and data analytics (Waverley Council, 2018).

### **Strathfield**

Strathfield Council's 'Smart City Roadmap' establishes how technology and Council's ability to collect, transmit, manage and interpret data will underpin how a 'smart city' enables service providers and users to make better decisions (Strathfield Council, 2018).

Council's aim is to treat data like a utility, similar to transport, energy and water by building capacity to leverage off new technology which will be integrated with current and future infrastructure. This focus will allow Council to measure its progress against community development goals and make informed decisions. Council intends to promote a continued shift from a decision-making culture to a more data-driven culture and recognises the ongoing challenges. Their ability to understand a culture that is resistant to adopting analytical technologies may prevent them and local government from exploiting data (Strathfield Council, 2018).

Strathfield is determined to face the challenge around the lack of understanding on the importance of data. They continue to identify opportunities to leverage data whilst at the

same time being sensitive about when to get involved. To ensure success, leadership at the Council will have to set clear goals, define what success looks like and ask the right questions. Their 'smart city roadmap' will have an ecosystem of analytics which will generate new insights for both business and the community by sharing information and facilitating a cohesive decision making process (Strathfield Council, 2018).

Strathfield has a vast data base which is diversified and rich in cases. In many aspects it is very similar to the description of their community base. Frameworks, along with new forms of information and communication technologies, as well as an understanding of them, continue today to emerge and evolve to address new challenges. Current technological advancement has contributed to gains and efficiencies. The ongoing challenge for the Council is to extract the best out of technology use in practice (Strathfield Council, 2018).

Council will also use open standards to make data publicly available and accessible to local organisations and citizens. They will provide data-driven insights to citizens to increase the levels of transparency. Building digital platforms to enable faster customer responses is another goal the strategy aims to achieve (Strathfield Council, 2018).

### **City Western Deal**

The City Western Deal incorporates federal, state and local governments in Western Sydney to deliver 'transformative change to the Parkland City Region over the next twenty years'. The strategy behind the deal facilitates a collaborative approach to create and deliver quality outcomes to the area which includes Campbelltown, Liverpool and Penrith Councils together with Western Sydney Airport and the strategic centres of Richmond–Windsor, Katoomba, St Mary's, Fairfield, Leppington and Narellan. Its aim is to enable the 'City' to become a highly connected, innovative and economic powerhouse, exemplified as having access to open space and lifestyle opportunities for residents to enjoy (City Western Deal, 2018).

One key strategy around the use of data is that the NSW State Government along with local governments will explore, identify and make data publicly available online with open-data

principles. The Federal Government will additionally establish a Western Parkland City data catalogue on a data.gov.au site and a national map. They have made the commitment to support local governments to fully utilise the platform. As a result, by creating better access to local data, the Deal has delivered the possibility to drive innovation and improved service delivery across the Western Parkland City (City Western Deal, 2018).

## **4.2 Semi structured interviews**

Having researched all 128 councils in NSW to determine each council's level of involvement in the use of data analytics, it was evident that predominantly only large metro Sydney councils were involved in using data analytics in some form. The presentation of the results of the research process will be supported from the selected interview excerpts. From these metro councils, relevant staff were contacted to gain insights into how they were specifically using data analytics initiatives. An overview of the experiences with the various councils studied in this research, discussing their differences and similarities to their individual experiences, are described. Key questions revolved around areas such as:

- What tools of analysis are used;
- What efficiency or cost savings have there been (if any);
- How data analytics is being used to enhance customer experience or community engagement;
- The major challenges with data utilization; and
- What strategies have been used to overcome these challenges

The specific questions that were asked to each stakeholder are shown in Appendix 3.

### **What tools of analysis are used**

All the stakeholders described data analytics as being in the initial formative stages and were found to have different levels of maturity as far as their experience with data-driven initiatives was concerned. Reporting was predominately being used in the preliminary stage



as the main method of analysis (descriptive analytics). The goal of reporting translates raw data into meaningful information and insights which can be used to better understand and improve business performance (Dykes, 2020).

One respondent describes their current practice:

*“We have Power BI in place. Our Council developed data mart's using formal dimensional modeling as opposed to a specific analytical processing structure to run the transaction processing procedure. We built and continue to build these data marts for specific data domains. As an example, Council developed a workforce dashboard, data mapped it and we allocate the data into divisions like city services, community and maintaining neighbourhoods. However, it is basically still in the reporting field and the measurement phase needs improving. It's getting the transactional information, for example, and saying how many infringement notices have we in this area so we can then link in the spatial for this time by a specific Ranger, etc. So it's very much that it's drill down, drill into, drill across the data but pretty much it is just providing and reporting on those insights. But in effect, it is slightly different and marginally more advanced reporting.*

*We very much like having a corporate dashboard which presents all the financials and the high level measures. Being able to observe that measurement architecture and what kind of systems we have in place to give us the information needed is important. The metrics are the measures that we can then report on.”*

However, they are also evolving towards a 'data lake' concept:

*“We are currently using Azure to set up a data lake and to establish resource groups so we can commence to utilise predictive analytics. And of course, Azure contains a variety of different offerings for bringing in streaming data and IoT data....”*

Another Council provided the following statement:

*“Our data collection and maturity is really, really huge. We have collected so much data. We do not use it in the same manner as with most councils in Australia. In my opinion, no one really uses that amount of stored data and be advanced enough to do much with it. The data we do use is entirely retrospective. It is not the predictive approach or close examination process, you know, about getting on the front foot and being proactive on something. It's always retrospective. It's looking at progress reporting rather than performance reporting. And it is traditionally always looking behind at what have we done.”*

As many interviewees suggested, existing data has always been traditionally used as a reporting tool:

*“Our council has not really been using the data collected for anything more than just like reporting on parking occupancy rates in our car parks or energy use from our solar panels. Up to date it's just been purely reporting. And so I guess what I've been focusing on probably in the last six months is working with our data analysts to pull that data to basically a central repository...”*

Overall, the results obtained suggest that descriptive analytics are predominantly being used currently amongst those councils that have adopted a data analytics framework. As Sivarajah, et al (2017) point out, descriptive analytics are considered 'backward looking' and reveal what has already occurred. The use of dashboards and reporting allows councils to produce different metrics including data to monitor a process or various processes across times (Banerjee, Bandyopadhyay, and Acharya, 2013).

Findings also suggest that councils are reporting retrospective data which correlates with Symons (2016) research that historic data can be used to establish patterns based on the presence and weight of certain variables. An example sighted by one of the respondents was parking infringements ranked by area within the council boundaries.

Interviewees did state that they intend to move towards the full potential for predictive analytics through establishing data lakes and data warehouses (central repository). Their enthusiasm to embrace technical infrastructure and to affect the routine of data analytics, irrespective of the size of their council, was gratifying.

This will allow councils to uncover patterns and capture relationships through the use of data. (Banerjee, Bandyopadhyay, and Acharya, 2013).

### **Efficiency or cost savings from using data analytics**

Multiple respondents stated that whilst they acknowledge that there were recognised efficiency savings in using analytics, it is often hard to quantify:

*“We’ve saved a lot in time. We don’t quantify it though. Basically there’s a lot of information known that we don’t go and say, well, we saved this number of hours because it was in this format. And it’s always a combination. It’s not just the reporting, but it is also the use of all the data quality and simply avoiding waste.*

*Have we done anything that has actually said if we do this, and we have provided this data in this format, that we will avoid future costs or save existing costs? No, not yet. It’s all been about the efficiency gains.*

*It’s very much the case that we want to get to that end. I think that is where you understand predictive analytics comes into its own. That’s when you start to believe it is possible to reach that kind of level. At the moment we are just using both basic and advanced reporting.”*

The position above is similar with another perspective on measuring cost savings:

*“It is a really hard one to answer that question because people who are in my type of role, particularly in local government, are basically in a low maturity industry at the moment in local government and local government currently is not 100% sold on analytics. So it really is dependent on how much leadership wants to take these things*

*up to another level. What I would say is there is definitely an opportunity for efficiency. Whether or not they're actually being capitalised on, that's yet to be seen”*

Additionally, an interviewee details a specific example on how they will aim to use analytics to drive long term cost savings relating to road resurfacing:

*“One of the other areas that we're looking at in terms of service delivery and efficiency gains using data and technologies in the initial stage is to do it through Council’s waste trucks. We're now going to put them all on AVs. We pay about \$350,000 every three years to receive Council’s condition report. This report essentially tells you where the potholes are located, where the cracks are appearing and generally what the state of the road conditions are like in our LGA. Now, a day after you get that report the information is completely outdated. Arguably the day that you get a report it's still outdated because the consultants completed the assessment months prior to the delivery of the report.*

*What we're looking at doing is potentially reallocating some of those resources and it is going to require a higher capital investment in the first instance. It's not acceptable financially to simply get rid of the report. However the report will be supported by sticking artificial intelligence cameras on the bottom of every council waste truck because they travel every street every day pretty much throughout our city.*

*This means each truck can then potentially detect problems utilising LIDAR (light detection and ranging) technology in real time. This is what we are trying to achieve. These cameras can and will detect where there are cracks and pothole’s appearing which require immediate attention. Through some machine learning and algorithms, council can start to put in place some predictive workflows to be able to allocate our asset management resources.”*

The findings suggest that councils’ overall perspective on the use of technical infrastructure, and recognising the efficiency gains when adopting the use of data analytics, is proving to be

a challenge. As one interviewee suggested, data seems to have its value only associated with the context in which it can solve problems. This seems to be consistent with research undertaken by Rogge, Agasisti, & De Witte, 2017 which observed that the most pervasive problems are the lack of information to determine the quality and quantity of outputs in objective measures or figures.

However, data analytics can and does provide detailed information concerning the quality and quantity of government outputs. It would be worthwhile for councils to track any cost savings achieved to facilitate a more data driven decision making culture. Council would relieve their operational burden by having a system in place that supports data collection and extraction and overcoming technical limitations.

The example given by the interviewee regarding the replacement of an external commissioned road condition report with attached cameras on every Council waste vehicle would require an upfront cost but would be financially more sustainable in the long run.

### **Enhancing Customer Experience through Data Analytics**

Overall, respondents identified using analytics to enhance customer experience as limited:

*"I would say, you know, at first glance, yes we are using data. It would be no different to any other Council and how they're using it in that you have to use some customer data to be able to make things happen from a community engagement and customer perspective. And so, is the short answer to are we doing it? Well, no. But we have projects in the pipelines and we have plans. And we're currently I want to say, 75% of the way through one of our major projects that will allow us to completely shift the way that we use data to support the community member to be a better citizen, or engage better with their community. But we're just not there yet. So where we are is in the planning and testing and piloting phase of it"*

According to another respondent, the organisation has an awareness of the full potential analytics can have on the customer, however is also not at that level at this stage:

*“Not really. I guess the use of the data is more for reporting on things now and to hopefully try and improve the delivery of services to maybe make things a bit more efficient. I know within Council we have our executive team who has discussed a few times the idea of the 360 degree view of customer service. Because right at this moment we simply do not know who our customers are. We have so many systems where the same resident can be registered multiple times in each system and we just don't understand who our customers really are. That would be a great project to work on because customers are at the heart of what we do.”*

The findings show that there still remains enormous potential for Local Government to focus on enhancing experiences for their customers through analytics and to recognise the value in data collection. The Council strategies and interview responses openly demonstrate that there is clear intention to embrace the perception on data quality and consequently, usability and influence. This however remains a challenge and something that metropolitan councils are working towards.

As indicated by Tat-Kei Ho et al. (2016), policy-makers should make information gained from data analytics at the forefront of the customer relationship. Results from analytics programming need to have real-life stories that highlight community significance, so customers can more effectively connect data-driven policymaking with their daily life. Data analytics is not all about statistical analysis with the real impact relying on the effectiveness of public engagement and the story behind the data.

### **The Major Challenges with Data Utilisation**

Respondents described various challenges with adopting data analytics as part of their business practice. As one interviewee highlighted:

*“One of the major challenges is the concept of custodianship and stewardship versus no ownership. Getting people to understand when they work on data it should be important to them because it has more meaning and relevance in a distinctive way is a*

*constant challenge. In moving forward, they have to realise it is also important that people are going to use that data later on. So we go in and we look at all the data stakeholders, and quite often link it back to the idea we undertake data improvement initiatives and then we show it in a dashboard or report. When it becomes visible people can start to see the importance of why they are going to take more custodianship over the data they have on file. A lot of people who under utilise data analytics and mismanage data collection cause problems for the next person down the line”*

Privacy concerns and implications also appear to make data use more complicated and can act as a barrier to councils:

*“...consent notices and the privacy management framework are major things that we have to be cognizant of and find the right balance. We get whatever data we need that is necessary for the delivery of service, but also what additional data we might want to get for analytics. My current position concerning the responsible officer is that you must follow a data minimisation process. So you only ask minimal questions to obtain the data you are seeking. That's a key principle of privacy, only request the information you need to be able to fulfill the service”*

According to another interviewee, privacy concerns are also inhibiting their data use and further potential to engage with the community:

*“At this stage, although we have great marketing data, we do not really utilise it because we're a little bit scared about privacy. So our communications teams are just a tad reluctant to head down that route. Which is a shame because it's a missed opportunity I think in terms of quality engagement”*

A respondent additionally referred to cultural change with a negative connotation as hindering motivated talent across the industry:

*"I would say definitely at the top of the list would be behavioral change. We continue to operate in exactly the same way that we've worked in local government for such a long time. Unfortunately as is fact, with every historical case of transformation out there in the work place people are really resistant to change, even though it might be the better outcome long term. I think probably the most damaging issue at the moment is that transformation requires people with extreme resilience. People have to be able to withstand pressure when they are told that they're crazy over and over and over again even though the ideas they're proposing are not necessarily crazy. I worry from a long term perspective when the most damage is actually being carried out in beating down exceptional talent across the industry. The people in our business who are the game changes. And you know I make these comments even with my own staff. That also includes every single team that I have ever worked with at any other council or government agency. It does wear you down after, you know, two years of being told, you're crazy. You start to think to yourself this can't be done, you sort of start to worry, can I do this? Am I crazy?"*

Another interviewee also mentioned the challenge of moving from silos into data centralisation:

*"I guess another challenge is trying to remove certain data from silos. So in a way we're trying to almost centralise data across the entire organisation"*

The protocol for the study into the major challenges for the utilisation of data in local government clearly demonstrates that there are varied obstacles when implementing data analytic use and initiatives. The concept of custodian vs stewardship was highlighted as a challenge as data ownership plays an important role in how the data is managed. Spacey (2016) advises that data custodian and data stewardship play complementary roles in data governance with data assets being assigned to each role in which they are held accountable for.



This accountability, highlighted by one respondent, suggested that without proper custodian or stewardship, can lead to long term issues if the data is not handled correctly (Spacey, 2020).

Findings also suggested that privacy and sensitivity were recurring topics in every interview. It was recognised as a legitimate concern that, while unavoidable, did not necessarily impede the ability to access data and produce analytics. In that regard consideration as to how privacy is handled when collecting data and the associated risks to the public is a concern and a challenge identified by interviewees. Data privacy and sensitivity were perceived to be a concern but one that respondents understood had to be used responsibly. Guidance issued by the OAIC (Office of the Australian Information Commissioner) states that given 'new' data analytics processes can differ from 'traditional' data activities, it has additional challenges such as:

- collecting data from a broad range of diversified sources, including, but not limited to, third parties
- produce new information via IoT technology
- utilise data insights for a variety of specialised purposes, including new intentions that may not have been foreshadowed, and
- keep in place data for a longer period of time than is required, in case it may be needed for future utilisation and for any unspecified purpose.

The relationship between data analytics and the privacy act is complex and can have significant privacy implications for councils.

The results of the interviews also found that leadership support was and is the key in navigating resistance and the increase in data analytic use. Respondents seemed concerned and expressed that their ability to continue to engage in data analytics use is contingent on leadership. In some councils the General Manager was seen as the executor of that vision. This is consistent with research from Tat-Kei Ho (2016), which identifies that a

culture of bottom up innovation and anticipatory change would help organisations adopt quickly and effectively to data analytics.

### **Strategies to overcome challenges**

Interviewees in general did not articulate with specifics or general answers as to how they are currently overcoming challenges with data utilisation. Each respondent agreed the ultimate goal was focused on improving residents' experience, to improve services, inform, and engage people through providing greater data accessibility. They recognised the use of data analytics for policy purpose had increased over recent times considerably but there was still a long way to go to reach peak performance. This gap suggests that many councils are still at a stage where data analytics is a relatively new concept and on-going challenges have not yet been identified nor overcome.

Respondents from smaller Sydney councils did identify in the context of data analytic use in the public sector, skills could also be considered a resource and contribute to the capability development in organisations. Some felt the constant struggle to upgrade the skills of the existing IT workforce has been a persistent human resource challenge. The challenge is relevant to local government where the highly educated and well-qualified people are needed.

However, one respondent did identify leadership as a success factor when overcoming challenges

*"I'm fortunate that the council I work for at the moment has had exceptional leadership uptake. I can walk into my GM's office at any time on any given day and say, I need your support on this and he will give it to me. But it's not always been that way. And I know that it is not as easy in a lot of other places. So as you know, it's challenging when you're trying to nudge people towards a behaviour change. To fix problems that are not just simple problems, but are systemic failures of an organisation that has not adapted for a number of years. And it's really challenging when we place that*

*responsibility wholly and solely on one single person or a team of people that are officer level specialist or whatever that is”*

As previously stated, because Big Data is still a relatively new concept, willingness to experiment with new ideas and commit to learning by doing are critical (Helms 2015). Promoting a shift from a decision making culture can be challenging especially in local government where such a change has been considered ambitious.

City leadership needs to foster this type of culture among employees and encourage them to take ownership of the technological change.

### 4.3 Summary of Case Studies

The table below provides a summary of practical examples whereby Councils have used data to enhance service delivery. It is evident that data has the ability to solve real world problems at a local level.

Area of Service Delivery/Customer Experience	Challenges and barriers	Benefits	Source
Waste Management - removal of oil and grease from restaurant premises	Dumping of grease into sewage/drainage system resulting in blockages  Large area to monitor, including difficulty in identifying culprits	Mapping collected data into geo located data base which identified where blockages were occurring and pinpointed likely offenders who were contacted	New York City, Symons, 2016.
Treatment of depression	Areas with higher levels of residents suffering from depression were unable to reach a proportionate level of care that met their needs	Using information gathered from insurance companies to connect data with the additional considerations which examined and provided the cost of treatment	City of Amsterdam's Fitzgerald, 2016.
Child Welfare	Prioritising	Using case	USA

	resources to focus on high risk cases	histories to predict the likelihood of children at risk saving both time and resources	Lowman, 2017.
Noise Pollution	Increasing noise levels from garbage trucks	New buildings being equipped with smart garbage collection stations that separate and send rubbish directly to recycling Centre. Eliminated the use of trucks.	South Korea Moustaka and Vakali, 2019.
Road Conditioning	High cost and the use of out dated data concerning road condition reports	Camera's installed on Councils' garbage trucks to gather and present real time data on road condition	Sydney, Respondent, 2020

## 5. SUMMARY, CONCLUSIONS, RECOMMENDATIONS

The research and synthesis undertaken in this dissertation attempt to provide a comprehensive answer to the main question around a scoping study of NSW councils and recommendations on how data analytics can be used to enhance service delivery and customer experience.

Whether it is gathering data through the use of cameras on waste trucks leading to the provision of up to date road conditioning reports or utilising case history algorithms to improve child welfare, data is a tool which enables councils to perform a range of activities at an optimum level. The various case studies mentioned in this dissertation, demonstrate analytics can assist public sector managers allocate resources more effectively.

Research conducted by Symons (2016) established that councils are becoming increasingly sophisticated in how they gather their data, how they manage it, the types of analysis they can perform, and the ways in which they use this collected data to contribute towards enhancing service delivery and customer experience.

However, findings also suggested that data analytic use within local government is still at a relatively preliminary stage. Research undertaken demonstrated that only 18% of NSW councils identified the use of data and analytics in a formal strategy or plan. From those councils, over half (52%) were metropolitan developed i.e., Sydney.

Results from the semi structured interviews, featuring metropolitan developed councils, identified that basic and advanced reporting (descriptive analytics) are being used as the main tool of analysis. However, one council in particular is moving towards a 'data lake' concept which will allow them to delve into predictive analytics by combining existing data with new data obtained through IoT and other smart devices.

Many respondents from the interviews reported that there have been efficiency gains by adopting a data analytics framework. However the associated cost savings are not being measured. Such a finding is interesting as Cong and Pandya (2003) surmised that in order to change the attitude and shift an organisation's perception on data analytics, creating a culture that raises the awareness of the benefits of data analytics is essential. Efficiency is important in keeping costs down however to measure the costs of a service and its performance is complex (Trémolet and Binder, 2010). This response might go towards explaining why councils have not gone down this path.

Without exception, interviewees all recorded the fact that their goals in using data analytics were to connect with the community they serve and to make life better for customers. One council respondent said that they did not know who their customers were despite the recognition they were the heart of community. This should help data analytics users to understand the nature of the problem being addressed and the extent to which analytics could be so important and useful when truly engaging and enhancing the experiences with customers. According to all interviewees, customers were both a source of data and the ultimate goal of data analytics' use.

Organisational considerations were frequently discussed by respondents, often as having a greater impact on data analytics' use in their individual council. Results suggested that even when there is financial support and when resources are available with a dedicated team of enthusiastic people, behavioural change is difficult. It can be concluded, that for many councils data analytics technology may not have been considered a 'must have' but a 'good to have' technology. Across the board it was agreed that data analytics' adoption and the extent it was embraced into their council was dependent on good leadership.

This study found evidence that leadership support is the key to navigate resistance and increase the use of data analytics and facilitate a data driven decision making culture. Without a driving force most respondents filled the mould of statements that they 'intended to, or were working towards, planning to, hoping to achieve' but were never actually achieving or embracing the adoption of analytics. Research supported, with the exception of one Sydney council only, that empowerment was not forthcoming from leadership. Therefore, in most cases studied, a haphazard approach to the full introduction of data analytics was still pending and in a couple of cases, a long way off. Such cases introduced other relevant factors that emerged during this study.

Given the evidence provided in this paper, featuring the benefits of data analytics and how its use can enhance service delivery and customer experience, the following recommendations are proposed to facilitate greater adoption of data analytics in local government.

Firstly, councils should look at the adoption of a formal strategy which defines how the data will be gathered, how the data will be used, what insights were gained, what technology infrastructure requirements are needed and the importance of data governance (including privacy).

As part of any robust data strategy, councils will need to identify how analytics will be applied to data in order to extract business-critical insights that provide evidence-based decision making which leads to the improvement of services and generates value.

Secondly, because data analytics can have significant privacy implications, it is essential that councils adhere to the following guidance:

- Councils will be required to give individuals notification of the collection of their data. This is achieved through privacy notices which must communicate information handling practices clearly and simply (Office of the Australian Information Commissioner, 2019).
- Councils can collect personal information only where it is reasonably necessary for, or directly related to, the organisation's functions or activities and only by lawful and fair means directly from the individual. Unless it is considered unreasonable or impractical the collection of sensitive information can only occur with the individual's consent (unless an exception applies) (Office of the Australian Information Commissioner, 2019).
- De-identify the data if possible by removing or altering other information that may allow an individual to be identified (name, address or other directly identifying information) (Office of the Australian Information Commissioner, 2019).
- Councils can use and disclose personal information for direct marketing (advertising Council services for instance) if the Council organisation collected the personal information and the individual has consented to their personal information being used. It may prove impractical or even challenging to get the individual's consent to their personal information being used or disclosed for direct marketing. However, where an organisation has obtained the authority to use or disclose personal information it must allow an 'opting out' option (Office of the Australian Information Commissioner, 2019).

## 6. REFERENCES

- Banerjee, A., Bandyopadhyay, T., & Acharya, P.A. 2013, 'Data Analytics: Hyped Up Aspirations or True Potential?'.  
Becker, M. 2019, 'Privacy in the digital age: comparing and contrasting individual versus social approaches towards privacy'. *Ethics and Information Technology*, vol. 21, pp. 307–317, <<https://doi.org/10.1007/s10676-019-09508-z>>.  
Beresford, M. 2015, *Demystifying Data: The Data Revolution and What It Means For Local Government*, New Local Government Network, London, p. 10.  
Canterbury Bankstown Council 2018, *The Smart CBCity Roadmap*.  
Chessell, M. 2014, *Ethics for big data and analytics*, IBM.  
City of Sydney 2019, *Digital Strategy*.  
Cong, X. & Pandya, K.V. 2003, Issues of Knowledge Management in the Public Sector, *Electronic Journal of Knowledge Management*, vol. 1, no. 2.  
Dey, N., Hassanien, E.A., Bhatt, C. & Ashour, A. 2018, *Internet of Things and Big Data Analytics Toward Next-Generation Intelligence*, 30th edn, Springer International Publishing, New York.  
Dykes, B. 2020, 'Reporting vs. Analysis: What's The Difference?', *Adobe Blog*, weblog, Adobe, viewed 2 June 2020, <<https://theblog.adobe.com/reporting-vs-analysis-whats-the-difference/>>.  
Fisher, L. 2018, 'Code of Ethics for Data Analysts: 8 Guidelines', *Blast Analytics & Marketing*, weblog, viewed 18 Oct. 2019, <<https://www.blastam.com/blog/code-of-ethics-for-data-analysts-8-guidelines>>.  
Fitzgerald, M. 2016, *Data-Driven City Management*, MIT Sloan Management Review.  
Goldsmith, S. & Crawford, S. 2014, *The Responsive City: Engaging Communities Through Data-Smart Governance*, Jossey-Bass, San Francisco, CA.  
Grossfeld, B. 2019, 'Demystify your data: the 3 types of customer analytics', *Zendesk*, viewed 16 October 2019, <<https://www.zendesk.com/blog/3-types-customer-analytics/>>.  
Grant, B. and Drew, J. 2017, *Local Government in Australia: History, Theory and Public Policy*. Singapore: Springer Nature.  
HereMobility 2019, 'Smart city technologies: role and applications of big data and IoT, HERE Mobility', *Mobility.here.com*, viewed 14 October 2019, <<https://mobility.here.com/smart-city-technologies-role-and-applications-big-data-and-iot>>.  
Ho, A.T. & McCall, B. 2016, 'Ten Actions to Implement Big Data Initiatives: A Study Of 65 Cities', University of Kansas.  
Johnson, R. & Onwuegbuzie, A.J. 2004, 'Mixed Methods Research: A Research Paradigm Whose Time Has Come', *Educational Researcher*, vol. 33(7), pp. 14–26, <<https://doi.org/10.3102/0013189X033007014>>.



- Kim, G., Trimi, S., & Chung, J. 2014, 'Big Data Applications in the Government Sector', *Communications of the ACM*, vol. 57(3), pp. 78–85.
- Klievink, B., Romijn, B., Cunningham, S. & Bruijn, H. 2016, Big data in the public sector: Uncertainties and readiness. *Information Systems Frontiers*.
- Liverpool City Council 2019, *Innovation Liverpool: An Innovation Strategy To Support LCC's CSP to 2027*.
- Lowman, M. (ed.) 2017, *A Practical Guide to Analytics for Governments: Using Big Data for Good*, John Wiley & Sons, Incorporated, New York. Available from: ProQuest Ebook Central. [19 October 2019].
- Malomo, F. & Sena, V. 2016, Data Intelligence for Local Government? Assessing the Benefits and Barriers to Use of Big Data in the Public Sector, *Policy Studies Organization*.
- Matheus, R., Janssen, M. & Maheshwari, D. 2018, Data science empowering the public: Data-driven dashboards for transparent and accountable decision-making in smart cities. *Government Information Quarterly*, pp.101-284.
- Moustaka, V. & Vakali, A. 2019, A Systematic Review for Smart City Data Analytics. *ACM Computing Surveys*, 51(5).
- Nambiar, R. 2017, *Transforming Industry Through Data Analytics*. O'Reilly Media, Inc.
- Northern Beaches Council 2018, *Digital Transformation Strategy*.
- OAIC 2019, *Australian Privacy Principles*, viewed 13 October 2019, <<https://www.oaic.gov.au/privacy/australian-privacy-principles/>>.
- Parramatta City Council 2015, *Smart City Masterplan*.
- Pearson, T. & Wegener, R. 2013, *Big Data: The Organizational Challenge*, Bain & Company. viewed 4 June 2019, <[https://www.bain.com/insights/big\\_data\\_the\\_organizational\\_challenge/](https://www.bain.com/insights/big_data_the_organizational_challenge/)>.
- Phippen, A., Raza, A., Butel, L. & Southern, R. 2011, 'Impacting Methodological Innovation in a Local Government Context – Data Sharing Rewards and Barriers', *Methodological Innovations Online*, vol 6(1), p.64, <<https://doi.org/10.4256/mio.2010.0028>>.
- PWC 2017, *Australia introduces mandatory data breach notification regime*, PricewaterhouseCoopers International Limited.
- Randwick City Council 2018, *Digital Strategy*.
- 'Real-Time Analytics: The Key to Unlocking Customer Insights & Driving the Customer Experience', *Harvard Business Review*.
- Rogge, N., Agasisti, T. & De Witte, K. 2017, Big data and the measurement of public organizations' performance and efficiency: The state-of-the-art. *Public Policy and Administration*.
- Spacey, J. 2020, *Data Custodian vs Data Steward*. Simplicable, viewed 3 June 2020, <<https://simplicable.com/new/data-custodian-vs-data-steward>>.
- Strathfield Council 2018, *Smart Strathfield Roadmap*.

Susmitha, K. & Jayaprada, S. 2019, Smart Cities using big data Analytics, *International Research Journal of Engineering and Technology*, 4(8).

Symons, T. 2016, *Datavores of Local Government: Using data to make services more personalised, effective and efficient*, Nesta, London.

Thusoo, A. 2016, *Analyzing Data in the Internet of Things*, O'Reilly Media, Sebastopol, CA.

Trémolet, S. & Binder, D. 2010, 'Efficiency Measures – How Do You Measure The Efficiency Of Service Provision?', *Regulationbodyofknowledge.org*, viewed 4 June 2020, <<http://regulationbodyofknowledge.org/faq/price-level-and-tariff-design/efficiency-measures-how-do-you-measure-the-efficiency-of-service-provision/>>.

Waverley Council 2018, *Smart Waverley Strategy*.

## 7. APPENDICES

### Appendix 1

Project information sheet

#### **PARTICIPANT INFORMATION SHEET**

***Data analytics for local government: How can local government use data] for enhanced service delivery and customer experience?***

##### **WHO IS DOING THE RESEARCH?**

Jessica Quilty (Student at UTS). My supervisor is Bligh Grant (Associate Professor)

##### **WHAT IS THIS RESEARCH ABOUT?**

Exploring how local government can use data analytics for enhanced service delivery and customer experience

##### **FUNDING**

Not applicable.

##### **WHY HAVE I BEEN ASKED?**

Relevant Local Government expert in the field of data analytics

##### **IF I SAY YES, WHAT WILL IT INVOLVE?**

If you decide to participate, it will consist of a half an hour face to face interview

##### **ARE THERE ANY RISKS/INCONVENIENCE?**

There will not be any risks/inconvenience or any kind of questions which would be sensitive.

##### **DO I HAVE TO SAY YES?**

Participation in this study is voluntary. It is completely up to you whether or not you decide to take part.

##### **WHAT WILL HAPPEN IF I SAY NO?**

If you decide not to participate, it will not affect your relationship with the researchers or the University of Technology Sydney. If you wish to withdraw from the study once it has started, you can do so at any time without having to give a reason, by contacting Jessica Quilty at [jesster\\_x45@hotmail.com](mailto:jesster_x45@hotmail.com) or by contacting through phone number 0400367890

##### **CONFIDENTIALITY**

By signing the consent form, you consent to the research team collecting and using personal information about you for the research project. All this information will be treated confidentially. Your information will only be used for the purpose of this research project and it will only be disclosed with your permission, except as required by law.

The information will not be stored for future use in research projects that are an extension of this research project. In all instances your information will be treated confidentially.

I plan to submit the research project which includes your data to the University of Technology Sydney as part of the research project of the researcher's master program. Only the information related to the questions asked and a generic position title will be used.

#### WHAT IF I HAVE CONCERNS OR A COMPLAINT?

If you have concerns about the research that you think I, Jessica Quilty or my supervisor Bligh Grant can help you with, please feel free to contact me at [jesster\\_x45@hotmail.com](mailto:jesster_x45@hotmail.com) Bligh Grant at [Bligh.Grant@uts.edu.au](mailto:Bligh.Grant@uts.edu.au)

If you need to confirm the identity of the researchers or would prefer to discuss a complaint or reservation with an independent local contact their details are listed below. The local contact person will pass your comments on to the UTS contacts listed above.

You will be given a copy of this form to keep.

#### **NOTE:**

If you have any concerns or complaints about any aspect of the conduct of this research, please contact the Ethics Secretariat on ph.: +61 2 9514 2478 or email: [Research.Ethics@uts.edu.au](mailto:Research.Ethics@uts.edu.au), and quote the [UTS HREC reference number/IPPG ethics reference number]. Any matter raised will be treated confidentially, investigated and you will be informed of the outcome.

## Appendix 2

### Written consent form template

#### **Data analytics for local government: How can local government use data for enhanced service delivery and customer experience?**

I, (participant name), agree to participate in the research project Data Analytics in Local Government, is it desirable and if so why?: A comparative study being conducted by Jessica Quilty, Student number: 11096082, University of Technology Sydney).

I have read the Participant Information Sheet or someone has read it to me in a language that I understand.

I understand the purposes, procedures and risks of the research as described in the Participant Information Sheet.

I have had an opportunity to ask questions and I am satisfied with the answers I have received.

I freely agree to participate in this research project as described and understand that I am free to withdraw at any time without affecting my relationship with the researchers or the University of Technology Sydney.

I understand that I will be given a signed copy of this document to keep.

I agree that the research data gathered from this project may be published in a form that:

does not identify me

I am aware that I can contact Jessica if I have any concerns about the research.

\_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_  
Name and Signature [participant] Date

Jessica Quilty \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_  
Name and Signature [researcher] Date

If you have any concerns or complaints about any aspect of the conduct of this research, please contact the Ethics Secretariat on ph.: +61 2 9514 2478 or email: Research.Ethics@uts.edu.au, and quote the [UTS HREC reference number/IPPG ethics reference number]. Any matter raised will be treated confidentially, investigated and you will be informed of the outcome.

## Appendix 3

### Interview Questions

1. Could you please state your job title and what your major responsibilities are?
2. How are you using data analytics in your current organization?
3. Are you using data analytics to enhance customer experience or community engagement in any way?
4. What tools of analysis do you use? Eg descriptive statistics, predictive analytics etc
5. What (if any) efficiencies and cost savings have you seen? Can you give any examples?
6. In your experience, what are the major challenges with data utilization in Local Government and what strategies have you used to overcome these challenges?