

PhD Dissertation

A Digital Transformation Governance
Framework for eGovernment: A
Systemic Approach



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Abstract

Policies which have transformed legacy services to digital services in the public sector have had considerable impact on both governments and service users. Research suggests that as a result of digital transformation, public sector services are failing to meet user needs and expectations, with a direct association between user ability to interact with public service entities and digital services. This dissertation argues for the development of a practical tool that can be used to identify, understand and assess relevant systems and their roles in digital transformation processes, in order to develop a governance framework for effective digital transformation in eGovernment. Evidence supporting this research is based on a case study of the Australian Taxation Office.

Methodology

An interpretative and exploratory mixed method approach was adopted, using a multimethod technique for data collection. Data included observations, focus groups, surveys and existing data sources, used to profile eGovernment service users and users of legacy systems. The aim was to understand the barriers to use, factors promoting their use and assistance required from service providers. Subsequently, soft systems, Enterprise Architecture and system of systems approaches were applied to provide a foundation for the exploration, collection and analysis of the data. Gioia and thematic analysis was used to find meaning within the qualitative data, while descriptive statistics, logistic regression and longitudinal analysis were used to analyse the quantitative data.

Findings

This research identified a number of key factors influencing the long-term adoption of public sector digital services. Within the public sector or eGovernment space, legacy systems are still important to the community as they provide a safety net. Similarly, assistance should be provided through multiple avenues, including online, in person and over the phone. Public sector entities need to invest in educating the community on both the technical and digital components of their services. For taxation, this includes an explanation of what taxation entails and how to lodge returns depending on circumstances. The results of a quasi-randomised control trial demonstrated that non-digital users were more inclined to shift to digital services

after receiving communication on their availability and effectiveness. There are numerous factors which impact the adoption and use of digital services in the public sector. Looking at each factor in isolation does not provide a holistic view of the various users. This research identified the need to create a holistic view of the various systems affecting digital transformation and adoption. The findings were used to inform and develop a framework for effective digital transformation of eGovernment services, which has assisted in identifying the relevant systems and assessing their roles and interactions in the process.

Research Limitations

This research provides a framework for the ongoing development of eGovernment services. A limitation to this research is that it was based on a case study of a single entity. Additional research was carried out on digital health platforms to demonstrate the generalisability of the findings; however, further research is recommended to address the limitations.

Practical Implications

This dissertation proposes a governance framework as a practical tool to guide public sector organisations' effective digital transformation to eGovernment. The proposed governance framework provides a tool for the identification and assessment of the relevant constituent systems and their roles and interactions within digital transformations.

Originality and Value

This research contributes to the body of knowledge through the development of a governance framework which forms a practical tool to guide organisations through effective digital transformations. The research argues that a more holistic understanding of the constituent systems comprising the digital transformation system as a whole can aid with the use or creation of effective digital services within the public sector. Through qualitative and quantitative data analyses, the research was able to identify relevant systems influencing the adoption or non-adoption of digital services in the public sector. The contribution to knowledge within this research is the creation of a practical framework for the effective digital transformation as it assists in the identification and assessment of the relevant systems and their

roles and interactions in the process, and which can be applied to private and public sector entities.

Keywords

Effective Digital Transformation, Triangulated Systems Approach, Governance Framework

Statement of Originality

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Glossary of Key Terms

Mandatory Environment: Public sector organisations who must by legislation provide digital platforms for their services. Included in Paper's 2, 3 and 4.

Mandatory Interactions: Users who meet certain characteristics and must by legislation interact with the public sector service provider to meet these obligations. Included in Paper's 2, 3 and 4.

Assistance seeking: When individuals or groups search for guidance or support with using digital services. This includes practical and technical support for the use of taxation services, how to use the system and how to complete annual taxation obligations.

Lodgement: Completion of annual interactions with the Australian Taxation Office, resulting in the completion of the annual reporting obligations.

Digital Lodgement: Completion of the aforementioned annual reporting obligations through online services (e.g., myTax platform).

Digital Services: Services (including eGovernment services) that utilise information and communications technology and are run through online forums requiring access to computers and internet.

Digital Literacy: Having the necessary skills, understanding and confidence to use digital services provided by either public or private sector entities.

Public Sector: Organisations or agencies who act on behalf of the government (including specific legislation) to provide services and information to citizens.

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Awards

Best Paper Award – 14th International Conference on Digital Society, for paper entitled '*A Digital Systems Approach Across eGovernment Services: The Australian Taxation Office and the Health Environment*'.

Outstanding Paper Award - 18th International Conference on e-Society 2020, for paper entitled '*eGovernment Digital Adoption: Can the Adoptive Behaviour of Individuals be Predicted*'

Chapter 1. Introduction

1.1 Research Question

Current legislative changes which mandate that legacy services need to be transformed into digital/eGovernment services within short periods of time and with limited funding, are impacting public sector organisations. The aim of this research is to explore and better understand relevant systems and their roles in digital transformation and then develop a governance framework for effective digital transformation in eGovernment. The digital transformation process often fails to assess the roles, views and boundaries of constituent systems and the system as a whole, and how these may influence the efficacy of the transformation process. This research argues that a governance framework can be a useful mechanism to determine how constituent systems and the overall system affect digital transformation and consequently assist organisations with managing such a fundamental change to their operations more successfully. An extensive review of the literature revealed that no framework currently exists to help policymakers, digital service designers and engineers to improve digital transformation projects. This research addresses this gap by developing and presenting a governance framework which takes into account multidimensional levels of integrated and autonomous constituent systems and the overarching complex system to provide a more holistic representation of their interactions and roles in digital transformation. This research further proposes the most pertinent constituent systems that can be assessed through the governance framework to gain more knowledge about their roles in and impact on digital transformation.

1.2 Research Objectives

This research presents a framework based on the application of a systems approach, that identifies each constituent system within the system effecting digital transformation. The aforementioned systems approach presented in this paper is supported by triangulation, this approach refers to the use of multiple approaches to collect and analyse data in order to enhance the research credibility. This systems triangulation approach utilises soft systems methodology, system of systems and enterprise architecture. By combining three methods, the approach can leverage the benefits of each method and overcome some potential limitations of each method. The proposed

framework allows an organisation to holistically identify stakeholders, goals, limitations and risks for each system and the broader system as a whole. The presented framework allows organisations to switch views between the various constituent systems and identify and mitigate risks, understand who the stakeholders are and their points of view and goals at the constituent system and system. This framework fills the gap in the literature and addresses the challenges associated with a lack of management framework for organisational digital transformation. Specifically, a process for addressing systemic risk. Systemic risk is based on the product of the manner in which the various parts and systems act and interact across the broader system, to create the emergence of a risk or breakdown of the entire system rather than just the individual part. This is similar to system of systems methods, which states that whole system is more than the sum of its parts. Therefore a holistic approach is needed to assess the situation.

Without a framework for the effective management of digital transformation, the reactions to changes in the system are often slow and ineffective in the long-term. Within the current approach equal attention to being both reactive and proactive given the situation, whereas what is needed is greater flexibility to be able to integrate and be proactive and reactive at the same time. Understand that proactive tasks are critical, however the future is not predictable, so organisations need to be reactive as well. Organisations need a framework that is flexible. With changes within the environment occurring rapidly, an adaptive framework is needed to help organisations to better adapt to changing events in a dynamic manner. For governments, traditionally demands have been stable, however due to the expansions of the scope of services offered by governments, they are more exposed to unexpected events. This is a result of being more interconnected, therefore a framework is both adaptive and flexible. Without understanding all of the constituent systems and the system as a whole, it is difficult for planning for effective contingencies. Currently, there is no holistic view of the constituent systems and the whole, a holistic view is needed to incorporate the systems within a whole, specifically understanding that the whole is more than the sum of its parts.

1.3 Dissertation Structure

The dissertation follows a “dissertation by publication” structure. Chapter 1 introduces the problem space and outlines the research to be undertaken, including the research objectives. Chapter 2 presents the literature review, and the six published papers as follows:

- Paper 1: Conceptual paper: A Public Sector Approach to Digital Inclusion

- Paper 2: Digital Interactions Strategy: A Public Sector Case
- Paper 3: Digital Adoption Strategy: A Public Sector Ecosystem
- Paper 4: Digital Adoption: The Need for Truly Inclusive eGovernment Services
- Paper 5: eGovernment Digital Adoption: Can the Adoptive Behaviour of Individuals be Predicted?
- Paper 6: A System of Systems Management Framework for Digital Transformation in eGovernment

Chapter 3 outlines the methodology applied within this research. Chapter 4 outlines the governance framework developed in the case study environment. Additionally, the results chapter includes the findings of the validation and verification process for the governance framework and guidelines for application. Chapter 5 summarises the key findings, outlines the practical implications of the research, provides an explanation of the research limitations, and proposes future research avenues:

1.3.1 Overview of Chapter 2 Literature Review

In Chapter 2, an extensive literature review is presented, which explores previous research relating to effective digital transformation. The literature review demonstrates how digital transformation is not being managed effectively and how this can be linked back to a lack of governance framework. The literature also offers a greater understanding of the various systems impacting users, policymakers and digital service designers involved in digital transformations. Numerous barriers are also associated with eGovernment service provision, including levels of trust, usability and perceived usefulness of services, and inaccessibility of services (associated with lack of internet access or ownership of Information Communications Technology (ICT)) (European Commission 2007; Gilbert, Balestrini and Littleboy 2004; Hung, Chang and Yu 2006). Digital transformation is a complex process. The literature suggests that holistic governance can provide organisations with a better understanding of their environment, which then leads to improved decision-making and planning. This research therefore seeks to identify barriers to digital adoption within the mandatory space and how that relates to effective digital transformation, as well as develop a governance framework for effective digital transformations. The proposed framework considers the multiple constituent systems influencing digital transformations and provides guidelines for application.

Once the research gap was underpinned, the literature review was extended to assist in the identification of the various systems influencing digital service adoption, including understanding the impacts of the potential constituent systems (involving views and goals) and how they relate to the digital transformation system as a whole. The literature review revealed a gap in the method of identifying and classifying stakeholders, specifically how current stakeholder analysis techniques seem to identify stakeholders in isolation, without understanding their interactions. A multidimensional stakeholder analysis tool needs to be developed, to help view stakeholders holistically. This is especially relevant for understanding the constituent systems impacting digital transformation processes, as the interactions between systems and stakeholders are multidimensional in nature and by understanding this, the environment can be better studied and issues can directly be addressed. A literature review on systems approaches linked to the research argument was therefore required and developed.

An extensive literature review on soft systems methodology (SSM), system of systems and Enterprise Architecture (EA) was conducted. These three complimentary approaches were combined in order to increase research validity and overcome potential weaknesses associated with a single approach. To understand systems approaches generally, an in-depth analysis of the various systems definitions, components of systems approaches and how systems approaches are used was considered critical to gain a holistic picture of how systems are applied to different scenarios. Multiple systems theories were used to create an approach that was holistic and enabled the identification and understanding of the various systems and elements impacting digital transformation, within the literature and within the data collected. A lens for the combination of multiple systems theories and methods was required to understand the various systems impacting digital transformation.

1.3.2 Overview of Papers

Paper 1 Conceptual paper: A Public Sector Approach to Digital Inclusion

This conceptual paper contributes to the overall research by outlining the existing literature, government research and expert opinions relating to the eGovernment space. In this paper the problem space is also defined, and the Australian Taxation Office (ATO) case study is introduced.

Paper 2 Digital Interactions Strategy: A Public Sector Case

This paper contributes to the dissertation by providing an observational study. The study utilises qualitative data to understand the problem space and systems within the eGovernment space. This data analysis was used to understand the factors and systems impacting eGovernment service use within the ATO, and identifies links between digital adoption and effective digital transformation.

Paper 3 Digital Adoption Strategy: A Public Sector Ecosystem

This paper contributes to the dissertation by using a different approach for data collection and data analysis to provide validity and generalisability across the population. This study validated the pilot results and demonstrated the link between digital adoption, high use of the digital services, inclusive services with positive feedback and effective digital transformation. This research utilised the soft systems method.

Paper 4 Digital Adoption: The Need for Truly Inclusive eGovernment Services

This paper contributes to the dissertation by outlining the need for a systemic approach to digital adoption research and, in turn, digital transformation. This data analysis was used to test how advice and guidance could impact digital adoption. Furthermore, the paper verifies that the issues that occur whilst using eGovernment services and the assistance provided together form a vital component of effective digital transformation.

Paper 5 eGovernment Digital Adoption: Can the Adoptive Behaviour of Individuals be Predicted?

This paper contributes to the broader PhD research by demonstrating how big data can be applied to verify who would respond best to messaging about digital services. Predictive analytics is applied to determine who would shift from using legacy services to eGovernment digital services with assistance. The paper explores the future research and limitations of predictive data and analytics in eGovernment.

Paper 6 A System of Systems Management Framework for Digital Transformation in eGovernment

Paper 6 is the culmination of the PhD research. It identifies relevant constituent systems and assesses the systems roles impacting effective digital transformation. This paper introduces the system of systems and EA approaches to compliment the soft systems methods applied previously. Paper 6 adds to the existing body of knowledge by providing a practical tool for identifying relevant systems, their roles and how they interact with one another, and how they relate to effective digital transformation.

1.4.3 Overview of Chapter 3 Methodology

In Chapter 3, the research methodology is explained. This research used an exploratory approach to investigate the problem space which is complex and not clearly defined, and undertook both qualitative and quantitative data collection and analysis. An interpretative approach was adopted to sense-make the complexities of the field under study. As Weick states, “The basic idea of sensemaking is that reality is an ongoing accomplishment that emerges from efforts to create order and make retrospective sense of what occurs” (1993, p. 635). As sensemaking requires systems approaches (i.e., an interpretation of the system’s elements), a triangulated systems approach was also used to support the analysis and adopted in the process of data collection and analysis. Three systems approaches were applied: SSM, system of systems, and EA. Figure 1 outlines the research structure and justification for each stage.

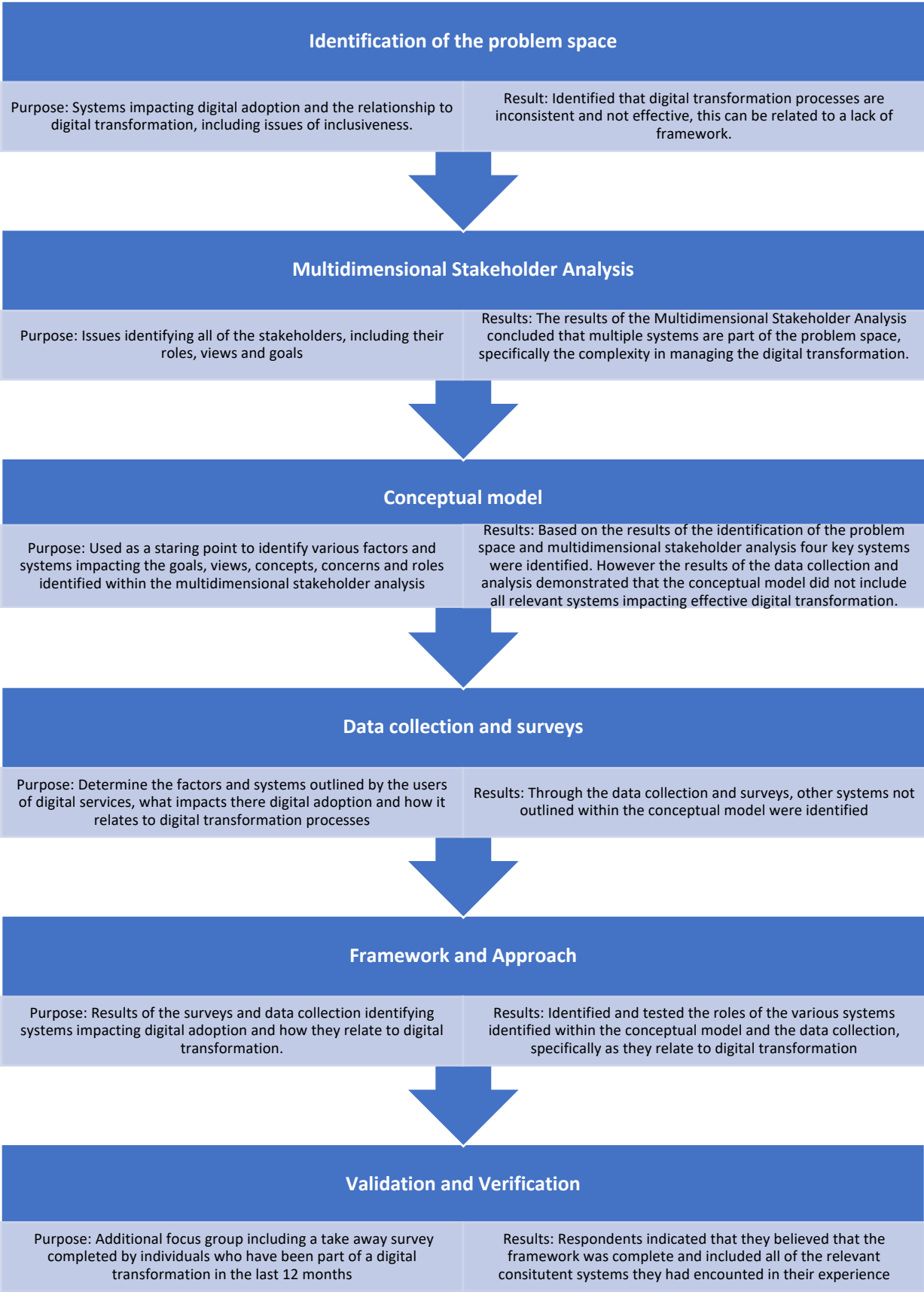


Figure 1 Research Stages and Justification

1.3.4 Overview of Chapter 4 Results

This chapter discusses the findings not reported within the papers. The first section in Chapter 4 outlines the application of the proposed governance framework for effective digital transformation to the ATO Case Study. The second section in Chapter 4 outlines the results of four focus groups seeking to validate and verify the key systems identified within the governance framework, and the guidelines for application to assess the roles and interactions of the systems. The purpose of the focus groups was to ask practitioners about whether they believed the proposed governance framework was complete, valid and added value.

1.3.5 Overview of Chapter 5 Key Findings and Implications, Future Research and Limitations

This chapter summaries the key findings of the research. First, it presents the practical implications of this research, highlighting how clarifying relevant systems and their roles can lead to effective digital transformation. It also explains how the proposed governance framework can relate to other industries, government agencies and countries. Then, it outlines three primary research limitations and recommendations for future research.

1.4 Motivation and Context

This research was motivated by an interest in understanding the digital transformation processes within the public sector and how they relate to a client's positive experience. The researcher recognised the significant challenges facing public sector organisations undergoing digital transformations, especially as they navigate new territory while managing their legal requirements.

Digital transformation, automation and ongoing enhancements in technology are making the world smaller and more interconnected, changing how industries, labour markets and the global economy are managed. Digitalisation is causing ongoing disruptions, impacting leaders in every industry and sector, whether private or public (Tabrizi, Lam, Girard and Irvin 2019). In turn, digital disruption has had an impact on the provision of services in both the private and public sectors, and how individuals interact with financial services, insurance companies, governments, and education providers, to name just a few examples. Considerable literature

has also explored digital inclusion and exclusion and the digital divide within and across countries, indicating that a considerable number of individuals are unable to interact digitally (Thomas, Barraket, Wilson, Cook, Louie, Holcombe-James, Ewing and MacDonald 2018).

A fundamental component of successful and effective digital transformation is organisational culture change. The challenges organisations face in undertaking digital transformation can be linked back to a lack of effective governance, which is an important component of launching and executing digital transformation. This is of particular interest to the researcher. Digital transformations should be comprehensive and holistic, covering numerous processes, interactions, technological evolutions, and changes to and within industries. This is an ongoing development, which requires the appropriate leadership and people, and is a process that is clearly not solely based on technology (Cortellazzo, Bruni and Zampieri 2019). This process of digital transformation is even more complex for governments and public sector services, given the growing need to a) understand the variety of different implications of digital transformations, b) ensure inclusiveness of all citizens and potential users, and c) guarantee data security (Hamilton 2019). Within government, digital transformation also involves creating and implementing good governance processes around, for example, managing citizens and their experiences using real-time data (OECD 2016). To be effective, government digital transformation processes need to understand users' needs and expectations which, in turn, will drive greater compliance with mandatory services.

1.5 Case Study

A case study was developed for this research, based on the ATO. The ATO is an Australian Statutory agency responsible for acting on behalf of the Australian Government to administer the federal taxation system, including superannuation and other taxation legislation. The office is also Australia's principal revenue collection agency. Every individual and organisation who earns an income must, by legislation, lodge a tax return with the ATO. The ATO is impacted by legislative and policy changes implemented by parliament and government.

In 2015, the Australian Public Sector implemented a considerable policy change, overhauling how legacy services and platforms were provided, shifting from paper and in-person to digital (NAA 2015). This is called the "Digital Continuity Policy", originally the "Digital First Policy 2020" (NAA 2015). As part of the Australian Public Sector Reform, the

Digital Continuity Policy aims to optimise delivery of government services and programs and simplify information sharing between government agencies, thereby providing greater security for Australian citizens (NAA 2015). The policy requires all Australian Federal Government departments or organisations to transition to a digital first service platform by the end of 2020 (NAA 2015). The Digital Continuity Policy outlines the changes needed based on Australian Public Sector research, but does, however, also note the potential negative effects on stakeholders and service users when they are required to use multiple systems or platforms to interact with government departments (ATO 2015; NAA 2015).

The ATO was the first public sector agency to provide digital services to users (ATO 2015; ATO 2017) and has been largely successful in its digital transformation process. By conducting research prior to undergoing digitalisation, the ATO understood the basic needs of their users. By 2019, already 95% of self-preparing lodgers (those who do not seek support from an accountant or intermediary) are lodging through digital means (ATO 2019). Although a large number were first time lodgers, the ATO has seen high long-term adoption rates which relates to repeated use (ATO 2019). As the digital transformation process for the ATO has so far been deemed a success (ATO 2019), it provides an excellent case study through which to evaluate the effectiveness of digital transformation. Furthermore, the research obtained an industry partnership with the ATO in order to understand what was done correctly, identify lessons learnt, and determine how this approach can be applied more broadly.

1.6 Summary

This research aims to bridge the research gap associated with a lack of governance framework to manage an effective digital transformation. Through the application of a triangulated systems approach and the use of triangulated methods for data collection and analysis, this research explores the various constituent systems affecting digital transformation in detail, including the assessment of their roles and interactions. This research contributes to the existing body of knowledge by developing a governance framework which works as a practical tool to guide organisations undergoing digital transformation.

Chapter 2. Literature Review

2.1 Introduction

This chapter establishes the links and connections between digital services and digital transformation in the public sector and the underlying theory applied to the development of the framework. The literature review focuses on understanding the current research landscape, identifying existing research gaps within this body of knowledge, and developing an understanding of the whole problem space.

Services are shifting from physical locations to the digital space (OECD 2016; European Commission 2015). This dissertation argues that there needs to be public sector investment spent on understanding digital systems and providing a holistic view of the societal, economic and technological influences impacting stakeholder environments (Briscoe and Marinos 2009; Briscoe and DeWilde 2011). Digital services operate within a complex space, balancing both a user's needs and an organisation's capability, whilst also fitting within the digital system (Immonen, Ovaska and Passo 2017). Digital systems are driven by networks of social and economic stakeholders, and reliant on technological architecture to spread information, finances and services (Briscoe and DeWilde 2011). A digital system is an open community, with no centralised control or fixed roles, defined as a combination of self-organising systems, forming multiple architectural models (Briscoe and Marinos 2009; Razavi, Moschoyiannis and Krause 2009). It is made up of numerous digital platforms which create a digital environment; an understanding of this environment leads to greater collaboration between providers and users, promoting innovation (Briscoe and DeWilde 2011; EY 2017). However, strict regulations and legislation, budget constraints, ageing infrastructure and a growing population are all slowing the uptake in public sector organisations (EY 2017).

Internal adoption of digital technologies, data and information, impact organisational strategies regarding services and stakeholder engagement (Sivarajah, Irani and Weerakkody 2015). Organisations with high internal adoption often have skilled and adaptable leaders, effective use of workplace skills, user-centric designs and workplace cultures conducive to change (Sivarajah et al 2015). However, Wauters (2017) states that public sector organisations

globally do not have sufficient knowledge and information management to keep pace with technological advancements, causing complexity in strategic application of digital services (Wauters 2017), thus emphasising how vital knowledge and information sharing is to the success of public sector digital services (OECD 2016; Wauters 2017). Knowledge and information sharing are critical to quality public sector services and policy, as users require governments to utilise all information, knowledge and data available (OECD 2003; OECD 2016; Mullich 2013). Comprehensive data and information use improves efficiency, effectiveness and transparency while providing informed policymaking which understands the social climate (Janssen and Kuk 2016). However, the public sector has fallen behind user expectations of data usage, especially when compared to private sector organisations (OECD 2016; Mullich 2013).

Analysed in a holistic manner, the integration of the various stakeholder's views may assist with shedding light on key elements that make for sustainable digital engagement, as well as provide a unique underlying level of understanding. Even for complex digital products, the adoption process is based on only five stages, illustrated in Figure 2 (Bourne 1959; Nakata and Weider 2011; Reinders, Frambach and Schoormans 2010). The first stage, awareness, is the user's first exposure to the product. Interest is the second stage, as they seek additional information. Thirdly, evaluation is where consumers determine if the product is worth using. The fourth stage is where the product is trialled on a limited basis (Bourne 1959; Nakata and Weider 2011; Reinders et al 2010). The fifth stage is adoption where the consumer decides whether or not to use the product. Rejection can occur at any stage of the process (Bourne 1959; Nakata and Weider 2011; Reinders et al 2010). The adoption process links to the digital system, as these factors relate back to the adoption of digital services and products (Barrett, Davidson, Prabhu and Vargo 2015).

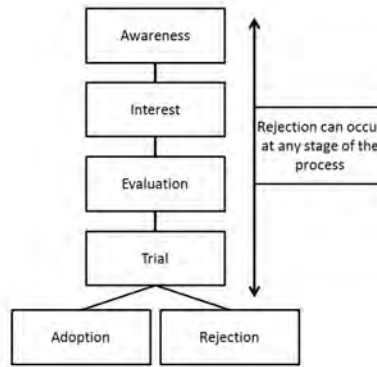


Figure 2 Digital Adoption Process (source: Bourne 1959)

The product adoption process demonstrates why understanding the influence of user expectations is necessary (Shaikh 2016). Increased access to information on digital products and services has improved comparability of available options, causing difficulties for public sector services which are meant to serve citizens (Shaikh 2016). This, however, only highlights part of the complexity facing the public sector. Private sector organisations have greater capacity to experiment, are more flexible in their adoption of digital platforms, with progressive implementation techniques (Clark 2016; World Economic Forum 2014). In contrast, public sector services require relevant solutions for the wider population, with less available funding and resources (Clark 2016), and a unique stakeholder group. Utilising and understanding digital systems for organisations providing public services is vital to the success of their digital services (Boley and Chang 2007; West and Chang 2006). Greater reliance on digital platforms has made digital services necessary for service provision in both public and private sectors (Damiani, Uden and Trisnawty 2007; Boley and Chang 2007).

Looking specifically at services in the public sector, it is clear that creating completely inclusive services is complex, especially with the transition towards the digitalisation of key services. Digital inclusiveness is a complicated issue, involving many components of the digital system and environment. By understanding digital inclusion and the systems which affect full participation in the digital system, a deeper understanding of the interactions between systems can be gained and documented, to guide the development of a governance framework for effective digital transformation.

2.2 Inclusion

The definition of inclusion is broad; it is based on using differences to benefit an organisation and its community and stakeholders (Thompson 2017). Inclusion incorporates numerous concepts, including awareness, acceptance, respect and understanding, and equal participation opportunities (Thompson 2017; Wallace and Pillans 2016). Building organisational inclusiveness requires adopting an environment which encourages people with different characteristics, backgrounds and ways of thinking to work together to fulfil their potentials (Thompson 2017; Wallace and Pillans 2016). Wallace and Pillans (2016) highlight that inclusive cultures are achieved through all people feeling valued, listened to and respected, regardless of differences. This is true for all organisations; however, it can be argued that inclusiveness for public sector organisations goes beyond employees and the organisation itself. Inclusive organisations take into consideration the perspectives of both internal and external stakeholders, but the value placed on external stakeholders in particular varies depending on the type of organisation (OECD 2015). The first priority is often to understand and address internal stakeholders, commonly employees who are committed to serving the organisation. External stakeholders, however, are not always addressed or understood in the same manner, even though they are the clients or users of the goods or services (OECD 2015).

The features of social inclusion and exclusion indicate that it is a process, not a singular outcome, and understanding the causes of exclusion and inclusion are important (Atkinson 1998; Saunders 2003). According to Atkinson (1998), social exclusion is based on three key themes: relativity, agency and circumstances. Relativity is related to the norms and expectations of the particular society at that point in time (Atkinson 1998). Agency relates to exclusion as an outcome of an act of an individual, group or entity resulting in a person either excluding themselves by choice or being excluded by other people, entities or groups (Atkinson 1998). Finally, current circumstances that do not currently cause social exclusion, could limit the person's prospects (Atkinson 1998). Furthermore, social exclusion is not limited to individuals – it is possible for a group of individuals to be affected, exhibiting exclusion at a community level (Atkinson 1998). Saunders (2003) goes further and states that social exclusion and inclusion are multidimensional in nature, as they reflect combinations of multiple interrelated factors. This indicates the need for research into the different users to be multidimensional in nature, to understand the needs and issues associated with social as well

as digital inclusiveness. Social inclusion and social citizenship are built through encouraging full participation of all citizens in economic, social and political spheres (Weaver, Backhaus, Pel and Rach 2017; Buckmaster and Thomas 2009). This is based on shifting from building inclusive organisations to participatory organisations (Weaver et al 2017; Buckmaster and Thomas 2009). To achieve social inclusion, governments and public sector organisations must invest more in public services and citizens that boost sustainable growth and prevent groups from being left behind (Weaver et al 2017; Buckmaster and Thomas 2009). Governments (including public sector service providers) need to develop more robust and rigorous policies that embed the principles of equal access to digital services for everyone (Weaver et al 2017; Buckmaster and Thomas 2009).

There are practical concerns for achieving equitable levels of access between different social groups and public services, and much research does not take into consideration environmental factors that can help overcome the digital divide. Where public services are placed affects different users (Pollitt 1990). The place directly affects how and even sometimes which public services can be accessed (Pollitt 1990). As society is not homogenous, providing basic accesses to the community is not sufficient. Research demonstrates that those who fall behind or who, in fact, never get started, face ongoing and amplified issues of social and economic exclusion moving forward (Pollitt 1990). If public sector organisations align with community members, they can then engage them as agents who can effectively co-design systems and not just be targets for services. This means engagement of all, as to not marginalise or negatively impact any citizens or groups. This research identifies those who are disengaged because their needs are not being met, and when and why they may be seeking assistance.

According to the UK Government's Digital Inclusion Strategy, digital inclusion is defined by digital skills, connectivity and accessibility (UK Government 2014). Digital skills include the capacity to use the technology to connect with the services (internet and computer), connectivity is having access to the internet (the infrastructure), and accessibility is having user friendly digital services that assist in accessing the service (UK Government 2014). Similarly, the Australian Digital Inclusion Index research states that digital inclusion is about accessing information and communications technology (ICT), resulting in social and economic benefits for the users (Thomas et al 2018). The digital divide is the gap between individuals or groups with limited access to digital information and services, compared to those who have effective

access (Thomas et al 2018). The digital divide in Australia is a significant issue, with more than 2.5 million individuals still not online (Donaldson 2018). In general, a digital divide is the result of digital services and information not being completely inclusive. For public sector services this is increasingly difficult due to changes in service provisions to digital first platforms, limiting access to those who have capacity to connect, access and use the technologies to access the services.

According to the OECD (2016), going digital assists in building a new model of government that is more transparent, simple, efficient, inclusive and user friendly. Furthermore, the OECD (2016) and Australian Digital Transformation Agency (2018) both state that there are numerous positives to transitioning services to digital platforms. These include building new tools that translate into improvements in services and efficiency, and detecting evasion. Inclusion in public sector services is multidimensional as it goes beyond simply supplying services, requiring a closer relationship between the organisation and users (OECD 2016; DTA 2018). To rethink how services are built and users are understood, a different form of evidence-based research needs to be undertaken – one that involves co-production and bringing the social components back into public sector services (OECD 2016; DTA 2018). If inclusion is multidimensional, then so too should the stakeholder analysis and environment analysis models used to study inclusion. This gap could be filled by creating a multidimensional stakeholder analysis which assists in understanding the different elements within the users' digital systems and environments. This can assist with providing a vital understanding of the users' potential blockers, where assistance can be provided, and how the incorporation of all stakeholders' goals and views can lead to highly effective services.

Digital inclusiveness is an area that requires ongoing discussion and research, especially as it relates to physical systems or infrastructure-based access issues (Thomas et al 2018). Without understanding how individuals are affected by digital inclusiveness issues outside of their own control, organisations, especially public sector organisations, are not able to provide accessible or effective digital services. This forms only a small component of digital inclusion that requires understanding. There are practical concerns for achieving equitable levels of access between different social groups and public services, as much research does not take into consideration enough environmental factors to overcome the digital divide. As society is not homogenous, providing basic accesses to the community is not sufficient. Government services

provided to citizens need to be aligned in design and application with the needs of the community, to encourage digital inclusiveness and begin to breakdown the digital divide.

2.3 eGovernment

Within the literature there are three channels for government access and services: traditional, eGovernment and non-digital media. Traditional channels incorporate office visits, face-to-face contact, voice phone calls and surface mail (Ebbers, Pieterse and Noordman 2008). Non-digital media includes text messaging, social media and various mobile apps which comprise an emerging domain (being adopted progressively by governments) (Linders 2012). Both of these channels have been challenged by the rise of eGovernment. The eGovernment channel includes all digital options, including information provided on government websites, emailing options and service portals. eGovernment services are growing. In the public sector, technological communication devices and services, commonly referred to as eGovernment, provide public services to citizens and other individuals and entities within a country, state or local government region. eGovernment services promote the use of self-service through the convenient access to technologies which connect citizens to governments on a 24/7 basis, with minimal geographical constraints (Gilbert et al 2004). eGovernment services ensure less effort is required by citizens to use and access government services, and as a result there are fewer constraints on service time, location, and availability. This convenience factor increases adoption of services, access to support or the use of convenient technology which also helps minimise the need for support, thus contributing positively to perceptions of the services (Chen 2010).

According to Ndou (2004) there are three major components which characterise eGovernment: (1) Transformation Areas, (2) Users, Stakeholders and Their Interrelationships, and (3) eGovernment application domains.

eGovernment transformation areas

This includes Internal, External and Relational components. The internal transformational components are based on the improvement of the efficiency of the various internal functions and processes within government (this can be broadly across government or within a department). As for the external transformational components, this includes the new possibilities for the government to be more transparent to their citizens, businesses and

individuals who interact with them. This includes the dissemination of and access to a greater range of information collected and generated within the government sphere. Finally, the relational transformational components may enable increased and fundamental change in the relationships between government and their clients. This includes the implication for different democratic processes and government structures.

eGovernment users, stakeholders and their interrelationships

This includes the four main groups of stakeholders: citizens, businesses, governments and employees. Stakeholders interact with the government through multiple communication channels, including electronic transactions, voting for government members and filing tax returns, for example. These interactions between the government and each group often constitute all four eGovernment webs of interrelationships (as highlighted in Table 1).

eGovernment Application domains

This component is based on three domains including: eAdministration, eSociety/eCitizens and eServices. eAdministration is the electronic administration of some administrative tasks, specifically their automation and computation including the realisation of the strategic connections between the various internal processes, the various departments and their functions. eCitizens and eSociety includes enabling all the various relationships and interactions between and among the various public sector agencies, the citizens and the civil community generally. Finally, eServices include the various connections and the interrelationships between the government, citizens, businesses and other individuals who interact with government to deliver and automate the various digital services.

Therefore, according to Ndou (2004), eGovernment provides considerable opportunities to reduce costs, increase service scope and quality, promote ongoing transparency, and build a network and community. It also has the potential to increase the quality of government decision-making and policymaking and produce the use of digital/ICT services across different industry sectors (including public and private sectors). Thus, the implementation of eGovernment platforms has been used to help governments deliver services and transform relationships with citizens, businesses and other parts of government (Gronlund and Horan 2005; Guida and Crow 2009). As part of the implementation of eGovernment platforms, there

are four different levels of eGovernment interactions between stakeholders which are worth noting. These are outlined in Table 1.

Table 1. Types of eGovernment Services

eGovernment Type	Public Service Type	References
Government to Citizen (G2C)	The digital interactions between citizens and their government (G2C), this involves government departments/agencies create websites and online forms, platforms and information. The G2C interactions are based on government departments/agencies managing their relationships with customers (citizens or service users) by providing the necessary products and services used to fulfil the needs of the service users.	Carter and Belanger 2005; Hai 2007; Miller and Walling 2013
Government to Business (G2B)	The interactions between government and businesses (G2B), this is similar to G2C, whoever these are tailored platforms to create online interaction portals between government and the commercial or business sector. The purpose of these services is to provide information and advice to businesses, while also providing a forum for them to complete their interaction requirements.	Carter and Belanger 2005; Miller and Walling 2013
Government to Employee (G2R)	The interaction between government and employees (G2E), this relates to the relationship between the employees of a government department and between online tools, sources and information provided to assist in the maintenance of communication between government departments and citizens. eGovernment platforms between government and employees provides a central repository for the storage of data, documents and learning technologies. The use of within government online platforms increases the likelihood of departments going paperless, increasing the ease of data and document sharing across departments both nationally and internationally.	Carter and Belanger 2005; Fang 2002; Miller and Walling 2013
Government to Government (G2G)	The digital interactions between government and various government agencies or organisations (G2G), the purpose has been the introduction of new forms of record keeping and data sharing, providing more consistency in service provision and encouraging participation within the system. eGovernance is a key part of this, providing consistent government digital services across departments within the same region and countries.	Carter and Belanger 2005; Miller and Walling 2013

2.3.1 eGovernment Definitions

There has been a global movement towards public sector or government services being provided through digital formats (Benjamin and Potts 2018). Furthermore, eGovernment has become a driving force in governance and government service provision worldwide (Misra 2007). There are a number of definitions for eGovernment and digital services within government; the majority outline the use of ICT (e.g., the internet) to improve the delivery of government services to citizens, businesses and other government agencies (Jain Palvia and Sharma 2007). eGovernment services are used in many cases to increase both operational efficiency and effectiveness, enhance internal and external communications, and provide better forms of transactional operations for users (Warkentin, Gefen, Pavlou and Rose 2002). Therefore, in the majority of cases eGovernment also refers to eServices which are based on the delivery of information and services through the internet or another form of digital means (West 2001, p.1). eServices (also referred to as technology-based self-services) are causing progressive changes in how services are provided and how interactions occur with organisations (Kamar et al 2017). With the shift in government investment into electronic services, there is a commonly perceived understanding of what citizens, businesses, employees, and customers of Government need, without measuring the factors that increase their willingness to adopt eGovernment services.

The majority of definitions of eGovernment include the concept of using ICT to better serve citizens (Evans and Yen 2006; Muir and Oppenheim 2002; Norris, Fletcher and Holden 2001; Reddick 2006; Shareef, Archer, Kumar and Kumar 2010). Carter and Belanger (2005, p.5) define eGovernment as the use of information technology to enable and improve the efficiency with which government services are provided to citizens, employees, businesses and agencies. A similar definition by Nica (2015) states that eGovernment is the use of ICTs to enhance the services provided by public sector entities and increase participation of citizen involvement in schemes and policymaking via high quality eservices. Alternatively, Gil-Garcia (2005, p. 27) defines eGovernment as the use of ICT to provide public services to improve managerial effectiveness and to promote democratic values and mechanisms, as well as being a regulatory framework that facilitates information and fosters a knowledge society (Gil-Garcia

2005, p. 27). West (2004) provides a simpler definition of eGovernment as the delivery of information and services from government entities through digital means. eGovernment services are defined as either transactional or informational. Transactional services are two-way, between governments and citizens, whereas an informational service is based on the delivery of government information to citizens (Norris and Moon 2005; Venkatesh, Chan and Thong 2012). Research by Turbans, King, Lee, Warkentin and Chung (2002) indicates that eGovernment encompasses applications of various technologies to provide citizens and entities with more convenient access to government information and services. Each of these definitions have one similar defining characteristic – eGovernment incorporates the use of ICT to provide services to citizens, businesses or other government entities. For the purpose of this research, eGovernment is regarded as the provision of digital services offered by public sector organisations replacing or in conjunction with legacy systems.

Following on from these definitions, eGovernment can be characterised by five key elements: 1) the extensive use of ICT, 2) the impersonal nature of the online environment, 3) the ease by which the information can be collected and used across organisations, 4) the implicit uncertainty of using open technological infrastructure for transactions, and 5) the newness of the communication medium (Warkentin et al 2002). These five key elements have been adopted in this research.

Rapid digitalisation across both public and private sector organisations has been causing complexities and opportunities for organisations and society, including increasing access to new forms of collaboration (Dellerman, Lipusch and Ebel 2017; Maedche, vom-Brocke and Hevner 2017). Digitalisation of public sector services impacts both government administration processes and government-to-citizen interactions. The current question is whether or not it is for the public good (Bertot and Jaeger 2008; Chadwick and May 2003). Interestingly, one of the key drivers to public sector digitalisation is the economic savings for citizens (Kernaghan 2013; Reddick and Anthopoulos 2014).

2.3.2 Public Value in eGovernment

Many citizens are now using internet searches to identify information and access and government services, and are generally enjoying greater transparency (Belanger and Carter 2012A). Research suggests that citizens and organisations recognise the value of electronic

information (Belanger and Carter 2012B), confirming the idea that eGovernment does translate into positive impressions regarding government effectiveness and encourages rebuilding citizen trust in government (West 2004; Lollar 2006), as eGovernment works to make government services more responsive and easy to access (Gauld, Gray and McCom 2009; Tolbert and Mossberger 2006). The eGovernment concept entails government institutions making use of ICT to enhance their operational efficiency and effectiveness in meeting citizens' needs and service delivery (Chen 2010). eGovernment involves novel forms of delivering and tailoring information and services, connecting communities and businesses locally and globally, and reforming us towards digital democracy.

eGovernment is capable of providing considerable benefits to users of public sector services when it works correctly. Public value is defined as citizens' collective expectations with respect to government and public services (Moore 1995). Creating public value needs to be a primary goal of public sector entities, as they need to serve the wishes and needs of the public (Harrison, Guerrero, Burke, Cook, Cresswell, Helbig and Pardo 2012; Jorgensen and Bozeman 2007). Citizens are defined as the stakeholders, that is, as policymakers, public servants, users or customers of public services, participants, taxpayers or entrepreneurs (Castelnovo 2013). Therefore, in this definition, citizens are not defined as only individuals who hold citizenship in the country providing the public service. Public value addresses complex socio-political impacts of ICT adoption within the public sector (Cordella and Bonina 2012). The public value is composite outcomes of socially shared expectations of fairness, trust and legitimacy, whose effects would depend on the social and political context in place (Cordella and Bonina 2012). eGovernment policies should be evaluated against their ability to increase public administration's capacity to produce public value for citizens as users, customers, policymakers and operators (Castelnovo and Simonetta 2008; Castelnovo 2013).

Government entities need to incorporate strategic goals for public value, outside of economic gains, encouraging political and social objectives, including efficiency in public services, equality of constituents, social inclusion, openness, community regeneration, community well-being, stewardship and accountability (Chircu 2008; Chircu and Lee 2005; Cordella and Bonina 2012; Grimsley and Meehan 2007; Moore 1995). Therefore, eGovernment public value is defined as the ability of eGovernment systems to provide enhanced efficiency for government, improved services for citizens, and social values such as

inclusion, democracy, transparency and participation (Twizeyimana and Andersson 2019). Even though both private and public sector organisations exist to serve people, they have different concerns and issues. Private sector entities provide services for customers with the aim of maximising profit. In contrast, government entities provide services for constituents. Government entities need to provide public value on top of economic benefits and quality services (Castelnovo 2013). Government entities' actions rarely make direct impacts on citizens/constituents, they instead impact stakeholder groups and the interests of groups and individuals (Castelnovo 2013).

With the ongoing developments in the eGovernment space there is a considerable value added to public sector services, resulting in improvements in public sector services, accessibility of services, citizen engagement, dialogue and balancing interests of various stakeholders (Rose, Persson and Heeager 2015; Karkin and Janssen 2014). Moving forward, further improvements to eGovernment or public sector services should focus on increasing levels of communications or interactions between governments and users and improving accessibility to government information and services (Pirannejad 2011; Rose et al 2015). eGovernment enables improvements to be made in responsiveness, effectiveness, efficiency, cost-reduction and collaboration in the delivery of public services (Bannister and Connolly 2014; Castelnovo 2013; Karkin and Janssen 2014).

eGovernment also enables seamless two-way communications between governments, citizens, and businesses (Susanto and Goodwin 2013), and improves the quality of public service delivery (Nam 2014) and the transparency of public decision-making (Deng, Karunasena and Xu 2018), while encouraging citizens' involvement in public administration (Heeks and Bailur 2007). It also enhances information sharing between government institutions (Puspitasari and Ishii 2016) and streamlines processes in public organisations, therefore improving their efficiency and effectiveness (Debjani, Umesh and Gupta 2012). These qualities have led to numerous countries introducing various initiatives to develop eGovernment (United Nations 2016).

It is fundamental for eGovernment policymakers to appraise the demand of citizens for eGovernment services in order to better direct deployment and implementation of electronic services. Reddick (2005) insists that governments may be investing in the provision of online

information and services while the demand might not be real and present, and this is expected to have an indirect effect on the acceptance and diffusion of those information systems. Adoption of eGovernment by users is largely affected by social, human, organisational and cultural factors (Carter and Belanger 2005). The ultimate goal of eGovernment is to pursue or create increased public value that will provide utility for multiple stakeholders and increase social equity (Siskos, Malafekas, Askounis and Psarras 2013; Machova and Lnenicka 2016). There is a need for continuous monitoring and assessment of eGovernment progress which has led to the development of relevant frameworks and models (Siskos et al 2013). However, there are barriers to eGovernment which are important to consider for the creation of effective and inclusive digital services.

2.3.3 Barriers to eGovernment

According to the European Commission (2007 p. 3), a barrier to eGovernment is defined as, “characteristics within the contexts of legal, social, technological, or institutional which negatively impact the development of eGovernment”. This can be caused by users’ lack of demand and the obstacles preventing engagement with services, or disincentives for the government to supply the eGovernment services, or prevalence of obstacles preventing its supply (European Commission 2007, p. 3). The European Commission identified barriers and compiled them into seven key categories: leadership failures, financial inhibitors, digital divide and choice, poor coordination, workplace and organisational inflexibility, lack of trust, and poor technical design (European Commission 2007).

The most commonly defined factors causing barriers to eGovernment services include: digital divide (European Commission 2007; Van Ryzin 2006), lack of legal bases (Esteves and Rhoda 2008; Fugini, Maggolioli, Krysnaia, Boselli, Cesarini and Mezzamanica 2008; European Commission 2007; Van Ryzin 2006), lack of policy cycle management (Kunstelj and Vintar 2009), lack of measurement and evaluation (Moon 2002; Esteves and Rhoda 2008; Kunstelj and Vintar 2009; Van Ryzin 2006), and lack of citizen participation (Esteves and Rhoda 2008; Fugini et al 2008). Accessibility in the online environment is a relatively new development as a focus of research and is also highly complex, involving policy, technical and user issues (Jacko and Hanson 2002; Stephanidis and Savidis 2001). There is considerable research on barriers specific to eGovernment services, collated in Table 2 in three general

categories. Additionally, a number of general barriers have been identified in the research, as presented in Table 3.

Table 2. Themes Within Adoption of eGovernment Services

Themes	Inclusion	References
Organisational – strategy, procedures, regulations, poor leadership and poor policy	Law and public policy, accessibility, trust, privacy, security, transparency, permanent availability and preservation, public/private competition/collaboration, workforce issues, cost structures and benchmarking, lack of internet access.	Alamarabeh and AbuAli 2010; Dixon 2010; Gao, Song and Zhu 2013; Thi, Lim and Al-Zoubi 2014
Technological – hardware, software, interface, eservices, email, eAdministration	Citizen privacy, the elimination for the tendency of eGovernment to replicate traditional government and services, ICT development, interoperability, records management.	Mache and McNiven 2003; Davison, Wagner and Ma 2005; Ebrahim and Irani 2005; Ramli 2017; Raham, Naz and Singh 2017
Human – low ICT skills/capability, lack of awareness, lack of knowledge, dissatisfaction	Adequately skilled citizens and government employees, disparities on computer knowledge, generational gap, lack of awareness, language barrier, security fears, lack of trust, non user-friendly websites, digital divide, eliteracy, education and marketing.	Chourdrie, Weerakkody and Jones 2005; Sharma, Shakya and Banepali 2015; Dixon 2010; Abu-Shanab 2013

Table 3. Common Barriers Identified in Previous Research on eGovernment

Barriers	Definition	References
Confidentiality	Personal data must be kept private and not used for other purposes.	Van Riel, Liljander and Jurriens 2001; Zhu, Wyer and Chen 2002
Easy to use	The delivery mechanism must be straightforward to use with minimum effort required.	Agarwal and Prasad 1998; Dabholkar 1996; Lederer, Maupin, Sena and Zhuang 2000; Meuter et al 2000
Enjoyable	Using the system must be an enjoyable experience.	Dabholkar 1996; Davies, Bagozzi and Warshaw 1989; Liao and Cheung 2001

Reliable	The website must have services that are required, and individuals must trust that a requested service will be delivered.	Berkley and Gupta 1994; Evans and Brown 1988; Hansen 1995; Zhu, Wyer and Chen 2002
Safe	The website must be secure with respect to personal data.	Berkley and Gupta 1994; Evans and Brown 1988; Szymanski and Hyse 2000; Liao and Cheung 2001
Visual Appeal	Website should be visually appealing.	Lederer et al 2000; O’Cass and Fenech 2003
Trust	Trust is known to reduce the level of social complexity which is the result of people being independent actors whose behaviours are not always predictable and controlled.	Gefen 2000; Lewis and Weigert 1985; Luhmann 1979
Perceived Risk	Engagement through online transaction processes or online services, is commonly associated with a certain level of risk (both perceived or observed) by users.	Jarvenpapa and Tractinsky 1999
Perceived behavioural control	Two components of the perceived behavioural control: self-efficacy (confidence in one’s ability), and facilitating conditions which provide the appropriate resources for interactions.	Ajzen 1985; Triandis 1971

One of the most notable obstacles to user adoption is a lack of trust and confidence, with security threats adversely affecting the level of confidence and trust felt towards a system (Nikkhahan, Aghdam and Sohrabi 2009; Zhao and Hu 2008). Where there have been improvements to policies with regard to information security, an increase in the confidence and trust felt towards both government and their services has followed (West 2004; Wimmer and Bredow 2002). Research suggests that, regardless of the platform, the impact of stakeholders (internal and external) can negatively influence use (Angelopoulos, Kitios, Kofakis and Papadopoulos 2010). Therefore, successful eGovernment platforms depend on understanding the environments in which they operate (Yildiz 2007). These elements, including stakeholder inclusiveness, should be considered more in-depth, considering their important relationship with the multiple barriers preventing eGovernment/digital service adoption. Inclusiveness is one of the main focuses of this research.

2.3.4 Mandatory Systems Adoption

At this stage it is important to define mandatory systems and their process of adoption. Governments and public sector services are in a unique position, as they are able to dictate the rules and regulations, as well as create mandatory/legislative obligations to use services provided online (Warkentin et al 2002). The use of such force/power can cause frustration for citizens, creating a dependency on capabilities required to participate and causing a feeling of lack of control over government actions (Warkentin et al 2002). Therefore, it is important for public sector services and governments to facilitate citizens' choices about how to access services and participate in online service use (e.g., lodging tax returns online) (Warkentin et al 2002).

Considerable research into technology adoption has explored voluntary adoption, with a lack of consistent and comprehensive research exploring mandatory environments (Chan, Thong, Venkatesh, Brown, Hu and Tam 2010). Research suggests that the underlying relationships between stakeholders and the systems impacting technology adoption could be considerably different in the mandatory adoption context (Brown, Massey, Montoya-Weiss and Burkmann 2002). Furthermore, when exploring mandatory adoption environments, user satisfaction with the system or product has considerable impact on long term adoption rather than behavioural intention (Brown et al 2002; Brown, Venkatesh, Kuruzovich and Massey 2008). The current measures used to assess willingness to adopt a service do not fully explore the intention of users to use a technology or system within a mandatory environment (Brown et al 2002). Therefore, the existing models exploring technology and system adoption do not appropriately explain technology acceptance within the mandatory environments (Brown et al 2002). Interestingly, most research exploring adoption in mandatory environments often focus on the core beliefs of general models, including perceived usefulness and perceived ease of use (Brown et al 2002; Brown et al 2008). Literature demonstrates that further research is required in this area.

The end users of mandated eGovernment platforms are members of the general public, therefore strategies need to prepare potential users for the services (Hsieh, Rai and Keil 2008; Ke and Wei 2004). For example, assistance should be provided to those who are socio-economically disadvantaged in order to enhance the opportunities for overcoming barriers in

terms of technical expertise and supporting resources (Hsieh et al 2008; Ke and Wei 2004). By sharing the eGovernment platform, users are targets and more likely to adopt, and help contribute to the wide acceptance and use of eGovernment (Rivera and Rogers 2004).

When it comes to technology adoption models and diffusion of information model, within the mandatory context there are four core technology adoption beliefs: (1) performance expectancy, (2) effort expectancy, (3) social influence, and (4) facilitating conditions (Brown et al 2008; Thong 1999; Thong, Hong and Tam 2006; Venkatesh, Morris, Davis and Davis 2003). These four factors are all considered to be important and represent key aspects of the user's evaluation of the technology use that contributes to user satisfaction (Brown et al 2008; Thong 1999; Thong et al 2006; Venkatesh et al 2003). Within the voluntary adoption sphere, performance expectancy, effort expectancy and facilitating conditions have been known to have more positive effects on users' intentions and/or use of technology (Chen 2010). However, these factors have different and less direct effects on citizens' satisfaction in a mandatory adoption context (Chen 2010).

Organisations who mandate particular technologies alter the basic relationships of conventional technology acceptance factors (Brown et al 2002), because voluntary systems imply voluntary behaviour. Researchers have traced recent implementation failures to a lack of user commitment. Malhotra and Galletta (2005) found that user commitment plays a critical role in the acceptance and usage of systems. In the case of eGovernment, most eServices to be implemented will be on a mandatory basis and hence, it is justified to study the user perceptions of voluntariness. In mandatory environments, attitude and social influence are found to be strong predictors of adoption due to individuals' tendencies to comply with pressure from a higher authority (Venkatesh et al 2003; Brown et al 2002). Furthermore, self-efficacy reinforces users' beliefs about their capacity to use technology, which has been defined as a key driver of intention to use within a mandatory setting (Brown et al 2002). Barriers to adoption and use of eGovernment services is a complex phenomenon requiring additional research and exploration.

2.3.5 Benefits of Adopting eGovernment Services

As the primary purpose of eGovernment is to improve public services quality, and to be more efficient, effective and transparent (Astawa and Dewi 2017), the service provision should

aim to improve the interactions between government and society. There is a considerable amount of eGovernment literature focusing on increasing public trust as a factor to increase adoption and use (Belanger and Carter 2008; Warkentin et al 2002; Carter and Belanger 2005). This research indicates that through the creation of increased public trust, an increased level of adoption of eGovernment services can be seen, bringing benefits to citizens including time, availability and cost savings (Gasova and Sofkova 2017; Arduini and Zafei 2014; Abu Baka, Talukder, Khan and Haque 2019). However, as trust as a measure is largely based on perceptions, it is not easy to measure consistently and forms only a small component of factors influencing whether or not an individual will adopt a government service. As outlined in Table 4, there is considerable research outlining the numerous benefits to adopting eGovernment services.

Table 4. Benefits to Using eGovernment Services

Benefits	Definitions	References
Avoiding Personal Interactions	The ability to be able to receive public services without having to interact with members of the service provider's staff.	Forman and Ven 1991; Hansen 1995; Meuter et al 2000; Prendergast and Marr 1994
Control	The ability to exert more control over the delivery of the service than through other methods.	Dabholkar 1996; Liao and Cheung 2001; Zhu, Wyer and Chen 2002
Convenience	The ability to receive the service how and when the individual wants to.	Meuter et al 2000; Szymanski and Hyse 2000; Zhu, Wyer and Chen 2002; Berry, Seiders and Grewal 2002; Torkzadeh and Dhillon 2002
Cost	The electronic delivery of public services saving money.	Liao and Cheung 2001
Personalisation	The ability to tailor the delivery of the service more towards the individual.	Van Riel et al 2001
Time	The time saved by obtaining the service electronically.	Berkley and Gupta 1994; Dabholkar 1996; Hansen 1995; Liao and Cheung 2001; Meuter et al 2000

The impact of quality antecedents was examined by Chen (2010). These included the impacts of information quality, systems quality and service quality, and the effect on taxpayers' satisfaction with online tax filing services. Floropoulos, Spathis, Halvatzis and Tsiouridou (2010) examined the employee perspectives on the Greek taxation information systems. This research demonstrated the importance of information quality, systems quality,

service quality, user satisfaction and perceived usefulness (Floropoulos et al 2010). Research conducted in Hong Kong exploring the determinants of service quality and long-term use intentions outlined the importance of two service traits (security and convenience) and a technology trait (ease of use), on the likelihood to adopt long term (Hu, Brown, Thong, Chan and Tam 2009). Information quality and system quality have been shown to have a significant impact on behavioural intentions to use eGovernment services and the level of user satisfaction (Rana, Dwivedi and Williams 2013).

There is considerable research that goes into understanding a number of external constructs impacting adoption of digital services, which include perceived usefulness, perceived ease of use and perceived risk (Rana, Dwivedi, Williams and Weerakkody 2014; DeLone and McLean 2003). These studies show the positive and significant impacts that have been identified between users' satisfaction, information and service quality. According to Weerakkody, Irani, Lee, Hindi and Osman (2016), user satisfaction is positively impacted by better quality information provision through eGovernment systems as well as the overall quality of the system. Furthermore, Weerakkody et al (2016) found that both information and system quality positively impacted levels of trust, which links positively to user satisfaction. Improving information quality and service provision appears to be a fundamental component of providing high quality online services (for both public and private sector).

There is considerable research from information systems understanding how and why individuals adopt or do not adopt new IT or IT services (Dwivedi, Shareef, Simintiras, Lal and Weerakkody 2015a; Dwivedi, Wastell, Laumer, Henriksen, Myers, Bunker, Elbanna, Ravishankar and Srivastava 2015b; Hossain and Quaddus 2015; Kapoor, Dwivedi and Williams 2015). A large portion of this research is based on the individual's acceptance of technology, using intention or usage as the predictor (Ajzen 1991; Davis, Bagozzi and Warshaw 1989; Dwivedi et al 2015a; Dwivedi et al 2015b; Seethamraju 2015). Furthermore, other research focusses on organisational success based on the effectiveness of the technological systems utilised measured through technology adoption models (Barclay 2008; DeLone and McLean 1992; DeLone and McLean 2003; Rana et al 2014; Seddon 1997; Swar, Moon, Oh and Rhee 2010; Leonard-Barton and Deschamps 1988). There seems to be growing evidence acknowledging the slow adoption and the numerous efforts made to identify the factors affecting the adoption of these services (Akkaya, Obermeier, Wolf and Kremar 2011;

Bwalya and Healy 2010; Lee, Kim and Anh 2011; Lu, Huang and Lo 2010; Schaupp, Carter and McBride 2010).

2.3.6 Technological Adoption Model

The Technological Adoption Model (TAM) has been used extensively in research on eGovernment adoption (Hung, Tang, Chang and Ke 2009; Lee and Rao 2009; Lu et al 2010; Rana et al 2014; Schaupp et al 2010; Shareef, Kumar, Dwivedi and Kumar 2014). Previous research into the adoption of eGovernment platforms and other online services have frequently used the TAM, as it relates heavily to technology adoption research. TAM is used to provide an explanation of determinants of computer acceptance that is general, capable of explaining users' behaviour across a broad range of end-user computing technologies and user populations, while also being both parsimonious and theoretically justified (Davies, Bagozzi and Warshaw 1989, p. 985). In its original state TAM was proposed to explore and understand how users adopt and use new technologies, based on the evaluation of key factors which influenced the decision to accept new technologies (Davies 1989). TAM outlines that the ease of use and usefulness are predictors of individuals attitudes towards a technology (Lederer et al 2000, p. 269). The level of perceived usefulness (PU) and ease of use (PEoU) of a technology join together to create the attitude about the technology, while influencing the individual's decision to adopt the technology or not (Jaeger and Matteson 2009). PU and PEoU are impacted and ultimately shaped by numerous external factors which are unique to each situation, while behavioural decisions or intentions form the ultimate decision point to whether a technology is adopted or not (Davis et al 1989). TAM is based on the theory of reasoned action, which states that beliefs influence intentions, and intentions influence one's actions (Ajzen and Fishbein 1972).

There have been multiple iterations of TAM; however, Figure 3 highlights the factors in version one that have remained constant across multiple iterations. Both PEoU and PU are fundamental components of TAM and are defined within the model as the most important in determining acceptance and use of a technology (Gefen 2002; Moon and Kim 2001; Sabramanian 1994). TAM has been used widely to explore the user adoption behaviours in IT-related fields, in both broad and narrow environments (Serenko and Bontis 2004). According to Shih (2004), the major advantage of applying TAM is the flexibility in application, whereby

it can be extended to include additional variables when necessary. This depends largely on the specific technological context, whereby additional domain-specific constructs and explanatory variables may be needed beyond the ease of use and usefulness constructs (King and Gribbins 2002).

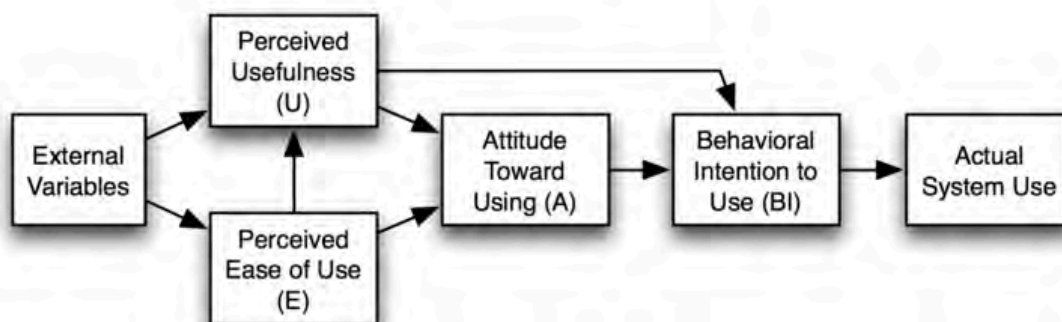


Figure 3. Technology Adoption Model (Version 1) (Source: Davis, Bagozzi and Warsaw 1989)

Table 5 outlines the common factors outlined within TAM. There are a number of different external variables/factors considered, and the importance of each factor is different depending on the research.

Table 5. Factors within Technology Adoption Model

Construct	Definition	References	eGovernment Research
Perceived Ease of Use (PEoU)	1) The degree to which a person believes that using a particular system would be free of physical and mental effort. 2) The extent to which a person believes that using a technology will be simple.	Karavasilis, Zafiroopoulos and Vrana 2010 Davis et al 1989; Venkatesh 2000; Venkatesh 1999; Adam, Nelson and Todd 1992	PEoU is linked to an individual’s estimation of the effort he or she will have to put in to learn and use a technology.
Perceived Usefulness (PU)	The degree to which a person believes that using a particular system would enhance his or her job performance.	Karavasilis et al 2010; Davis et al 1989; Mathieson 1991; Taylor and Todd 1995	PU is a strong determinant of user acceptance, adoption, and usage behaviour.

Attitudes Towards Using (A)	The degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour.	Ajzen 1991; Ajzen and Fishbein 1980; Jackson, Chow and Leitch 1997	Individual users who develop a positive attitude toward adopting a technology are more inclined to build up firmer intentions to consider long term use.
Behavioural Intention	Attitudes towards behavioural intentions are defined as the degree to which individuals make favourable or unfavourable evaluations or appraisals of the behaviour in question.	Ajzen and Fishbein, 1980; Davis et al 1989; Dishaw and Strong 1999; Szajna 1996; Moon and Kim 2001; Venkatesh and Davis 2000; Venkatesh et al 2003; Davis et al 1989; Mathison 1991; Pavlou and Fygenson 2006; Taylor and Todd 1995	The strength of an individual's behavioural intention to use or to support the adoption of eGovernment innovation will impact ongoing use.
External factors			
Social Influence	1) The degree to which an individual perceives others believe in the system provided. 2) The degree to which an individual believes that others thought they should use electronic government services.	Rana, Dwivedi, Lai, Williams and Clement 2017; Melone 1990; Davis et al 1989; Malhotra and Galletta, 2005; Hsu and Lu 2004	Social influence has been found to have positive impacts on attitudes towards adoption. The effect of social influences has been found to play a vital role in determining the acceptance and usage behaviour of new adopters of technological innovations.
Voluntariness	The degree to which the use of the innovation is perceived to be voluntary or of free will.	Rogers 1983; Brown et al 2002; Malhotra and Galetta 2005	In the case of eGovernment, most eServices implemented will be done on a mandatory basis and hence, it is justified to study the user perceptions of voluntariness on the eGovernment service implemented.
Compatibility	1) The degree to which an innovation is perceived as consistent with the existing values, past experience, and needs of potential adopters. 2) The degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters.	Rogers 1983; Agarwal and Prasad 1998; Carter and Belanger 2005; Hung et al 2006; Moore and Benbasat 1991	Compatibility has been found to be a significant determinant in citizen's intention to use eGovernment services.

Trust	1) Belief that the trustee will act cooperatively to fulfil the trustor's expectations without exploiting its vulnerabilities. 2) Belief that a particular eGovernment service will act in a responsive manner when a citizen engages with the service. 3) Set of expectations that tasks within an eGovernment service can be completed reliably.	Belanger et al 2002; Carter and Belanger 2005; Hung, 2006; Ha and Stoel 2009; Gefen, Karahanna and Straub 2003; Kim and Lee 2009; Pavlou and Fygenson 2006; Pavlou 2003; Wang and Benbasat 2005; Teo, Srivastava and Jiang 2008; Sitkin and Roth 1993	To adopt eGovernment services, citizens need to have a degree of confidence in the electronic services provided by Government before they accept and use it. Trust has been identified as an indicator of citizen's acceptance of eservices.
Facilitating conditions	The degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system.	Venkatesh et al 2003; Taylor and Todd 1995; Rana et al 2017; Carter, Schaupp, Hobbs and Campbell 2012; Schaupp et al 2010; Lee and Lin 2008; Schaper and Pervan 2007	Facilitating conditions (resource facilitating conditions and technology facilitating conditions) are significant motivators to citizens' use of eGovernment services.
Culture	Culture determines the values of an individual and impacts on behaviour and varies across countries.	Hofstede 1997; Gefen and Straub 1997; Schepers and Wetzels 2007; Thomas and Streib 2003	Recognition of cultural and contextual variations when nations adopt information technologies, including eGovernment services.

Previous research has investigated the use of TAM within the eGovernment context and found that on its own TAM was not able to explain issues of technology adoption related to eGovernment (Al-adawi, Yousafzai and Pallister 2005; Colesca and Dobrica 2003; Sang, Lee and Lee 2009; Jaeger and Matteson 2009). The issues are commonly associated with the creation of TAM to respond to voluntary settings, as opposed to understanding mandatory settings (e.g. eGovernment) (Koh, Prybutok, Ryan and Wu 2010; Lee and Park 2008). Research utilising TAM to understand adoption in mandatory spaces was found to not provide specific outcomes (Koh et al 2010). For example, within voluntary systems users are free to decide whether or not to use the system, whereas in mandatory settings the choice is not present (Rawstorne, Jayasuriya and Caputi 2000). Within a mandatory setting, users are required to use a certain system or technology (Koh et al 2010), and technology use is determined by organisational objectives and aims (Adamson and Shine 2003). Therefore, it appears that

external factors impacting the use of a technology in a mandatory setting provide less information about the adoption of technology. This includes facilitating conditions, whereby it is expected that they will have a significant influence in mandatory settings, as users may vary considerably in terms of access and ability to use resources and obtain assistance (Hsieh et al 2008; Sykes, Venkatesh and Gosain 2009). However, this does not provide sufficient information into who would be more likely to be impacted by a lack of access to support or ability to use a service. This highlights where TAM and extended models of TAM could have fallen short.

eGovernment is a manner to improve public services quality to be efficient, effective and transparent (Astawa and Dewi 2017). eGovernment's aim is to improve the interactions between government and society for the provision of public services through the use of ICT (Gil-Garcia and Pardo 2005), with multiple different government platforms from across the world that can be compared against (Ciarniene and Stankeviciute, 2015). The majority of eGovernment literature focuses on increasing public trust as a factor to increase adoption and use (Belanger and Carter 2008; Warkentin et al 2002; Carter and Belanger 2005). The creation of levels of public trust determines adoption of eGovernment services, bringing benefits to citizens including time, availability and cost savings (Gasova and Sofkova 2017; Arduini and Zafei 2014). TAM has a broad application, however it does not provide a holistic response to how digital adoption relates to the effectiveness of digital transformation or the digital services.

2.3.7 Diffusion of Innovation Model

The Diffusion of Innovation (DOI) model has also been utilised heavily for the explanation of adoption of new innovations or technologies (including eGovernment) (Rogers 1995). The model is broken down into the two key parts – diffusion and innovation. Diffusion is defined as “the process by which an innovation is communicated through certain channels over time among the members of a social society” (Rogers 1995; Rogers 2003). An innovation is something that is perceived to be new (Rogers 1995). Furthermore, within DOI, adoption is defined as the decision of the full-time use of an innovation, which is based on the idea that it is the best course of action available (Rogers 2003). In contrast, rejection refers to the decision to not adopt an innovation (Rogers 2003). Finally, the diffusion of an innovation is defined as

the rate at which the innovation (for example, online services) has been adopted and the rate at which this adoption has spread more broadly.

Diffusion is a process by which an innovation is identified then communicated through certain channels, and then taken in by members of a society (Rogers 1995). There are five stages of the decision process: (1) knowledge, this is when the individual learns about or becomes aware of the existence of the innovation and learns how to use it correctly. Persuasion (2) occurs when the individual develops an opinion, be that positive or negative, about the innovation (influenced through subjective evaluations provided by others, including peers, to reinforce social ideas). The decision (3) is when the individual chooses to either adopt or reject the innovation. If the decision is to adopt the innovation, the next stage is implementation (4), whereby the mental information processing and decision-making comes to an end, but the behavioural change begins, and the innovation is put into practice. Finally, confirmation (5) occurs when the individual seeks support for their decision. This requires continuous evaluation of the results of their decision, and if the level of satisfaction is significant enough and the level of support is high, then the use of the innovation will continue. However, in contrast if the level of satisfaction is low and there is inadequate support, rejection can occur.

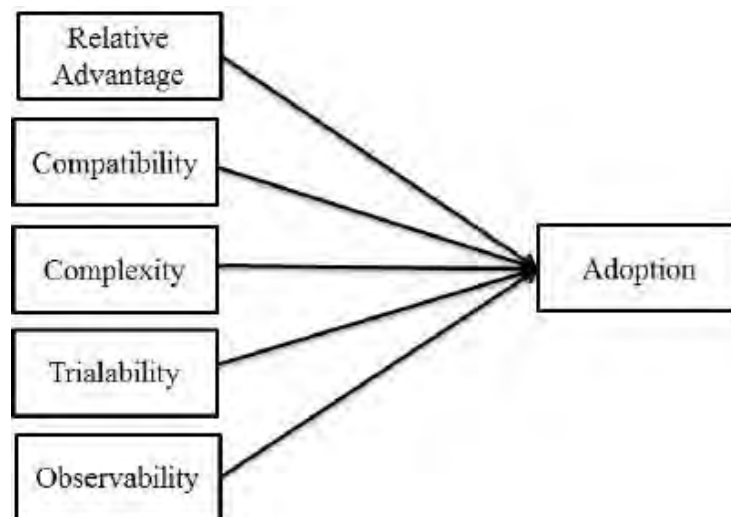


Figure 4. Diffusion of Innovation Model (Roger 1983)

Figure 4 outlines the five attributes associated with the rate of diffusion: relative advantage, compatibility, complexity, trialability and observability (Rogers 1983). The definition of each key factor is outlined in Table 6. These key factors are also supported by additional factors that relate to each of the key factors, outlined in Table 7.

Table 6. Key factors of Diffusion of Innovation

Factor	Definition	References
Relative advantage	The degree to which an innovation is perceived as better than the idea it supersedes	Carter and Belanger 2005; Sang et al 2009
Compatibility	The degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopter	Agarwal and Prasad 1998; Carter and Belanger 2005
Complexity	Degree to which an innovation is perceived as difficult to understand and use	Agarwal and Prasad 1998; Carter and Belanger 2005; Sang et al 2009
Triability	Degree to which an innovation may be experimented with on a limited basis	Puspitasari and Ishii 2016; Sausanto and Goodwin 2013; Venkatesh et al 2003
Observability	Degree to which the results of an innovation are visible to others	Zhu, Dong, Xu and Kraemer 2005; AlKalbani, Deng, Kam and Zhang 2017

Table 7. Additional Factors Relevant for Diffusion of Innovation

Factor	Definition	References	eGovernment literature
Performance expectancy	Degree to which an individual believes that adopting eGovernment will result in better public service performance.	Sabani, Deng and Thai 2018; Venkatesh et al 2003; Kurfali, Arifoglu, Tokdemir and Pacin 2017	Performance expectancy is about the degree to which citizens believe that adopting eGovernment would result in better public service performance.
Effort expectancy	Degree of ease in using eGovernment.	Sabani et al 2018; Williams, Rana and Dwivedi 2015; Venkatesh et al 2003	Influences the intention to adopt eGovernment.
Social influence	Degree to which individuals perceive the importance of others' perceptions on the adoption of eGovernment.	Sabani et al 2018	Not been popularly examined in the context of eGovernment adoption.

Availability	(a) System availability (b) Information availability (c) Service availability	Mirchandani, Johnson and Joshi 2008; Papadomichelaki and Mentzas 2012	The availability of eGovernment system, obtainability of government information and availability of eGovernment services.
Efficiency	(a) Process simplicity (b) Process timeliness (c) Process efficiency	Deden, Teddy, Farhan and Aizi 2017; Nam 2014; Venkatesh et al 2003	Easy to understand, faster than traditional services to obtain and less expensive than traditional approaches.
Information security	Availability of law and policies around information security, levels of organisational compliance, identification of risks and awareness.	AlKalbani, Deng, Kam and Zhang 2017; Debjani, Umesh and Gupta 2012 Posthumus and Von Solms 2004.	The existence of security policies in relation to eGovernment.
Information Quality	Information is accurate, relevant, prompt and understandable.	Papadomichelaki and Mentzas 2012; Wangpipatwong, Chutimaskul and Papasratorn 2009	eGovernment should provide information that is necessary and understandable.
Usefulness of service	Reliability of the service, usability and fit for purpose.	Deden, Teddy, Mohd Farhan and Aizi 2017; Idris 2016; Yasar and Giovanni 2007; Ionescu 2013; Kim, Kim and Lee 2009; Prahono and Elidjen 2015	It can be assessed by measuring the extent to which eGovernment services fulfil the citizens' requirements.
Accessibility	Ease of access to the service and the availability of ICT and internet.	Ahmed and Shirley 2014; Idris 2016; Puspitasari and Ishii 2016	The level of effort that the individual must make to access ICT devices.
ICT Literacy	Capacity of the individual to utilise ICT and the internet confidently.	Maslihatin 2016; Puspitasari and Ishii 2016; van Deursen and van Dijk 2011	eGovernment adoption is impacted by the level of ICT literacy an individual has and the level of experience they have using the internet.
Usability	The perceived user-friendliness of a service.	Puspitasari and Ishii 2016; Sausanto and Goodwin 2013	The level of effort citizens must make to learn and use eGovernment effects ongoing adoption.

Government Encouragement	Refers to the actions taken by the government to support the adoption of eGovernment.	Furuholt and Wahid 2008; Hwang and Syamsuddin 2008; Nurdin, Stockdale and Scheepers 2012	The level of support from the government to maintain the timely information about the presence of eGovernment effects adoption.
Community Expectation	Pressure by a person's proximity to take certain actions or adopt certain values.	Deden et al 2017; Kurfali et al 2017; Rana et al 2017; Voutinioti 2013	The level of eGovernment acceptance from individuals' community

Although the DOI has been used widely, there is a lack of consistency as to its application and how its findings can be applied to determining the effectiveness of digital transformations. Specifically, there is a lack of measurability of the methods and tools applied within the DOI approach, thus highlighting why DOI was discarded for this research.

2.4 eGovernment Evaluation Frameworks

The trend towards eGovernment services follows the ongoing digital transformation in service provision in the public sector in general, which in itself mirrors the transformation undertaken in the private sector. Increased eGovernment service provision has led to more research which focuses on developing different evaluation frameworks to determine its effectiveness or success. Although there are a number of eGovernment evaluation frameworks, outlined in Table 8, the majority focus on specific elements of the process or on a particular platform (Osman, Anouze, Irani, Lee, Balci, Medini and Weerakkody 2011). Each of these eGovernment evaluation frameworks focuses on different elements of eGovernment services; however, there is a lack of measurability and guidance for linking digital adoption, eGovernment services and effective digital transformations.

Table 8. eGovernment Evaluation Frameworks

Themes	Description	Reference
Holistic, complete and continuous evaluation	Holistic Reference Framework for eGovernment Evaluation evaluating multiple different factors and elements impacting the effectiveness of eGovernment services.	Wimmer 2002

	Evaluation of eGovernment systems using a holistic Framework to determine what impacts views on eGovernment services.	Alalwan and Thomas 2011
	Holistic evaluation framework (COBRAS) focusing on the cost, opportunity, benefit, and risk analysis for user satisfaction with eGovernment services provided.	Osaman et al 2011
	Utilising business process management for modelling the creation of a holistic framework for the evaluation of effective eGovernment services.	Palkovitis and Wimmer 2003
Multi-dimensional	Evaluation of eGovernment service performance, based on understanding the success and failure factors associated with eGovernment portals.	Wang, Bretschneider and Gant 2005; Alanezi, Mahmood and Basri 2012
	Evaluation of eGovernment services by focusing on the internal tools for security, privacy, usability, content, services, features and citizen participation.	Middleton 2007; Eschenfelder and Miller 2007; Golubeva 2008
	Evaluation of Government websites focusing on openness and trust (social and political evaluation) factors and perspectives.	Eshenfelder and Miller 2005
	Evaluation of government websites focusing on users' perspectives on ease of navigation, website design, communication, information quality and security.	Kaisara and Pather 2011
	Evaluation of eGovernment services focusing on users' perspectives of four major factors: usability, user feedback, usage data, and web and internet performance data.	Wood, Siegel, LaCroix, Lyon, Benson, Cid and Fariss 2003
	Creation of a four-dimensional quality framework (CC2ST) for eGovernment services focusing on coordination, control, sharing and transparency.	Corrdaini, Hinklemann, Polini and Re 2012
	Evaluating perceptions of reliability, efficiency, citizen support and trust of eGovernment services, to develop eGovQual multimethod scale evaluation.	Papadomichelaki and Mentazas 2012
	Evaluating eGovernment services based on the link between perceived usefulness and users' expectations leading to user satisfaction. To create Customer Satisfaction Index for eGovernment (g-CSI).	Kim, Im and Park 2005
	Evaluating eGovernment services focusing on maturity, stakeholders and assessment of the services provided. End product called eGovernment Assessment Model (EAM).	Esteves and Joseph 2008

	Evaluation of eGovernment through factors of user satisfaction, continuous usage and users' profession to develop a framework for ongoing service use.	Kalamatianou 2017
Model Development	Creating adoption criteria of the users of eGovernment services to evaluate the same services.	Bwalya 2009
	Using various factors outlining the effectiveness of the processes used within the eGovernment services to build a reference process model for evaluating effective eGovernment services.	Tsohou, Lee, Irani, Weerakkody, Osman, Latif and Medeni 2012
	Using multiple criteria to understand what makes an eGovernment platform adaptive to change, to develop a Model for adaptive quality measurement (MAQM).	Magoutas and Mentzas 2009; Magoutas, Schmidt, Mentzas and Stojanovic 2010
	Evaluation model derived from Analytic Hierarchy Process to use various options, model the options and build the best practice model to achieve optimal system goals.	Ray and Rao 2004
	Using decision support systems to determine the most effective problem-solving techniques to manage eGovernment services to develop a Novel Decision Support System Framework for eGovernment Evaluation.	Riad, El-Bakry and El-Adl 2010
	Building a model for the evaluation of information systems based on diffusion of innovation and user centric principles – focusing on eGovernment.	Zhang, Guo and Chen 2007
	Building an evaluation strategy for eGovernment services provided in developing countries.	Alshawy and Alawany 2009
	Using local accountability principles to build an evaluation strategy.	Griffin and Haplin 2005
	Creating a hard, soft and hierarchal measure to build a flexible evaluation framework for eGovernment.	Gupta and Jana 2003
	Using the various stages of growth to evaluate eGovernment services through interoperability measures.	Solli-Saether 2011
Public Value	Understanding the role of public value and evaluation-led design in eGovernment services.	Grimsley and Meehan 2007
	Development of a comprehensive framework to assist in understanding what is meant by public value in eGovernment.	Ndou 2004

	Development of a four-dimensional model, using the achievement of outcomes, development of trust, delivery of public services and effectiveness of public organisations as the background for evaluation of eGovernment services	Karunasena and Deng 2009
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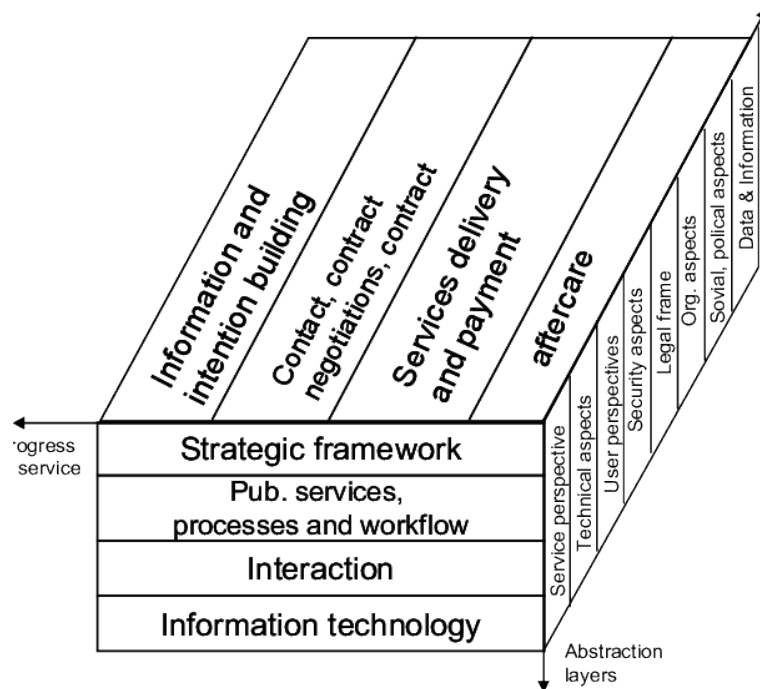


Figure 5. Wimmer (2002) 'Holistic Reference Framework for eGovernment Evaluation'

Within Table 8, the most used framework is that of Wimmer (2002) – the Holistic Reference Framework for eGovernment Evaluation (as outlined in Figure 5). Wimmer (2002) states the necessity of a holistic approach for evaluating eGovernment services. As per Figure 5, Wimmer (2002) has outlined a three-dimensional model which includes (1) progress of a public service, (2) abstraction layers, and (3) different views. The different views include (1) cultural, societal and political, (2) legal, (3) process, (4) organisational, (5) user, (6) knowledge, (7) security and privacy, and (8) technical. Although this model outlines a number of factors for consideration and provides a reference point for an individual to consider, it does not outline how to clearly implement the reference framework.

Although the frameworks and models outlined in Table 8 have been widely cited and have been used to inform one another, including Wimmer’s 2002 framework, criticisms of these

frameworks and models have also been documented within the literature. Firstly, many of the models are not adaptable and/or directly applicable to the eGovernment environment in every country or organisation, due to differences in policies or requirements (Yildiz 2007; Ostasius and Laukaitis 2015). Although many of these frameworks and models discuss the importance of governments having a certain level of preconditions in place to ensure eGovernment platforms are successful, they do little to discuss how these can limit the objectives of eGovernment platforms (Omari and Omari 2006; Ostasius and Laukaitis 2015). They tend to focus on physical infrastructure or policy requirements, instead of understanding how each country faces different cultural, social and economic impacts as well as political, infrastructural and technical factors (Zarei, Ghapanchi and Sattary 2008). By focusing only on some of the issues impacting effective eGovernment services, they are not providing holistic frameworks for digitalisation of government services.

As a result, there is a gap in the literature for customisable, holistic and systemic models or frameworks for guiding effective digital transformations, building digital services and meeting the minimum expectations of service users. Critiques of the frameworks and models within Table 8 state that there is a greater need for adaptable models that can meet changing environments which are able to monitor, evaluate and benchmark the current challenges and prepare for future ones (Valdes, Solar, Astudillo, Iribarren, Concha and Visconti 2011). Ostasius and Laukaitis (2015) indicated that there was no model or framework which could be universally applied to eGovernment evaluation or planning, especially across countries and different services. The large number of different models and frameworks identifies how there is a lack of a common framework in place (Siau and Long 2005). Therefore, there is a need for a universal or systemic model or framework that can guide or support the creation of eGovernment frameworks, along with the digital transformation process associated with eGovernment service creation.

2.5 Digitalisation and Digital Transformation

It is important to have a clear definition of digital transformation and digitalisation as for this research it is the phenomenon of study in the field (i.e., ATO). Both digitalisation and digital transformation refer to a business model driven by the changes associated with the application of digital technology in all aspects of human society (Stolterman and Fors 2004, p.

689). Digital technology is usually implemented through digitisation, which is the transition of existing products or services into digital variants which offer specific advantages over tangible products (Gassman, Frankenberger and Csik 2014). More specifically, the digitisation process refers to changes to an organisational model based on the application and use of digital technology within all aspects of an organisation (Henriette, Feki and Boughzala 2015). Consequently, organisations who undergo the digitalisation process are more able to provide new products, organisational models, services and organisational structures based on changes made with the addition of technologies that combine information, computing, communication and connectivity (Bharadwaj, El Sawy, Pavlou and Venkatraman 2013; Fichman, Dos Santos and Zheng 2014; Yoo, Boland, Lyytinen and Majchrzak 2012).

EY (2011) and Australian Parliament House (Hamilton 2019) both delineate digitisation as the conversion of analogue information to digital, capturing and storing different elements of everyday life into digital formats. Digitalisation is increasing the networks and interconnectedness of everyday objects, people and environments, increasing the complexity of understanding and assessing different stakeholders. The primary impact of digitalisation is the ability to share information in real time and globally between multiple devices. McDonald and Roswell-Jones (2012) state that digitalisation uses digital technologies to alter business models, to provide enhanced value adding and produce opportunities. This definition differs slightly from that of Hamilton (2019), who describes digitalisation as increases in efficiencies as a result of the increased use of technologies, through the integration of processes and linking customer experiences (Hamilton 2019). More generally speaking, services alter and/or accelerate previous business operations without changing their fundamentals (Hamilton 2019). Digital transformation is the next stage – it challenges the operational structure of an organisation by enabling services to be performed in new ways or creating completely new services. Numerous challenges arise when going digital, including privacy and employment (Hamilton 2019).

Digital transformations often form part of an enterprise transformation, which might include a change in products, processes, organisational structures and/or governance (Matt, Hess and Benlian 2015). With the rapid digitalisation across both private and public sector organisations, there are increased opportunities within both sectors to collaborate and improve. However, research by Matt et al (2015) demonstrates that there are four key elements that need

to be considered when undergoing digital transformations. The first is the use of technology, which includes the ability to adopt the new technology and build standards for use. Second, changes impacting value creation includes changing how business models are comprised and managed in the long and short term. Third is the structural changes to the organisation, which includes upskilling, organisational set-up (employees and equipment) and products used. Finally, finance needs to be considered, whereby the cost becomes a primary driver to digitalisation, in both short-term increased cost and long-term decreased cost of service provision (Matt et al 2015). These four factors need to be considered by organisations when implementing effective digital transformations.

The transformative effect that the emergence and ongoing growth of digital technologies has had on organisations is profound, enabling changes to the way businesses manage internally and externally, while also impacting how organisations communicate with their clients (Kamar, Loonam, Allen and Sawyer 2016). Digital technologies are defined as a combination of information, computing, communication and connectivity technologies (Bjharadwaj, Sawy, Pavlou and Venkatraman 2013), which enable the development of new products, business models, services and organisational norms (Fichman et al 2014; Yoo et al 2012). The inclusion of digital technologies within a business or organisation impact people, culture and information technology within and outside of an organisation. The people impacted first are those who are essential to the transformation, including the collaboration and communication between the human actors (e.g. internal and external collaborators including customers, clients) (Wilms, Meske, Stieglitz, Decker, Frohlich, Jendrosch, Schaulies, Vogl and Rudolph 2017; Klotzer and Pflaum 2017; Piccinini, Hanelt, Gregory and Kolbe 2017; Tan et al 2017; Schmidt, Drews and Schirmer 2017). As a result of the digital transformation, the culture within and outside the organisation will be impacted. This includes the collective values and beliefs, and the changes and challenges that are created during this process (Oesterle, Buchwaid and Urbach 2016; Hartl and Hess 2017; Roecker, Mockler and Novales 2017). Digital transformation is a process full of complex challenges and requires an understanding of all internal and external stakeholders to ensure ongoing engagement.

2.6 Stakeholders

For an organisation to thrive, they must include all of the different stakeholders and their perspectives, while also addressing the variety of expectations and influences (Brenner and Cochran 1991). This is also directly relevant for projects and transformations, whose success depends on an organisation's ability to develop, maintain and express the different expectations of internal and external stakeholders (Kennon, Howden and Hartley 2009). Therefore, this research supports Kennon et al's (2009) work that posits that satisfied stakeholders often greatly improve progress, and the relevance of a project, organisation and transformation ultimately contribute to its success.

It is clear that human and social capital is a necessary resource required to deliver desired results (Kennon et al 2009). The focus of understanding and researching stakeholders is to assist organisations to identify and classify those individuals or groups who have a stake in the organisation. In doing so they gain an understanding of their external environment and can better manage the multiple drivers and influences (Mitchell, Agle and Wood 1997). In this space, research needs to use existing frameworks but also establish new approaches integrating and synthesising the different perspectives of multiple stakeholders (Yang and Lim 2008). Stakeholder engagement relates to how stakeholders are managed and the role management play in engaging stakeholders (Beach 2009). Therefore, there is an ongoing relationship between an organisation and the external environment, and the stakeholder has a relationship with both (Mainardes, Alves and Raposo 2011).

An organisation will not be able to maximise value if it ignores or does not consider the interests and expectations of its stakeholders (Jensen 2001). Identifying and understanding stakeholders is complex, as the real-world is comprised of interrelationships and trade-offs which are difficult to map and understand; however, understanding these is vital to building a clear picture of stakeholders (Wilmshurst 2002). All stakeholders have different levels of interest and investment in the organisation, transformation and project outcomes (Newcombe 2003). If managers fail to manage the dynamic differences between stakeholders, it could potentially jeopardise outcomes (Lim and Yang 2008). Therefore, without appropriate stakeholder identification and engagement, the organisation is more likely to irritate the stakeholders by either over or under engaging (Reed, Graves, Dandy, Posthumus, Hubeck,

Morris, Prell, Quinn and Stringer 2009). As a result, stakeholders identify an organisation's value by their willingness to satisfy the needs and demands of stakeholders beyond what is necessary to simply maintain their participation (Harrison and Freeman 1999; Jensen 2001).

2.6.1 Stakeholder Definitions

There are numerous definitions of stakeholders within the literature. This research has adopted the definition offered by Freeman (1984), which states that a stakeholder is anyone that could be to any extent potentially affected by the firm, project or transformation and vice versa. According to this definition, stakeholders include those groups and individuals that can affect and be affected by organisations or transformations (Freeman 1984). Freeman (1984; 2004) went further to state that stakeholders include any groups without whose support the organisation would cease to exist, or which are vital to the success of the organisation. Bryson, Patton and Bowman (2011) provide a broader definition by defining stakeholders as individuals, groups or organisations that can affect or are affected by, an organisation's operation and objectives. This broader definition provides additional scope for understanding and exploring the various stakeholders who are influential to an organisation.

Both Jones (1995) and Jonkers and Fosters (2002) provide a similar definition to Freeman, stating that a stakeholder can be any actor (group or individual) that is influenced by a decision, and/or that can influence that decision (Jones 1995; Jonkers and Fosters 2002). According to Donaldson and Preston (1995), all persons or groups with legitimate interests who participate in an organisation and obtain benefits are stakeholders, and that stakeholders, regardless of their position, have no hierarchy, thus there is no priority given to one set of interests and benefits over another. Barney and Hansen (1994) state that rational stakeholders are those who only reveal information or provide assistance in order to improve their own position, which adds complexity to understanding and identifying stakeholders. A different view is that stakeholders are those who have a critical interest in the operation and success of an organisation (Elias, Cavana and Jackson 2002; Freeman 1984; Androif and Waddock 2002; Ambler and Wilson 1995).

There are multiple definitions of stakeholders which are restrictive, including groups or individuals who yield power over the firms (Frooman 1999; Pajunen 2006) and/or those who take on the risks (Clarkson 1995; Cragg and Greenbaum 2002). As organisations can be seen

as social institutions with responsibilities beyond just economic to shareholders, directors and employees, it is important that stakeholder definitions include internal and external stakeholders (Ambler and Wilson 1995). By only incorporating a singular or restrictive view of stakeholders, the definitions do not provide a clear and holistic understanding of the stakeholders' view. A multidimensional lens and a broader definition of what constitutes a stakeholder can help managers and researchers better understand organisational stakeholders.

2.6.2 Stakeholder Theory: The Big Picture

Stakeholder theory outlines the need for stakeholders to be identified, analysed and engaged and managed in response to their level of stake within the organisation, project or transformation. According to Freeman and Reed's (1983, p. 91) definition, understanding stakeholders requires finding the balance between the various relationships which can impact the enterprise and affect it while it is trying to reach its goals (Freeman and Philips 2002). Therefore, the first step is to identify stakeholders. Two forms of stakeholders have been identified: primary and secondary. Primary stakeholders are those whose continual and direct participation or input is vital for organisational survival (e.g., owners, investors, employees, suppliers, customers and competitors) (Clarkson 1995). Secondary stakeholders are those who might influence or be influenced in the past, present or future by the organisation's operations, without directly engaging in transactions. Hence, they are not essential to the survival of the organisation (Clarkson 1995) (e.g., local communities, local government, social activist groups and business support groups). A systems approach can also be used to identify stakeholders, whereby stakeholders are identified according to their systems or relationships. This includes understanding and identifying which systems they are a part of and who they interact with (Freeman, Harrison and Wicks 2007). This technique is useful, as it specifically highlights how the way in which a firm treats one stakeholder will influence the relationships with other stakeholders (Freeman et al 2007).

Stakeholder analysis involves obtaining a deeper understanding of the various stakeholders, how they interact and what influences them, and should relate to the specific phase (of the project or change) or area of the organisation under review (Goodpaster 1991). According to Pfeffer and Salancik (1978) the interactions between the stakeholders, the organisation and between one another can be understood based on resource dependency theory.

This theory sees the environment and enterprise as strongly interconnected – the enterprise will depend on some of the actors within the environment in order to gain access to resources they control (Pfeffer and Salancik 1978). More recent research is based on similar ideas; however, it has shifted to consider the stakeholders based on the opportunities and threats they pose (Madsen and Ulhoi 2001). Madsen and Ulhoi (2001) outline the importance of stakeholder analysis, understanding the stakeholders by what opportunities they offer, through the use of a SPOT analysis (Secondary, Primary, Opportunity and Threat). According to this analysis, once stakeholders and their stakes are identified, they can be classified as either a threat to the achievement of the organisation's objectives or as an opportunity for the improvement of business by the encouragement of new ideas, exposure of market niches, contribution of information and knowledge, and the communication of expectations (Madsen and Ulhoi 2001). This analysis feeds into the creation of a stakeholder engagement and management plan, which defines the strategic direction based on the stakeholder needs, economic and ethical requirements (Goodpaster 1991).

Stakeholder engagement and management is influenced by the identification and analysis of stakeholders. Appropriate stakeholder engagement and management is impacted by three key challenges, including understanding the environment, the best approach to responding to stakeholders, and the influence of different organisations on the strategic decision-making (Dill 1975). Therefore, the primary goal of stakeholder engagement is to find the balance between the various relationships which can impact the enterprise and affect it while it is trying to reach for its own goals (Freeman and Philips 2002). This includes understanding and exploring the interdependence of the stakeholders to the environment as well as the organisation. This is especially important when an organisation needs to understand and prepare for the impacts of communication when there is no one-on-one correspondence between stakeholders (Wicks and Harrison 2013). Thus, it is important to understand, analyse and engage stakeholders in an appropriate manner.

2.6.3 Use of Stakeholder Theory in Practice

Stakeholder theory is commonly applied through three specific uses: descriptive/empirical, instrumental, and normative (Donaldson and Preston 1995). Firstly, the descriptive/empirical method outlines how stakeholder theory is used to describe and explain the various and specific

characteristics and behaviours of an entity (e.g., nature of the organisation, management behaviours and values, organisational management and external behaviour) (Donaldson and Preston 1995). Within the descriptive/empirical method, the stakeholder identification processes incorporate the organisation's broadest definition of stakeholders. In most cases this follows the Freeman (1984) definition, whereby a stakeholder encompasses all groups of individuals who can affect or are affected by the achievement of organisational goals (Freeman 1984; Donaldson and Preston 1995). Secondly, the instrumental method is used to determine how stakeholder theory can be used in a manner to identify connections (or lack of) between stakeholders, organisations and stakeholder management (Donaldson and Preston 1995). Under this method of stakeholder identification, analysis and management, all stakeholders are considered on the basis of their valid claims to an organisation (Ring 1994). This can be somewhat limiting, as it does not necessarily regard every stakeholder as valuable, and therefore provides a lack of inclusivity in the stakeholder engagement and management process. Finally, the normative component refers to how stakeholder theory is used to understand the function of an organisation in relation to the moral and philosophical guidelines which direct operational and managerial outcomes of the organisation (Donaldson and Preston 1995). This requires striking a balance between the broad method of descriptive/empirical and the narrow method of instrumental. Thus, as per the normative method, stakeholders are defined as anyone the organisation should take into account using organisational, stakeholder-focal group, and stakeholder network perspectives (Mitchell et al 1997; Friedman and Miles 2006; Rowley 1997). By classifying stakeholders according to their networks or interrelationships, the process of understanding the best management and engagement techniques for each stakeholder or stakeholder group becomes clearer (Freeman et al 2007). However, stakeholder network perspectives are not the only manner in which stakeholder relationships can be understood, as discussed below.

2.6.4 Stakeholder Analysis

There are various approaches to stakeholder analysis, which will now be presented and discussed.

Stakeholder Salience Model

One of the most widely used stakeholder analysis and identification processes is the Stakeholder Salience Model. It uses three key attributes to classify stakeholders: power, legitimacy and urgency. (Mitchell et al 1997). Stakeholder salience is defined as the degree to which stakeholders have the potential to influence an organisation's decisions (Mitchell et al 1997). Power is described as the capability of stakeholders through relationship dependency and resources occupation (Yang and Zou 2014) and the ability to bring about the outcomes they desire (Mitchell et al 1997). Power is defined by three specific types. Firstly, coercive power is based on the physical resources or use of force, violence or restraint (Etzioni 1964). This is also called observable power. Secondly, utilitarian power is based on financial or material resources. This includes rules, models, media and methods that underpin the observable (Lukes 1974). Finally, normative power is based on symbolic resources, including being able to command attention. This can also be associated with the deeper social structures underpinning the rules (Lukes 1974). The type of power is then associated with the stakeholder's level of legitimacy (which is their level of authority) and urgency (which is their time sensitivity).

Legitimacy is described as how appropriate the stakeholder claims or behaviours are according to the norms and values of the social organisation (Yang and Zou 2014). This refers to stakeholders' actions and whether or not they are perceived to be desirable, proper or appropriate based upon society's norms and values (Mitchell et al 1997). Urgency refers to the level to which a stakeholder claim requires instant response or awareness, depending on the time sensitivity of the issue and its necessity to the stakeholder (Yang and Zou 2014). Urgency also refers to the degree to which a stakeholder claim requires immediate attention due to its critical or highly important nature (Mitchell et al 1997). Therefore urgency can be broken into two separate views: firstly, the degree to which managerial delay in attending to the claim or relationship is unacceptable to the stakeholder, and secondly, the importance of the claim or the relationship to the stakeholder (temporality/time sensitivity and criticality) (Jones 1993).

Figure 6 highlights the subgroups under the power, legitimacy and urgency categories that assist with analysing and identifying stakeholders. Outside of the model are the non-stakeholders – these are the individuals or groups who have no power, legitimacy or urgency.

For these non-stakeholders, the level of engagement or communication is at the discretion of management (Mitchell et al 1997). The other subgroups include:

1. **Dormant.** These are the stakeholders who have power to impose on others; however, they do not have legitimacy or urgency. Therefore, stakeholders who fit within this category should be kept informed (Mitchell et al 1997).
2. **Discretionary** (or latent). These are the stakeholders who have legitimacy; however, they have no power or urgency. Therefore, these stakeholders should only be involved when necessary (also at the discretion of management) (Mitchell et al 1997).
3. **Demanding.** These are the stakeholders who have urgency; however, they have no power or legitimacy to enforce their claims. Therefore, these stakeholders should be kept informed (Mitchell et al 1997).
4. **Dominant.** These are the stakeholders who have both power and legitimacy, this provides them with a strong influence within and around the organisation. It is recommended to keep them informed (Mitchell et al 1997).
5. **Dangerous.** These stakeholders have both power and urgency; however, they do not have legitimacy. These stakeholders should be engaged and satisfied (Mitchell et al 1997).
6. **Dependent.** These stakeholders have both urgency and legitimacy; however, they lack power. They can have significant influence on different stakeholders (internal or external) and need to be managed (Mitchell et al 1997).
7. **Definite.** These stakeholders have power, legitimacy and urgency, and need to be communicated and engaged with in a manner of their choosing (Mitchell et al 1997).

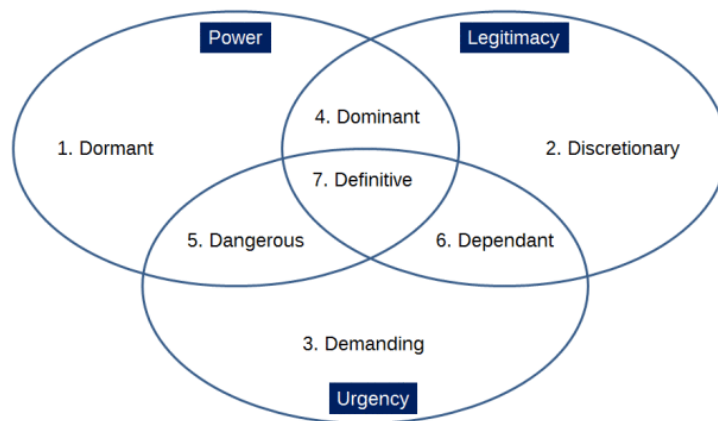


Figure 6. The Stakeholder Salience Model (Source: Mitchell et al 1997)

RACI Model

The RACI matrix/model (Smith 2005, p. 5) focuses on clarifying the roles and responsibilities of the stakeholders, commonly classified in accordance with specific activities or roles. There are four levels: Responsible (R), Accountable (A), Consulted (C) and Informed (I). The person (or persons) who performs the activities or is the overarching decision-maker is defined as responsible. The person who is answerable to the organisation, clients or government is defined as accountable. There can only be one stakeholder in the accountable role. Those who are consulted for opinions, assumptions, constraints, methods or objectives and assist in the development of products, services and processes as a result of their position or expertise are the consulted stakeholders. Finally, those who remain informed of the outcomes of the organisation are the informed stakeholders.

This model should only be applied to key stakeholders, and therefore does not provide insights into the stakeholders who are not key to the outcomes of the organisation (Smith 2005). This can be a limitation, as it is largely subjective in nature. The RACI model is most relevant to the understanding of internal stakeholders (those within the organisation, including the employees and senior leaders) to determine who is most impacted by different process changes, digital adoption and willingness to assist with altering the behaviour of others. The internal workplace culture needs to be considered, as it will have an impact on the success or failure of the adoption of the digital first strategy.

Power Influence model

Stakeholder importance is often identified by the stakeholder's power to influence, their legitimacy to make decisions, or their right to make claims (which are urgent or arbitrary). They have an impact on the system design or on other stakeholders' influence (Mitchell et al 1997). The power/threat level is determined by the resource dependence of the stakeholder, which involves identifying the level of dependence on specific resources and the level of willingness to cooperate (Savage, Nix, Whitehead and Blair 1991). According to this model, there are four types of stakeholders. First, supportive stakeholders are highly cooperative and are low on the competitive threat level (Savage et al 1991). The second level consists of the marginal stakeholders, and includes low cooperative potential and low competitive threat (Savage et al 1991). The third level includes the non-supportive stakeholders, including the stakeholders who have potentially low cooperative and high competitive threats. The fourth level includes mixed blessing stakeholders, which includes stakeholders who are highly cooperative and have high competitive threats (Savage et al 1991).

According to research by Kennon et al. (2009), there are five steps to the identification and analysis of stakeholders. Firstly, the analysis of stakeholders. This first step involves the classification of those stakeholders and discuss why they are critical for the success of the organisation. This step requires focussing on individuals and entities and determining their different levels of power and influence, and their different relationships and environments. The second step is the prioritisation of stakeholders. This process involves building a matrix which identifies how critical they are in helping to deliver outcomes, and determines how to prioritise communications and engagement activities. The prioritisation stage involves identifying levels of influence and power. Influential stakeholders are those who have power (direct or indirect) over the success of the overall project, change or organisation (e.g., financial, positional authority of persuasive power). Power refers to those stakeholders who have the power over the delivery of the outcomes and includes opinion leaders, experts, enablers and innovators. The third stage involves understanding and managing stakeholders. This involves considering the various attitudes, social norms, connections and other elements that present risks and opportunities which could impact the outcomes. The fourth stage is when the goals are set and costs are identified. This involves designating responsibilities for engagement with

stakeholders and organisations. Fifth and finally, is the evaluation and revision stage (which occurs throughout the life of the project).

The power interest model by Eden and Ackermann (1998) demonstrates the potential impacts that a stakeholder may have. The model also demonstrates the communication approach most applicable to the stakeholder group (Eden and Ackermann 1998). Power/interest analysis classifies stakeholders based on their power and interest in the organisation, project, process, service or product. Each stakeholder is allocated to one of four categories (outlined in Figure 7):

1. High power/High interest
2. High power/Low interest
3. Low power/High interest
4. Low power/Low interest



Figure 7. Stakeholder Power/Influence Model (Source: Eden and Ackermann, 1998, pp. 121-5).

The category a stakeholder is classified within suggests different ways to manage the stakeholder. In some cases the four figure matrix demonstrated in Figure 7 is not detailed enough and requires an extended power/interest matrix. As shown in Figure 8, understanding the power and influence of stakeholders is usually complex and may require more in-depth analysis (Eden and Ackermann 1998). The application of both the power/influence models are

most relevant to all stakeholders (both internal and external) and can provide a picture of the level of engagement that is required for each stakeholder group.

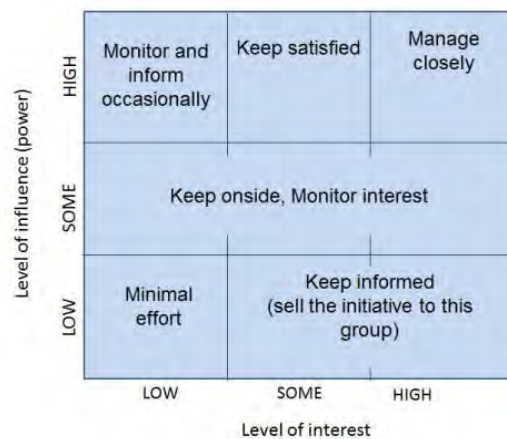


Figure 8. Extended Stakeholder Power/Interest Matrix (Source: Eden and Ackermann, 1998, pp. 344-6).

2.6.5 Stakeholder Management

The management of stakeholders includes managing relationships and interests, and is considered to be a critical component of and considerable challenge for the successful delivery of a project, change or organisation. According to Mok and Shen (2016), stakeholder management is comprised of four key components. Firstly, the identification of stakeholders and issues; secondly, stakeholder classification based on individual attributes; third, examination of stakeholder relationships; and finally, the evaluation of stakeholder influences (Mok and Shen 2016). This process involves balancing stakeholders, specifically the needs of the organisation and the stakeholders respectively (Freeman 1984). The strategies involved with stakeholder management will vary depending on the organisation, the orientation, and the organisational life cycle (Brickson 2005; Brickson 2007; Jawahar and McLaughlin 2001).

Stakeholder management should include maximising the long-term value of the organisation (Jensen 2001), including circumventing the control powers of stakeholders and ensuring ongoing use of ethical tactics (Huse and Eide 1996). Best practice differs depending on the industry of the organisation and the stakeholders (Bendheim, Waddock and Graves 1998). The practices can be better understood by using analytical techniques and understanding

the stakeholder's position within the interrelationships (Rowley 1997; Hosseini and Brenner 1992), including taking the perspective of multiple stakeholders (Schwarzkopf 2006), increasing the level of direct stakeholder participation (including the use of mediation), and balancing interests between decisions to ensure that the more ethical decisions wins (Burton and Dunn 1996; Lampe 2001; Reynolds, Shultz and Hekman 2006). Stakeholder management is complex and understanding and engaging with the correct stakeholders at the right time requires ongoing environmental analysis. The larger the organisation the more complex and challenging the stakeholder management becomes, especially when looking at the public sector which has various stakeholders who play multiple stakeholder roles and have different vested interests in the outcomes of change and projects, and interests in different departments.

2.6.6 Stakeholders in the Public Sector

Stakeholder analysis often only occurs on a singular dimension. There is a need to incorporate a multidimensional stakeholder analysis (Kivits 2013) which is relevant for the government and public sector. Incorporating the multiple points of view of the various service users is vital for the use of eGovernment (Gable 2015). Understanding multiple stakeholder influences provides a deeper understanding than only looking at singular relationships. These relationships occur between an organisation and one stakeholder on a small scale, whereas identifying multiple relationships requires analysing the whole system of stakeholders where an organisations' stakeholders are likely to have direct and indirect relationships with each other (Proctor 2001). For eGovernment performance, there is a multidimensional concept that needs to be considered, including stakeholders and criteria (privacy, services, usability and accessibility) (West 2001; Holzer and Kim 2005). There is a multidimensional and multiple stakeholder nature to the building of innovative government initiatives (Chopra 2014). Furthermore, the best services include citizens, business, non-profits and others in collaboration to build better services (Chopra 2014). Previously, stakeholder network theory was used in the public sector to understand the different relationships between the stakeholders, the organisation and the environment (Proctor 2001; Rowley 1997). Multidimensional stakeholder analysis instead analyses the links between stakeholders. This form of analysis is the one argued for in this research.

eGovernment platforms have become a vital component of governments globally; therefore, stakeholder analysis should be used to examine eGovernment from the perspective of the people who are currently using or who could potentially use the services (including citizens). This can include focusing on social needs (Rodriguez-Bolivar 2014). Addressing the needs of the stakeholders of eGovernment services ensures that service providers meet the performance criteria, outlined in Figure 9.

Performance Criteria
- Accessibility
- Citizen Participation
- Communication
- Efficiency
- Emergency Management
- Equality
- Innovation
- Openness
- Privacy
- Responsiveness
- Security
- Social Change
- Usability

Figure 9. Performance Criteria for Multidimensional Stakeholder Analysis (Chopra 2014; Kivits 2013; Mahmood 2014; Rodriguez-Bolivar 2014)

Due to the customer expectations from consumers of public goods and services, there is an increased demand for understanding stakeholders. In particular in the public sector, as people are used to the increased emphasis on quality and value for money offered within the private sector (Sanderson 1996; Stoney 1998; Vigoda 2002; Norman 2003). Therefore, technological advancements and pressures of expectations need to be continuously monitored and added to the public sector to ensure it keeps up with expectations (Stoney 1998).

Public sector organisations need to be more accountable to their stakeholders. This can be achieved by undertaking public engagement and consultation (Gregory 2003). They need to tap into a wider range of productive capabilities outside the organisation due to limited public resources, including volunteers, not for profits, local interest groups, the general public (Alford 2001; Bovaird 2005). The different “hats” the general public can wear at any one time in relation to public issues include interest groups, voters, customers and citizens (Bingham, Nabatchi and O’Leary 2005). Organisations need to carefully balance the needs and interests of customers who actually consume public products and services with those of the general

public whose interest is more about social outcomes and value for the taxpayer dollar (Alford 2001; Provan and Milward 2001; Moore 2003). Stakeholders are fundamental to the continued and ongoing success of public organisations as they exist to satisfy stakeholders (Bryson, Cunningham and Lokkesmoe 2002; Gregory 2003; Bryson 2004; Bryson, Ackerman and Eden 2007); therefore, public organisations should build their strategic ability around producing public value for their stakeholders (Bryson et al 2002).

The mandatory nature of interacting with public sector organisations and inclusion of stakeholder engagement and analysis has not been a priority in the research arena (Weimer and Vining 2017; Beach, Brown and Keast 2009; Jeffery 2009). Research demonstrates how applying stakeholder engagement based on analysis of relevant stakeholders assists in public policy planning for social, economic, cultural and political factors (Weimer and Vining 2017; Beach et al 2009). Engaging those affected by public sector decision-making creates transparency and improves relationships between users and providers (Weimer and Vining 2017; Freeman 2010). At a minimum, understanding the environment surrounding stakeholders will assist in encouraging willing participation in a mandatory system. (Bongiorno, Rizzo and Vaia 2017; Weimer and Vining 2017). In addition, co-design techniques can be used to create services at a lower cost (Bongiorno et al 2017; Weimer and Vining 2017). Stakeholder analysis should not only identify each stakeholder and their role but also the type of engagement required, especially with respect to how they affect an organisation and how they will be affected by policy (Freeman et al 2004; World Bank 2007; Weimer and Vining 2017). Appropriate analysis and application can assist in accommodating different stakeholder needs, including creation of adoptable, realistic and sustainable policies for mandatory digital services (Groff 2013; Weimer and Vining 2017; World Bank 2007).

2.7 Systems Approaches

A system can be defined as a body of interrelated and interdependent parts, and is composed of boundaries that are more than the sum of parts (subsystem) (Anderson and Johnson 1997; Capra 1996; Arnold and Wade 2015). Thus, changing one part of a system affects other parts and the whole system, as they are made up of predictable patterns of behaviour (Arnold and Wade 2015). Successful adaptation of part or all of a system is impacted by the environment (Cabrera, Colosi and Lobdell 2008; Mingers 2010). Systems theory aims

to determine the different dynamics within a system, including constraints, conditions and principles of measurement (Cabrera et al 2008; Mingers 2010). Once this is understood the system can be better measured and maintained (Arnold and Wade 2015; Mingers 2010). Applying systems analysis demonstrates the structure of direct and indirect stakeholders, assisting the creation of appropriate governance strategies (Kim 1999). Frooman (1999) states that undertaking a comprehensive systems analysis encourages understanding behavioural and social expectations of users. Thus, applying systems theory promotes a greater understanding of an entity, composed of interrelated and interdependent components (Kim 1999; Cabrera et al 2008).

Viewing stakeholders as a system enables identification of interactions between stakeholders and opportunities for communication (Neville and Menguc 2006; Oates 2013). This view identifies three elements for stakeholder analysis: (1) stakeholder interdependences, (2) relationships and interactions, (3) and dynamics of stakeholders or changes over time (Mok and Shen 2016). Viewing stakeholders as part a system assists in focusing on connections between stakeholders, and better equipping organisations to respond to how stakeholders adopt digital services even in the mandatory space (Elias 2017; Peters 2014). Understanding and including all relevant stakeholders is defined as stakeholder inclusiveness (Eskerod, Huemann and Ringhofer 2016; Steyn and De Beer 2012); whereby, stakeholders are all seen as equal, and analysis addresses needs and expectations, through encouraging organisational planning based on systems analysis and multiplicity (Eskerod et al 2016; Steyn and De Beer 2012; Neville and Menguc 2006; Oates 2013). Using a systems view to map stakeholders and their various positions in society and the surrounding complexity will assist in providing a clear multidimensional stakeholder analysis (Stermann 2000). By visually mapping the different stakeholders and influencing elements (Arnold and Wade 2015) stakeholders can be understood at various levels prior to implementing new strategy or creating digital services (Sedereviciute and Valentini 2011).

Multidimensional stakeholder analysis, employed in this research, is an emerging concept. It helps provide a clear analysis of the influences and interconnections of users of public sector digital services, and aids with understanding and mapping the various factors impacting adoption of digital services. A multidimensional stakeholder analysis can also be used to understand the various stakeholders impacted by eGovernment services and digital

transformations, the potential impacts of services and the influence of any changes in stakeholders individually and as part of a group. Through this lens, the researcher can understand and identify multiple different systems impacting the users and how they interact.

2.7.1 System Definitions

There are numerous definitions of a system. A system is defined as any group of interacting, interrelated or interdependent parts that form a complex and unified whole that has a specific purpose (Kim 1999). All parts are interrelated and interdependent in some way, and without such interdependencies, you have a collection of parts, not a system (Kim 1999). Similarly, Ackoff (1999) states that a system is a set of interrelated elements, with each element connected to every other element directly or indirectly. Therefore, systems are comprised of elements joined together by dynamics which produce an effect, create a whole and/or influence the other elements and systems (OECD 2017A). Systems share numerous common characteristics – they are self-organising, whereby systems dynamics produce internal structures, and they are connected and affect each other, constantly changing and adjusting (OECD 2017B). Systems exist on a continuum of comprehensibility, that can be easily observed and analysed to either a highly complex or novel postulation (OECD 2017B). Systems can also be counterintuitive which means that the cause and effect can be distant in both time and space. Systems are governed by feedback, path dependent, resistant to change and characterised by non-linear relationships (OECD 2017B).

2.7.2 Systems Approaches

General Systems Theory is less of a theory and more of a way of thinking; whereby, it explains systems in all fields of science (Von Bertalanffy 1968). It was not intended to be a single theory of systems, but more of a systemic inquiry into different domains of philosophy, science and technology (Von Bertalanffy 1968). Systems theory is defined as a discipline for seeing wholes rather than parts, for seeing patterns of change rather than static snapshots, and for understanding the subtle interconnectedness that gives (living) systems their unique character (Senge 1990). Systems are interconnected, hierarchically organised technical and social entities which often produce behaviour that cannot be predicted by analysing the behaviour of the system parts in isolation (or by simply aggregating the behaviour of the parts) (Senge 1990). Systems theory ensures that the big picture (or whole system performance) is

designed for taking into account all relevant factors when implementing change. Systems theory acknowledges the relationship between interacting components (Senge 1990). Systems theory is important for understanding complex projects, and managers are becoming increasingly interested in the subject (Jackson 2003).

Systemic theory is a loose body of ideas and techniques which are organised around the principle that each system is a whole system in its own right and yet also part of a larger principle (Dixon 2007). It is important that decision-makers understand the various systems that they are working with and that these often include many interconnected and interdependent elements (Senge 1990; Forrester 1961). This creates complexities and dynamism in problems and opportunities, requiring organisational action that is responsive and systems that are capable of adjusting to change (Lebeir 2006). The ability to manage the complexities, ability to respond to change and identify problems as they arise is based on an understanding of both internal and external environments (Lebeir 2006; Senge 1999). This requires researchers and managers to absorb and analyse enormous quantities of information, understanding complexities through webs of interdependence among multiple systems and elements, while keeping pace with the ongoing changes in the environment (Senge 1999).

Systems theory responds to wicked problems, which are defined as problems which are difficult to solve as they are incomplete, contradictory and have changing requirements which are difficult to identify (Bevan 1983; Rittel and Webber 1973). Wicked problems are often posed by systems theory; however, it is not always clear how they might be resolved, and it does not indicate how compromises should be made to achieve implementation, or how they might need to be altered (Bevan 1983). Environments that are internal and external to the organisation are considered as part of systems approaches, especially as the public sector and society are complex and dynamic environments create wicked problems. Thus, systems theory was considered useful for understanding the complexities of the field of study in this research (the ATO).

Systems theory involves uncovering and understanding the different patterns within information, values and ideas which are shared or vary across the different individuals within a system. This involves understanding the interaction and the different behaviours and events that follow suit (Gharajedaghi 2005; Checkland 1999), and this understanding results in a

holistic vision of the mode of inquiry in which the researcher or organisation is engaged (Laszlo 1996). To obtain the holistic vision, the aim is to understand the overall connections within the web of interconnections and interrelationships within the system and identify the manner in which each constituent part of the system influences and is influenced by the other parts (Dixon 2007). Therefore, the systems method treats systems as integrated wholes of their subsidiary components instead of as aggregate parts in isolable causal relations (Laszlo 1996). This creates both problem-structuring and problem-solving approaches which arise from the challenge of managing the complexity and operating within a problem/opportunity space defined by various stakeholders (Henning, Wilmshurst and Yearsworth 2012). Under this complexity, a comprehensive worldview or view of the environment is required. Worldview is the understanding of the cognitive orientation or framing of the individual or society incorporating the entire individual or societal knowledge and or point of view under review (Palmer 1996). More broadly speaking, the worldview refers to the general lens through which the world is seen by an individual, group or even a whole society (Henning et al 2012). By understanding this concept, it is easier to determine the effects that different changes and interactions within the system will have on the system long-term.

As outlined in Table 9 there are a number of tools which can help identify different components of a system, specifically through the visualisation of the different elements. For example, system archetypes can be a useful and critical lens through which the analysis of change and unintended consequences can occur (Senge 1990). Through the use of system archetypes, the user can create an effective visualisation that assists in gaining insights into the various patterns, which reflect insights into behaviours and which reflect the underlying structures of the system studied (Senge 1990).

Table 9. Tools for Systems Approaches

Tool	Description	Reference
Process mapping	A set of tools, such as flow charts, to provide a pictorial representation of a sequence of actions and responses.	Damelio 2011
Stock and flow diagram	Quantitative system dynamics tools used for illustrating a system that can be used for model-based policy analysis in a simulated, dynamic, environment.	Sterman 2000

Systems archetypes	Number of generic structures that describe common behaviours between the parts of a system.	Kim 1993; Senge 1990
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As a system is perceived as a whole and made up of numerous parts which interact and work together to achieve a common purpose, it is important to understand what causes the system to work together and potentially break apart (Peters 2014). Through the application of systems theory, it is possible to see the links between the various components of a system, assess their quality, the parts and the interactions at various levels (Peters 2014). This enables viewing complex problems as both a big picture, as well as its constituent parts (Aronson 1996).

Systems theory provides a way to effectively manage complex problems and to change how complexity is managed and understood for both individuals and organisations (Aronson 1996; Salahat, Wade and Lu 2008). However, there are numerous challenges that need to be overcome. The first challenge is understanding the complex and interactive factors (e.g., technical, social, organisational and personal), which influence the success of solutions. Many of these factors cannot be predicted and accounted for within the design and implementation of a project, transformation or organisation (Baxter and Sommerville 2011). The second challenge is the increased pressure to deliver according to the diverse and conflicting range of views and expectations surrounding the goals of the solution (Baxter and Sommerville 2011). The third challenge involves the increased size and multidisciplinary nature of the teams and stakeholders who are involved in the process (Baxter and Sommerville 2011; Checkland 2000). There are additional challenges associated with understanding the role of the observer or researcher, how this relates to the system and its requirements, and the influence of the system on the environment (Katina, Keating and Ra'ed 2014).

A system is also referred to as an organism, which is a whole that is said to co-exist in relation to its environment, and includes the continuous flow of energy and information between other organisms and the environment (Flood 2010). A key component between the flows of energy and information is emergence, which is where a whole is set to arise from a phenomenon which cannot be fully understood as a result of the properties of its constituent parts (Flood 2010). As all systems are interrelated, emergence causes issues when it comes to planning strategies to counteract anticipated or unanticipated consequences of actions or

decisions (Brimble and Jones 2017; Jackson 2010). Therefore, systems theory is used to understand the various actions and behaviours in complex environments, including the reaction to actions within the system (Brimble and Jones 2017). Another method for handling the complexity associated with emergence and the interconnectedness within a system, is soft systems methodology (SSM).

2.7.3 Soft Systems Methodology

SSM is an offset of systems theory. It considers the world as a complex and confusing entity which can be explored through a systemic process, organised as a learning system (Sgourou, Katsakiori, Papaioannou, Goutsos and Adamides 2012). SSM is concerned with understanding unstructured or poorly structured problematic situations (e.g., human activity systems) (Sgourou et al 2012). According to SSM, human systems are better understood in terms of the emergent systems of meaning which people assign to the world and situations within it. Meaning can be constructed through a systems or SSM approach (Checkland 1981). SSM is a form of systems theory which bases its understanding of reality on the creativity of human actors (Jackson 1991). Social reality is based on the construction of people's interpretation of their experiences, generating and working within an evolving appreciation of people's points of view and intentions (Flood 2010). Therefore, SSM defines situations through action concepts (Checkland 1981; Checkland and Scholes 1990), and these become transparent only in the deeper context of a certain set of social rules (Flood 2010). An authentic understanding of any action concept requires the participation of all stakeholders – everyone involved in taking action and those affected by those actions (Flood 2010). In order to deal with systems problems (especially soft systems problems involving human activities), all stakeholders should become participants (Ackoff 1974).

SSM is described as systemic, as opposed to a systemic approach used to manage soft systems problems (Emes and Grifaeths 2018). SSM uses an interpretive perspective of social setting, whereby a social setting and reality is an everchanging environment of the social process in which human beings continuously negotiate and renegotiate with others their perceptions and interpretations of the world outside themselves (Checkland 1981). Reality from this perspective is both complex and cannot in itself assume to be comprised of systemic properties (Checkland 1985). The purpose of SSM is to improve real world situations and

problems through the coordination of changes within the cyclic learning process (Bergavall-Kareborn 2001). SSM provides a view of human activity which cannot otherwise be easily structured, and the main aim of this approach is to explore appreciation, norms, relationships and emotions (Vickers 1968). SSM guides the exploration of a problem situation which occurs by repeatedly confronting the conceptual-systemic constructs within the real problem situation (Olivia 1993). The general agreement amongst researchers is that SSM can be applied to complex management problems as the process provides a rich inquiry process, a problem structuring process, a goal formulation process, or sense making devices (Galliers 1994; Mingers 1995; Nuseibeh and Easterbrook 2000; Ormerod 1995,) with the overarching aim to deal with fuzzy or soft problem situations, where multiple stakeholders and diverse objects exist (Checkland 1981; Rosenhead 1989). SSM looks at the different relationships of systems and individuals within a problem space and unpacks them to enable better decision-making (Jackson 2003).

There are two key components of general problem solving using SSM. First, defining and analysing the problem. This includes the identification of the issues and the context of the problem within which to frame the analysis, followed by an analysis of the problem situation and capturing the problem from the perspectives of the various stakeholders (Brown, Cooper and Pidd 2006; Shalhoub and Qasimi 2005; Hanafizadeh and Mehrabioun 2017). The second component is the decision-making. SSM builds solutions to improve the decision and policymaking, while developing a framework for handling similar problems in the future (Hanafizadeh and Valixadeh 2014; Lockett and Grossenbacher 2003). These two components form a small component of Checkland's (1981) seven stage process for the application of SSM. According to Checkland (1981) this process results in feasible, realistic and well-reflected systems of activities that indicate the best way to change the problem situation (the different tools are outlined in Table 10). Stage 1 suggests that a problem situation (the action area) might arise that makes a number of people feel uncomfortable. Stage 2 is the expression of the problem situation. Collectively, group members create a comprehensive picture of the problem situation through drawing a rich picture. Stage 3 is the creation of root definitions which provide insights into the problem, human activity systems, situation, and generates debate leading to action to improve the problem situation. Root definitions are built around the worldview that states the constitutive meaning underpinning the purpose of human activity systems. This includes outlining the transformation process, including outlining the Customers

(C), Actors (A), transformation process (T), worldview (W), Owners (O) and environmental constraints (E) (CATWOE). In Stage 4 a conceptual model is created for testing. This stage elaborates on the root definitions by drawing up the conceptual models, using a minimum set of verbs (action concepts) necessary to describe the actions of the human activity system. Stage 5 is the comparison of the conceptual models to reality and the problem situation. Stage 6 is the change of proposals (in two ways). First, the desirability of the human activity system captured in the systems model is raised and discussed. Second, feasibility is explored in the context of the problem, situation, attitudes and dominant political interactions. Stage 7 is the implementation of the feasible and desirable changes. This stage seeks to accommodate the differences in opinions and interests that result from the process of the implementation of SSM.

Table 10. Components of Soft Systems Methodology

Concept	Description	Reference
CATWOE Table	Core concept of SSM. Includes the Customer, Actor, Transformation process, Weltanschauung (worldview), Owner and Environmental constraints.	Checkland and Tsouvalis 1997; Smyth and Checkland 1976
Transformation Process	Purpose of CATWOE is to express the transformation process in which some entity is transformed into some new form of that same entity in order to achieve a longer-term aim. Input → T → Output	Hirschheim and Klein 1997; Mingers 1992; Bergvall-Kareborn, Mirijamdotter and Basden 2004
Weltanschauung	Result of worldview identification and can be described as the person's worldview and beliefs which makes the T meaningful. Three different levels: W1: represents the W in CATWOE and is said to be given as a taken set of assumptions which make a particular statement about a system meaningful. Purpose is for model building. W2: relates to a version of the problem situation and serves to make W1 relevant. W3: linked to our beliefs and assumptions about reality and makes us understand social situations.	Bergvall-Kareborn, Mirijamdotter and Basden 2004; Bergvall-Kareborn 2001; Checkland and Davies 1986; Bergvall-Kareborn, Mirijamdotter and Basden 2004

Actor (A)	Entities who make the T possible, perform the T – the people who carry out the change. The individuals who do the activities in the resultant conceptual model to map it into reality.	Feller and Fitzgerald 2000; Dias 1999; Wilson 1990; Bergvall-Kareborn and Grahn 1996A; Bergvall-Kareborn and Grahn 1996B; Bustard, He and Wilkie 2010; Checkland and Scholes 1999; Pidd 2001; Taylor and DaCosta 1999; West 1995
Customer (C)	People who are affected by the T in a positive or negative way. Customer is defined as the beneficiary or the victim of the systems activity.	Sanchez and Mejia 2008; Dias 1999; Bergvall-Kareborn, Mirijamdotter and Basden 2004; Checkland 1979.
Owner (O)	Represented by a person or group with the formal power to stop the transformation. The highest level is the level at which a decision to stop the system operating would be taken: it is the level of the system owner.	Checkland and Scholes 1990; Dias 1999; Checkland and Scholes 1999
Environmental Constraints	Gives the boundaries for the system in which it has to operate, this includes time and resources, and existing structure of norms. Elements outside the system which are taken as a given, including time and resources, existing structures, ethos, norms, modern technology, resources, objectives and project definitions.	Checkland and Scholes 1990; Kumela, Hujala, Rantala and Pykalainen 2012; Dias 1999; Checkland and Scholes 1990; Bergvall-Kareborn and Grahn 1996A; Pidd 2001; Taylor and DeCosta 1999; Bergvall-Kareborn et al 2004
Root Definition	Can be made out of the elements of CATWOE. A root definition describes a system doing something, using some means in order to achieve some purpose. Can be task-based or issue-based. Two line condensed statements about the system, roughly comparable to a mission statement and can be cast in the form of PQR or CATWOE – (P) what to do (Q) how to do it (R) and why do it?	Sanchez and Mejia 2008; Checkland 1981; Checkland and Scholes 1999; Bergvall-Kareborn et al 2004
Conceptual Model	Has a purpose to accomplish what has been defined in the root definition, using elements from the CATWOE.	Checkland and Tsouvalis 1997

Rich Picture	This process takes a deeper dive into the problem situation from the perspectives of multiple stakeholders (including sympathies and tensions between the actors). The picture should scrutinise the structure, processes and climate of the problem situation, probing the tasks (purposeful actions) and issues (perceptions causing disagreements) of the agents of that problem situation.	Checkland 1988; Niu, Lopez and Cheng 2011
Performance Management	3Es are measure of performance of the system. E1. Efficacy – does the system produce the output it is supposed to? E2. Efficiency – does the system use a minimum of resources? E3. Effectiveness – does the system meet the goals and aspirations of the owner?	Liu, Meng, Mingers, Tang and Wang 2012

A key element of the application of SSM is the cultural inquiry process, the purpose of which is to inform the logical line of inquiry of issues that need to be addressed formally and build the frame of reference within the process (Checkland 1988). There are three levels that comprise the cultural inquiry process. Analysis 1 explores the SSM intervention within the context of its solution, including the consideration of clients, problem owners, problem solvers and so forth (Lane and Oliva 1998). By undertaking analysis 1, the solutions provided from SSM take into consideration the various stakeholders involved in the process. Analysis 2 is used to address the social situation surrounding the problem space, including understanding the different interactions through a simplified model – appreciative system – that maps norms, roles and values (Vickers 1965; Lane and Oliva 1998). Through analysis 2, SSM encourages the researcher to consider various social interactions in the background, and the impacts that they can have on the problem situation. Analysis 3 focuses on the politics within the situation. This process involves understanding the different interests of each individual or group within the problem situation, including the identification of the elements which are used to express power within the problem area (Checkland and Scholes 1990; Lane and Oliva 1998). By utilising all three analyses in the cultural inquiry process, SSM ensures that the researcher considers all of the social and cultural components that could potentially affect the ongoing success of the solutions provided.

The literature suggests a number of limitations of SSM. Firstly, there is a level of subjectivism to SSM, specifically related to the failure to provide knowledge on how to best design a complex adaptive system in practice (Jackson 2003). Secondly, changes suggested by the application of SSM can be contradictory, conflicting or ineffective in the situations which can be characterised by detailed and dynamic complexity (Lane and Oliva 1998). Thirdly, SSM proposes general and sometimes unclear changes and solutions to messy situations, especially as these are often presented in verbal or colloquial language (Christis 2005). Finally, there is no tool to measure whether the particular change implemented within a real-world situation was the one recommended or proposed by SSM and if it was successful (Rodriguez-Ulloa, Montbrun and Martinex-Vicente 2011).

2.7.4 Complex Adaptive Systems

A complex system is comprised of numerous parts that have many interactions (Simons 1996). A complex system is described as a set of interdependent parts which make up a whole that is interdependent with some larger environment (Thompson 1967). Complexity is linked to a number of activities or subsystems within the systems and organisations, noting that it can be measured with three dimensions (Daft 1992): (1) vertical complexity is the number of levels in an organisational hierarchy, (2) horizontal complexity is the number of job titles or departments across the organisation, and (3) spatial complexity is the number of geographic locations (Daft 1992). A complex system is defined as a whole comprised as a large number of parts, each which behaves in accordance to some rule or force which relates it interactively to other parts (Maguire, McKelvey, Mirabeau and Oztas 2006). Individual parts can interact with one another to produce emergent patterns on the whole, whereby the emergent patterns that could not be predicted from the individual parts emerge (Corning 2002). According to Chan (2001), complex systems are those whose elements may or may not be complex themselves, and systems that are characterised by elements being individually dynamic are referred to as a complex adaptive system (CAS) with each element being adaptive.

The CAS model describes a system as composed of numerous autonomous or semi-autonomous “agents”, or subsystems, each functioning in a broadly similar manner (Dooley 1996). Agents scan their environment and develop schema: mental templates that define how reality is interpreted and the appropriate responses for a given stimuli (Dooley 1996). Leaders

in CAS benefit from using systems theory to create a shared vision, foster relationships between actors, allow for innovation, and synthesize perspectives in the decision-making process (Wilkinson, Goff, Rusoja, Hanson and Swanson 2016). Benefits of applying systems theory include avoiding unexpected and unintended consequences and seeing potential complementary partnerships (Wilkinson et al 2016). In human society, the ability of a social or an organisational structure to behave as a CAS has been associated with its ability to adapt successfully to rapid changing environments (Eidelson 1997). There are two key preconditions which have assisted in the effectiveness of understanding a CAS. (1) Each individual subsystem effectively requests and offers the relevant solutions for the needs which arise or potentially arise in the future, within the boundaries of the system's autonomy or within the autonomic boundaries of the other subsystems (Eidelson 1997; Hasgall 2013). (2) Each individual subsystem effectively informs the other subsystems of its personal ability to contribute to the other subsystems and to the system as a whole (Eidelson 1997; Hasgall 2013).

A CAS has four optimal behavioural characteristics (Passig and Hasgall 2004; Shoham and Hasgall 2005). Firstly, goal compliance matches the personal interests of an individual and the goals of the specific system to which they belong, allowing the individual to integrate as a subsystem within a clear systemic vision and define their needs and abilities according to the core competences of the system. Second, situational sensitivity is the individual's sensitivity to environmental changes and their ability to provide relevant solutions and possible courses of action in response to problems and local or systemic changes. Third, integration of information is the ability of an individual to collect, retrieve and introduce the various details regarding environmental systems changes. To accomplish this, the entire system must be continuously updated by all its members and each member must be continuously updated by the entire system. Fourth, resource synchronisation includes the ability of an individual to offer solutions by accessing, dividing, and distributing the required resources.

Chaos theory responds to chaotic systems. Chaos theory is a field of study which explains dynamic systems, those which are highly sensitive to initial conditions, whereby small changes in initial conditions produce wildly different results (Strogatz 1994). These changes occur outside of the fixed rules regarding changing relationships and without randomness (Strogatz 1994). Therefore, chaos theory is used to address deterministic chaos systems which are characterised by a few independent variables which interact non-linearly (Ricklefs, Howe and

Shiell 2007). Although it can be difficult to predict individual outcomes, a general direction can be deciphered based on the trajectory of system being loosely controlled by a strange attractor (Rickles et al 2007). The literature review demonstrated that CAS theory (including chaos and systems dynamic modelling) would not compliment the SSM for overcoming specific theoretical limitations, therefore could not be used for this research.

Although, multiple viewpoints are provided by SSM and it is complimentary to other systems approaches, the development of conceptual models can only help inform decisions to an extent. As in many cases the results are abstract and difficult to implement and measure. SSM can be enhanced with the support of additional systems approaches, including system of systems approaches, which complement the mode of inquiry while bringing additional structure.

2.7.5 System of Systems

As complexity grows with digitalisation and digital transformations, many large organisations seek to integrate their understanding of the various systems which work together to develop and accomplish their organisational goals. Within systems of systems approaches, accomplishing organisational goals cannot be achieved by the constituent systems alone. It is the integration of these constituents working together to meet their goals which is referred to as a system of systems (Jaradat, Keating and Bradley 2014). System of systems are based on the coordination and integration of multiple constituent systems, which together performs a function, purpose or behaviour that the individual constituent systems are unable to perform on their own (Jaradat et al 2014). A system of system is more complex than a system due to the additional requirements for integration, and the different emphasis and approach for design and validation (Madni and Sievers 2014). Therefore, the system of systems approach focuses on the system as a whole, and not on its independent parts (Ackoff 1971).

The system of systems approach focuses on total system performance, including small or large changes between or across the various constituent systems (Ackoff 1971). This view is more holistic, as the views provided of the systems are linked back to the relationships between the parts of the constituent systems, and how the parts interact and fit together (Madni and Sievers 2014). System of systems are naturally observed, as they are derived from systems interoperating with other systems (DeLaurentis, Lewe and Schrage 2003; Sauser, Boardman

and Gorod 2008). Therefore, as systems of systems comprise numerous constituent interdependent systems and are integrated complex systems, they provide a different perspective to understanding the complexities of an environment (Keating, Rogers, Unal, Dryer, Sousa-Poza, Safford, Peterson and Rabaldi 2003). Systems are autonomous and heterogenous (DeLaurentis, Lewe and Schrage 2003). However, when they form part of a system of systems, their interactions produce capabilities of unintended consequences as a result of emergent behaviour which does not originate from a single constituent system (Gorod, DiMario, Sauser and Boardman 2009).

Whilst there are multiple definitions of system of systems, there is yet to be a universally accepted definition (Sage and Cuppin 2001). System of systems are most commonly referred to as the combination of components that are themselves significantly complex, enough so that they may be regarded as systems assembled into a larger system (Maier 1998). The most commonly used definitions are outlined in Table 11.

Table 11. Definitions of System of Systems

Definitions	References
System of systems is a set of integrated elements of the systems concept.	Ackoff 1971
System of systems as large geographically distributed systems; however, it incorporates centrally directed development efforts in which the constituent systems and their integration are deliberately and centrally planned for a particular purpose.	Eisner 1994
Systems of systems are large scale concurrent and distributed systems that are comprised of complex systems.	Kotov 1997
System of systems include distinguishing large and complex, but monolithic systems from the true system of systems. These principles are operational and managerial elements, evolutionary development, emergent behaviour and geographic distribution. It implies the existence of distinct classes within systems. Such classes are useful as they represent the distinct demands within the design, development or operation of a system of systems.	Maier 1998
System of system is a collection of heterogeneous systems that are likely to exhibit operational and managerial independence, geographical distribution, emergent and evolutionary behaviours that would not be apparent if the systems and their interactions were modelled separately.	DeLaurentis and Crossley 2005

Collection of systems that were originally designed as stand-alone systems for specific and different purposes but that have been brought together within the SoS umbrella to create a new capability needed for a particular mission.	Mayk and Madni 2006
A metasystem comprised of multiple embedded and interrelated autonomous complex subsystems that can be diverse in technology, context, operation, geography and conceptual frame. These complex subsystems must function as an integrated metasystem to produce desirable results in performance to achieve a higher-level mission subject to constraints.	Keating, Padilla and Adams 2008
The multiple constituent systems within a system of systems are disparate, diverse, autonomous and asynchronised entities that work together without losing their individual sense of purpose and without loss of idiosyncratic capability, in order to realise some higher level and otherwise unattainable purpose.	Sauser, Boardman and Verma 2010
An arrangement of independent and interdependent systems that collectively exhibits unique capabilities.	Baldwin, Boardman and Sauser 2013
System of systems is the integration of internal and/or external systems to meet a goal and/or behaviour that cannot be achieved by any of the individual systems acting independently (autonomous systems/subsystems). This integration includes operational, managerial and geographic integration.	Jaradat et al 2014
System of system approach explicitly favours learning and adaption rather than control and alignment, which are critical capabilities for operating in high uncertainty contexts.	Otley and Soin 2015
System of systems have been referred to as an array system which is a large and widespread collection or network of systems functioning together to achieve a common purpose.	Shenhar 1994

System of systems performs within a dynamic environment; therefore a governance toolset is needed to address the complex problems of both industry and academia more effectively (Mansouri, Gorod and Sauser 2010). Through the system of systems lens, decision-makers can manage their system more effectively (Mansouri et al 2010). The categorisation of systems can be based on certain attributes of systems such as flexibility, adaptability, agility or resilience (Mansouri et al 2010). Systems of systems are comprised of task-oriented systems which pool their resources and capabilities together, which in turn creates an additional, more complex system (Popper, Bankes, Callaway and DeLaurentis 2004). This system offers additional functionality and performance than the sum of the constituent parts or systems (Popper et al

2004). A system of systems views multiple, dispersed and independent systems within the context as part of a larger and more complex system (Boardman and Sauser 2006). Table 12 details the key principles within system of systems, relating to managing and understanding the dynamic environment which impacts the application of the systems approach.

Table 12. Principles of System of Systems

Principles	Definition	Reference
Emergence	Unpredicted behaviours or patterns resulting from the integration and dynamic interaction between the constituent systems, their parts and the surrounding environment (open systems).	Goldstein 1999; Coming 2002
Law of complementarity	Any two perspectives (or models) of a system will reveal truths about the system which are neither entirely independent nor entirely compatible.	Weinberg 1975
Holism	In complex systems the performance or behaviours are generated from the interaction of the elements, not from the individual elements.	Becht 1974
System purpose	The system produces only what it can produce.	Calida, Jaradat, Abutabenjeh and Keating 2016

Maier (1996) outlines five key elements that a system of systems must have to be considered as such, further developed by Sage and Cuppan (2001). First, the components of the system need to be operationally independent. The constituent systems must be able to operate independently and contribute to the whole in their own right. Second, the different constituent systems must operate independently in practice and continue to operate in some form without the necessity for a system of systems. Third, the system of system is not fixed and may evolve with new purposes, functions and even constituent systems which are added, removed or modified. Fourth, the system of system produces emergent features and side effects that are not inherent or predictable in the separate constituent systems due to the complexity of the non-linear relationships between constituent systems. Fifth, the constituent systems should be geographically dispersed. These elements provide a clear picture of how to understand the various constituent systems and system of systems. The systems characteristics follow similar themes.

Research suggests that focusing on the characteristics of a system of systems is more beneficial than seeking a definition. According to Boardman and Sauser (2006), there are five distinguishing characteristics of a system of systems. Firstly, autonomy, defined as the ability of a system to make independent choices, including but not limited to managerial and operational independence while accomplishing the purpose of the system of systems (Baldwin, Boardman and Sauser 2013; Sauser, Boardman and Verma 2010). Secondly, belonging, defined as constituent systems which have the right and ability to choose to belong to the system of systems, based on their own needs/beliefs and/or fulfillment. Thirdly, connectivity is the ability to stay connected to other constituent systems (Glassman 1973; Weick 1976). Fourth, diversity is the evidence of visible heterogeneity, increased diversity in system of systems capability achieved by released autonomy, committed belonging and open connectivity. Fifth, emergence is the formation of new properties as a result of developmental or evolutionary processes (Bunge 2014).

Additionally, the characteristics outlined by Boardman and Sauser (2006) have three qualities, elaborated on by other researchers. Firstly, heterogeneity and hierarchy are where a system or system is comprised of a combination of numerous complex heterogeneous systems which are grouped into various categories. These systems do not need to operate within the same physical environment. The constituent systems in each category are organised into levels of hierarchy (DeLaurentis and Callaway 2004; Sage and Bierner 2007; Agusdinata and Dittmar 2009; DeLaurentis and Ayyalasomayajula 2009; Phillis and Kouikoglou 2012). Secondly, autonomy and evolutionary/adaptive behaviour is when constituent systems operate within their own goals and do not function under strict policies. They are linked in a functional manner, and their interrelation does not impact the functionality and therefore can maintain or adapt their operational features whenever the various constituent systems are removed, modified or connected with new ones (DeLaurentis and Callaway 2004; Sage and Bierner 2007; Agusdinata and Dittmar 2009; DeLaurentis and Ayyalasomayajula 2009; Phillis and Kouikoglou 2012). Third, emergent and unpredictable behaviour is when the properties appear in the system of systems that are neither evident in the component systems nor amenable to prediction in the way lumped parameters systems are described (DeLaurentis and Callaway 2004; Sage and Bierner 2007; Agusdinata and Dittmar 2009; DeLaurentis and Ayyalasomayajula 2009; Phillis and Kouikoglou 2012). Incorporating these characteristics

provides a clearer understanding of how the constituent systems interact and become a system of systems.

Systems of systems often do not have unique or crisply defined levels, therefore understanding the various levels depends on specific goals and capabilities of analysis (Phillis and Kouikoglou 2012). Factors such as fluidity of stakeholder requirements, evolving competitors, and the nature of the global environment demand a higher level of flexibility (Gorod, Gandhi, Sauser and Boardman 2008). Flexibility can be defined as an important phenomenon in today's changing environment, as it is necessary for an organisation to have options to cope with their dynamic environment (Sushil 2001). The system of systems approach provides an avenue for understanding the various constituent systems impacting the organisation or system of systems under review. The approach can assist in understanding and determining whether systems (e.g., infrastructure, social, political, business or cognitive) are interrelated and, if and when they are interrelated, the common goal or objective. Therefore, because of its suitability to the phenomenon under investigation, the system of systems method has been applied to this research as part of the triangulated systems approach.

2.7.6 Enterprise Architecture

An extension of system of systems methods, EA can also be applied to better understand complex organisations and their systems. The theoretical underpinnings of EA have been linked back to systems approaches (Nurmi, Pulkkinen, Seppanen and Penttinen 2018). EA is similar to a business model that aims to describe a business system or organisational structure; however, the process is more complex because of the greater scope (Musulin and Strahonja 2018). The set of representations and models which are described by the EA are used to describe the whole enterprise on each level, in order to align the business goals, processes and resources (Rahimi, Gotze and Moller 2017). EA has evolved as a discipline and is used as a method for the governance of information systems and the corresponding business elements within complex organisations (Zachman 1987; Lapaine, Gerber, Van Der Merwe, Zachman, De Vries and Hinkelmann 2016). The role of EA is to assist in creating meaning and understanding the various aspects within an organisation to enable more holistic planning practices.

There are numerous definitions of EA. According to Rouhani, Mahrin, Nikpay, Alumad and Nikfard (2015), EA is used to evaluate and identify gaps in modelling, management and maintenance. Matthes (2011) provides a detailed definition of EA as a discipline managing the architecture of an enterprise. Matthes (2011), further developing Schekkerman's (2004) contribution, defines EA as a process to understand and outline the fundamental organisation of a system, including its components, their relationships to each other and the environments, and the principles governing its design and evolution – a definition not dissimilar to that of system of systems. However, EA is not solely used to create holistic and detailed models of the entire enterprise – instead, it builds various architecture subdomains which deliver aggregates (Aier, Riege and Winter 2008; Fischer and Winter 2007). Although there are many definitions of EA, the common theme is that it can be used to understand the systems impacting the organisational goal. This relates to the purpose of system of systems methods and SSM, as it provides an additional avenue for exploring and understanding the various components and systems impacting organisational effectiveness.

The purpose of EA is to map assets, business processes, and a set of governance principles which drive ongoing discussions about business strategy and how it can be expressed (Minoli 2008). Therefore, EA is the process by which organisations standardise and organise infrastructure which aligns to business goals. These strategies support digital transformation, IT growth and the modernisation of IT as a department (Gampfer, Jurgens, Muller and Buchkremer 2018). There are various practices and frameworks available to help managers understand existing EAs and support the transition from a current to future state, including digital transformations (Winter, Buckl, Matthes and Schweda 2011; Matthes 2011; Schekkerman 2004). EA outlines the fundamental organisation of a system, embodied in its components, the relationships with each other and the environment, and the principles governing its design and evolution (Osterwalder 2004). As the process is not dissimilar to that of system of systems, the application of EA can play a complimentary role.

Zachman's (1987) EA model is the most commonly applied in research. The framework can be used to view an enterprise or information system from multiple perspectives (Jovanovic, Mrdalj and Gardiner 2006), and is used to organise and analyse data through specific classifications and questions by summarising a number of different perspectives to provide a holistic representation of the problem space. The Zachman (1987) framework outlines how the

5 Ws and H (outlined below) can be implemented to provide questions to ask at different stages of a project or solution. As outlined in Figure 10 through the use of a 6X6 matrix, there are six primary questions:

- What (is needed)
- How (processes in place)
- Where (distribution)
- Who (stakeholders)
- When (timing)
- Why (intention)

The Zachman framework has been critiqued as having limited practical value, but Zachman (1987) himself has stated that the framework is primarily speculative, non-empirical and based on a conceptual argument. Kim and Everest (1994) state that the framework creates a comprehensive description which is often based on unrealistic outcomes. Again, Zachman (2004) stated that his framework is predominately theoretical and has yet to be tested or implemented in completeness.

	Why	How	What	Who	Where	When
Contextual	Goal List	Process List	Material List	Organisational Unit & Role List	Geographical Locations List	Event List
Conceptual	Goal Relationship	Process Model	Entity Relationship Model	Organisational Unit & Role Relationship Model	Locations Model	Event Model
Logical	Rules Diagram	Process Diagram	Data Model Diagram	Role Relationship Diagram	Locations Diagram	Event Diagram
Physical	Rules Specification	Process Function Specification	Data Entity Specification	Role Specification	Location Specification	Event Specification
Detailed	Rules Details	Process Details	Data Details	Role Details	Location Details	Event Details

Figure 10. Zachman Framework (1987)

The Zachman approach can be linked back to the systems approach, and the 5 Ws and H or the 6 Ws is used as a fundamental stage in information gathering (Hester and Adams 2014,

pp. 46-47). As demonstrated in Figure 11, the centre of the figure highlights the mess and the circles on the outside outline the questions to be addressed. A mess represents a system of problems, with multiple problems which are contained within the mess (Mitroff, Hill and Alpaslan 2013). Utilising the 5 Ws and H assists in understanding the “mess” or the key components of the system and systems within it. Hester and Adams (2014) further elaborate on the questions:

- *Who?* Who is relevant? Who are the stakeholders? Who will benefit from the completion?
- *What?* What is trying to be achieved. What are the primary components and what is the solution?
- *Why?* Why is the analysis being conducted?
- *Where?* Where does the system reside, and where will it be done and delivered?
- *When?* When is the understanding required? When does the solution need to be provided?
- *How?* How did the problem arise? How does the solution address the problem?

The approach forms the basis for the analysis and creation of the proposed framework outlined in the following section.

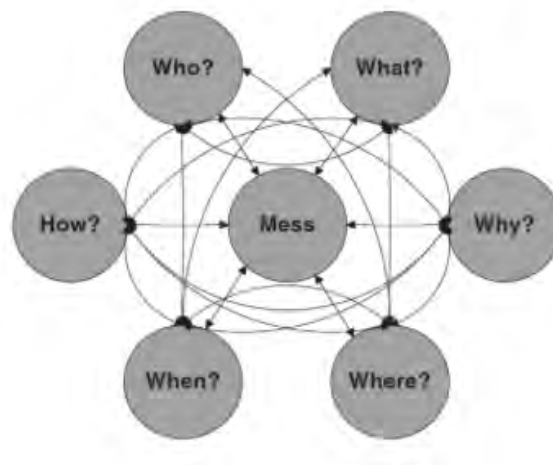


Figure 11. 5 Ws and H or 6 Ws (Hester and Adams 2014)

EA is a suitable and complementary component of the triangulated systems approach of this study, supporting the SSM and system of system approaches. The EA approach provides

a guide for understanding complex systems and system of systems. However, Zachman's approach can be difficult to follow and measure, and it can be misunderstood and applied inconsistently across and within organisations. Specifically, therefore, this research uses the 5 Ws and H approach. A key part of applying the various systems approaches, including SSM, system of systems and EA is understanding the role of systems governance.

2.7.7 Systems Governance

The influence of external environments on organisations and systems is important to understand, in conjunction with understanding the influence of internal factors. It is important to understand external performance and perspectives, as systems and organisational effectiveness are not only measured by internal performance (Abzug and Galaskiewicz 2001). Therefore, systems governance processes can support the role of EA models in understanding and documenting the various systems and elements under consideration. Governance can be defined as the relationship between participants in determining the direction and performance of corporations, organisations and systems (Monks and Minow 1995). When exploring systems governance, the definition goes further to include the performance of the metasystem functions necessary to provide direction, communication, control and change essential to ensure continuing system viability (Keating 2014). The role of system governance in the application of systems approaches is well known, as systems governance form a part of the foundations of applying a systems approach to understand a problem space (Beer 1979), therefore understanding systems governance is important to this research.

According to Beer (1979; 1981) there are four foundations of system governance. Firstly, the coordinated function provides the system stability. This is achieved through the synchronisation of the different systems which are integrated into the system of systems, thus promoting the operational performance of the system of systems by ensuring the integration of the systems is sufficient. Secondly, the operational control function maintains operational performance on a day-to-day basis. This provides for the execution of policy, distribution of resources and accountability within the system of systems. It includes the monitoring function exploring deviations or variances from expected behaviours or performance within the system of systems. Thirdly, the development function scans and captures information from the environment and assesses that information for strategic implications and system of systems

impacts. Fourthly, the policy function provides the strategic decisions and directions which maintain the identity of the system of systems, responsible for the ongoing monitoring and maintenance of balance between the external long-term focus and internal short-term goals. These four foundations demonstrate how systems governance provides an opportunity for engaging with the constituent systems within the system of systems, in order to meet the challenges and changes in the environment affecting ongoing success.

To address the systems principles outlined in the previous sections, systems governance practices should be put in place in order to understand potential changes within constituent systems and the system of systems and determine how to respond (Calida et al 2016). For example, emergence, which occurs within a system, requires a flexible governance design or framework which can manage changes within that system or constituent systems (Calida et al 2016). System governance identifies that emergence remains problematic, as governance of it is difficult. Emergence is known as the unexpected properties which come from the interactions between the constituent systems, the environment and the system of systems (Pierre 2000). Another example of system governance practices which require consideration is the law of complementarity, as the different perspectives will assist in accurate decision-making, thus encouraging taking actions and where possible achieving the most sustainable methods applied to the particular goal or system (Calida et al 2016). Additionally, systems governance practices discuss holism in order to understand the cultural, social, political and technical elements within the constituent systems as well as the system of systems (Calida et al 2016). Finally incorporating the systems purpose into the system governance is useful in order to prevent ineffective use of resources or inadequately designing products. Therefore, understanding these systems governance principles provides ongoing support and guidance for the application of the systems approach applied within this research.

According to Keating and Katina (2019), the application of systems governance can be based on four key components, which guide the systems. The starting point is answering the central question of “why?”. Specifically, what is the purpose of understanding the problem space or constituent systems or system of systems? The next point is to direct the focus, including future planning through long-term and future focused strategies, and building effectiveness measures and sustainability in the long term. This point links to the next – the emphasis on outcomes. These can be less tangible and subjective long term. Finally, system

governance recommends outlining and understanding the determinants of success. Although they are difficult to define, they are necessary to apply the systems approach appropriately.

Systems governance provides details into how to effectively apply systems approaches to understand an organisation, or a systems/system of systems.

2.8 Constituent Systems

The government and public sector organisations play a dual role in boosting the content and creation of digital systems within a country or region. The first role is as the policymaker whose function it is to create an optimal environment in which digital systems can flourish (El-Darwiche, Herzog, Singh and Maalouf 2015). This role requires understanding the state of the market and different factors within it (e.g., the level of skilled labour, capital and technology), the capacity for local content development, and the protections of digital copyright for both private and public sectors. The second role the public sector plays in the creation of digital systems is as a provider of essential services within the country (El-Darwiche et al 2015). Without a solid understanding of the various stages through which a digital transformation undergoes and the different challenges associated with creating public sector digital services, governments cannot provide high quality services. The exploration of the systems literature is used to guide and support the creation of the framework and approach, based on the data exploration phases (explained in detail in Chapter 3). The following section presents an overview of a number of constituent systems.

2.8.1 Biological Systems

Biological systems are commonly used as the benchmark for creating representations of different systems in other domains. Biological systems are comprised of various interdisciplinary interactions and engagements that occur between each actor within the system (West and Chang 2006). The majority of these interactions are based on building social well-being within the system and engaging across actors to discover interesting things, share resources, and unite as a group to defend against threats from human interference, pollution or natural disaster (West and Chang 2006). Biological systems, similar to other systems, are based on non-linear patterns of behaviour, which provides opportunities and challenges for the creation of scalable organisations, as well as the evolution of complex hierarchical solutions.

Rapid state transitions potentially allow the system to adapt to sudden environmental change (Levin 1999).

Systems that survive are those that find balance. A balanced system is harmonious, stable, and sustainable within the system and with the environment surrounding it (West and Chang 2006). Another key component is self-organisation; whereby, each species is independent, self-prepared, self-empowered, self-surviving (capable of self-defence) and undertakes self-coordination through swarm intelligence (West and Chang 2006). Biological systems, like other systems, are also comprised of domain clustered and loosely coupled elements. This means that within an ecological environment or biological system, a species chooses to join a system – a decision that is commonly based on finding somewhere with a similar culture, social habit, interests and objectives (West and Chang 2006). Figure 12 shows the key properties, behaviours and structures derived from Briscoe (2011; 2009) and Briscoe, Sadedin and Paperin (2007). Table 13 outlines the definitions of all of the elements within the biological system.

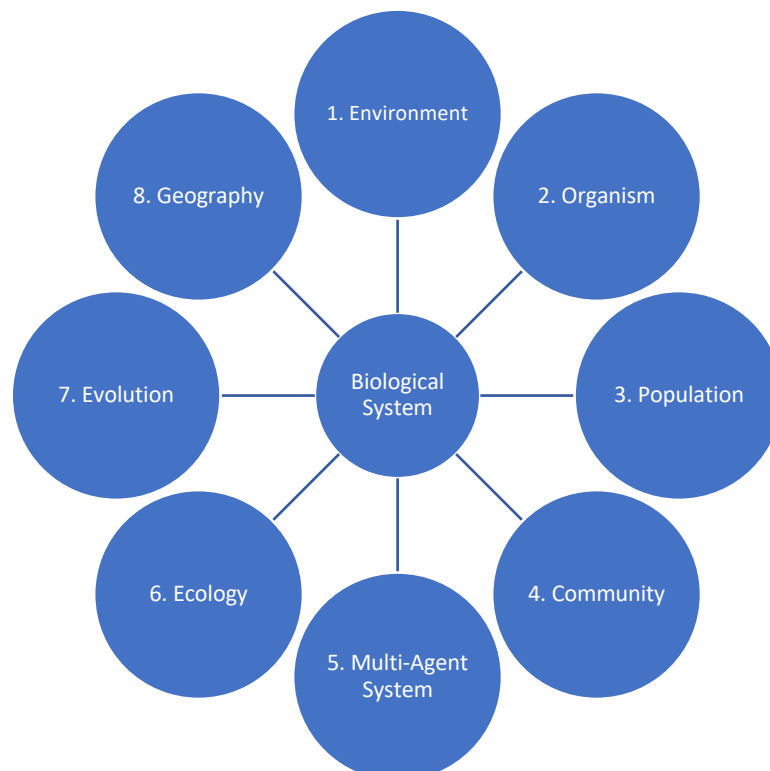


Figure 12. Biological System

Table 13. Components Often Described Within Biological Systems Literature

Element	Definition	Reference
Environment	The surroundings or conditions in which a person, animal, or plant lives or operates.	Merriam-Webster Dictionary, 2020, Environment
Organism	Any individual entity embodying properties of life (e.g. lifeform).	Hines 2008
Population	All the organisms of the same group or species, which live in a particular geographical area. Population also refers to the number of people in a city or town, region, country or world.	Hines 2008
Community	Entire species available within the digital system environment.	Yale Digital Corner Centre 2016.
Multi-agent system	Multi-agent systems consist of agents and their environment. A multi-agent system may contain combined human-agent teams.	Weyns, Omicini, and Odell 2007
Ecology	Interactions among organisms and their biophysical environment.	Merriam-Webster Dictionary, 2020, Ecology
Evolution	Changes over time in the heritable characteristics of biological populations, a process which occurs over successive generations.	National Academies of Sciences, Engineering and Medicine 2016
Geography	Includes land, features, inhabitants, and phenomena of the Earth and planets.	Merriam-Webster Dictionary, 2020, Geography

2.8.2 Generic System

The generic system is derived from the biological system. The generic system was built to provide an application of various ideas, concepts and models from multiple different classes of systems to create a basic or high-level system (Briscoe 2011). This forms a starting point which can be fundamental for researchers who are understanding the specific system or combining multiple systems to create or define a new or specific system (including digital systems) (Briscoe 2011). The generic system is a complex system, with agents who represent the organisms, the network to represent the geography, and dynamics to represent the ecology or interactions, as demonstrated in Figure 13. The key properties, behaviours and structures are

based on the understanding of biological systems. Table 14 outlines the definitions of the added elements in the generic system.

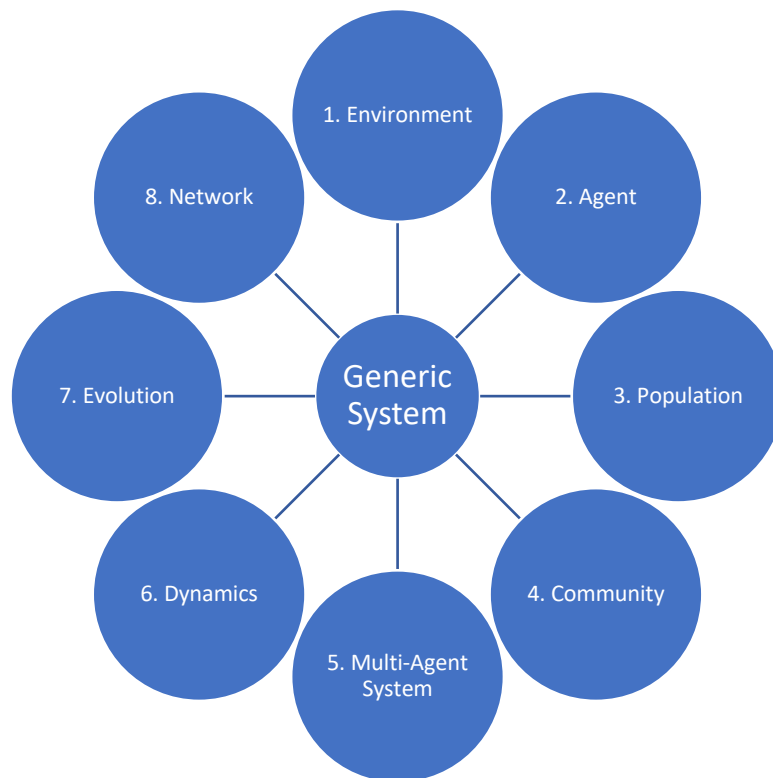


Figure 13. Generic System

Table 14. Components Often Described Within Generic Systems Literature

Element	Definition	Reference
Network	Group or system of interconnected people, things or elements.	Merriam-Webster Dictionary, 2020, Network
Agent	Person who acts on behalf of another person or group. A term interchangeable with organism.	Merriam-Webster Dictionary, 2020, Agent
Dynamics	Forces stimulating growth, development, or change within a system or process.	Merriam-Webster Dictionary, 2020, Dynamics

2.8.3 Social Systems

The social system is comprised of elements associated with the various interactions between the actors within the population. Social systems are comprised of persons within populations who adapt to their environment in order to survive and thrive (Diez Nicolas 1995). Within the social system, human populations or persons adapt to their environment and community, adopting cultural norms (Diez Nicolas 1995; Kumar, Loonam, Allen and Sawyer 2016). Figure 14 outlines the key components of a social system, extending on the generic system. The key definitions which differ from previous systems are outlined in Table 15. The generic system is mapped to the concept of “environment”, social systems maps to “society”, while the concept of “agent” maps to “person” (Briscoe 2011).

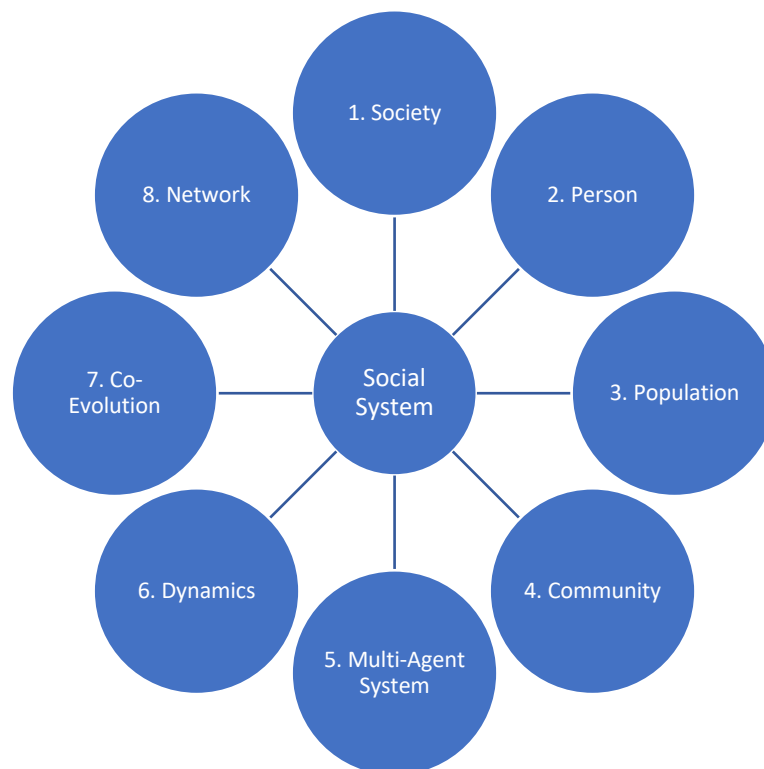


Figure 14. Social Systems

Table 15. Components Often Described Within Social Systems Literature

Element	Definition	Reference
Society	<p>Organisation or club formed for a particular purpose or activity.</p> <p>Often referred to as an aggregate of people living together in a more or less ordered community.</p>	Merriam-Webster Dictionary, 2020, Society
Person	Human being regarded as an individual.	Merriam-Webster Dictionary, 2020, Person
Community	Group of people living in the same place or having a particular characteristic in common.	Merriam-Webster Dictionary, 2020, Community
Co-evolution	Influence of closely associated species on each other in their evolution.	Merriam-Webster Dictionary, 2020, Co-evolution

2.8.4 Business System

The concept of a business system focusses on the micro-economic view of business networks as well as the macro-economic perspective (Nachira, Nicolai, Dini, Le Louarn and Rivera Leon 2007; Moore 1996). Figure 15 outlines key components extending the generic system. Table 16 outlines the definitions of the components within the business system that differ from previous systems. The concept of the “environment” for the generic system is mapped to “economy” here (Briscoe 2011).



Figure 15. Business System

Table 16. Components Often Described Within Business Systems Literature

Element	Definition	Reference
Economy	Careful management of available resources.	Merriam-Webster Dictionary, 2020, Economy
Business	A person's regular occupation, profession, or trade. Often referred to as commercial activity.	Merriam-Webster Dictionary, 2020, Business

2.8.5 Digital System

A digital system is an open, loosely coupled, demand-driven, domain-clustered, agent-based, self-organised collaborative environment (or a system) (Whelan 2010; Chang and West 2006). Digital systems capture elements of classical and complex ecological systems (biological) and relationships between dynamic networks of interrelated complex systems (Whelan 2010). The agents within the digital systems are similar to the organisms within the

biological system, with similar behaviours including mitigation, ongoing evolution and the use of hybrid environments (Begon, Harper and Townsend 1996; Briscoe 2011).

A digital system behaves in a similar manner to a biological system, whereby different species or agents, known within this environment as individuals or an organisation, have their own role to play (Rivera, Leon and Kataishi 2010). These individuals and organisations work collectively to care for their environment, whereby they facilitate, lead and direct collaborative swarms which represent the interactions between domains. Within a biological system this would include the interactions between animals, humans, plants and geography. A digital system is characterised by its composition of various mechanisms for sharing and the open diffusion of knowledge within local clusters (Rivera et al 2010). These local clusters are supported by the different interactions between elements of the system and networks, and can lead to international cooperation across national and local networks (Rivera et al 2010). Digital systems are based on shared interest and support for distributed infrastructure and open source, with an interest in the promotion of knowledge embedded within local clusters.

There are two types of digital systems within the literature – the digital system and the applied digital system. The fundamental difference is that the applied digital system is applicable to various situations, and therefore has been followed by this research. Figure 16 outlines the key components of the digital system, extending on the generic system. Table 17 outlines the definitions of the new concepts not previously outlined, and Figure 17 outlines the key components within the applied digital system.

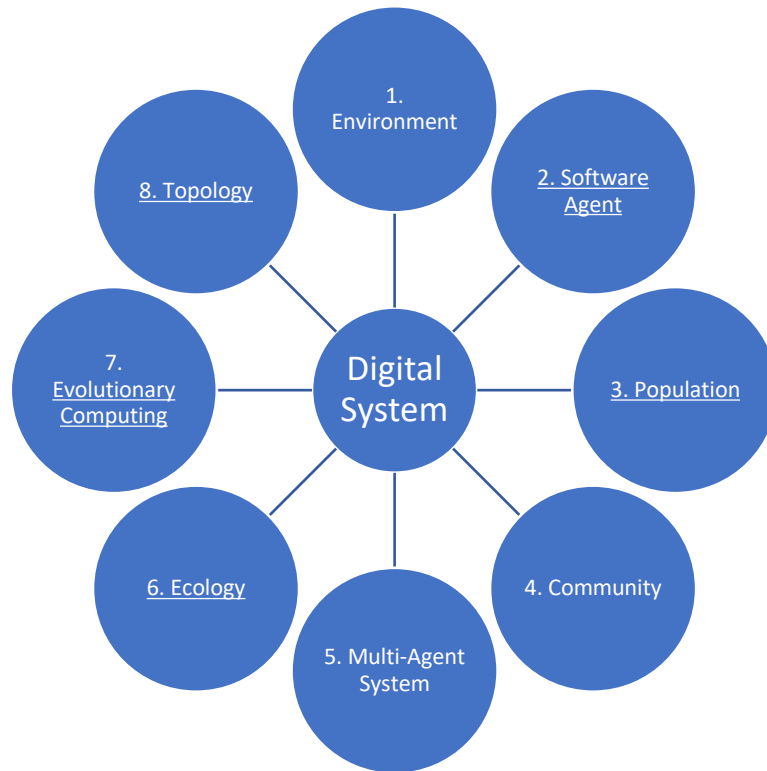


Figure 16. Digital System

Table 17. Components Often Described Within Digital Systems Literature

Element	Definition	Reference
Topology	Manner by which constituent parts are interrelated or arranged.	Merriam-Webster Dictionary, 2020, Topology
Software agent	A computer program acting for a user or other program in a relationship of agency.	Nwana 1996
Evolutionary Computing	Optimisation procedures or methodologies, implemented through ICT, and used to solve problems.	Back, Fogel and Michalewicz 1997

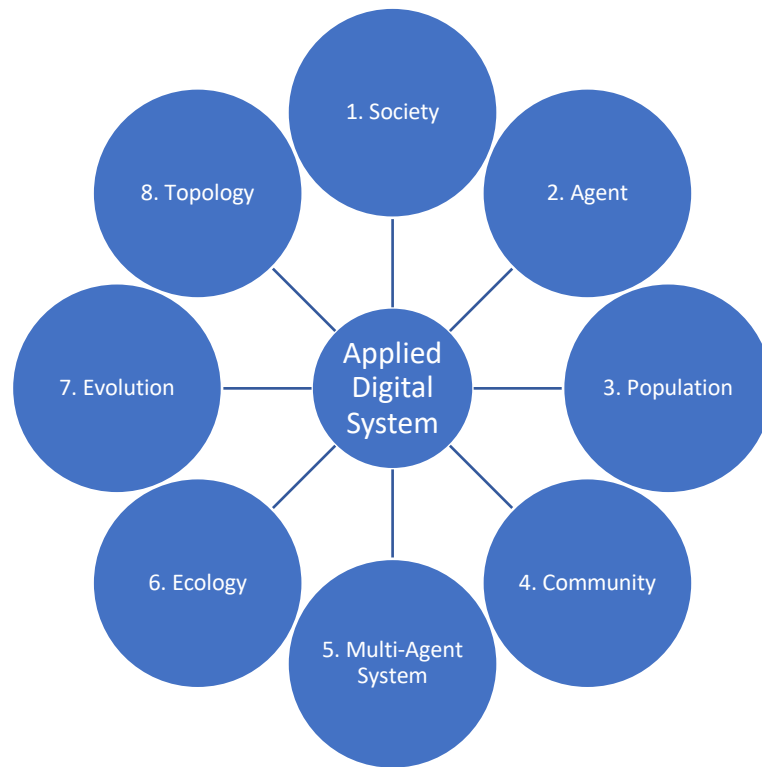


Figure 17. Applied Digital System

As applied digital systems are concerned with building an open source environment through which businesses, individuals and groups can interact within a reliable environment, they can assist in building a good understanding of the impacts of digitalisation on government services (Razavi, Siqueira, Serra and Krause 2010). Within the digital system there are numerous long-running multi-service transactions which take place and are of interest to researchers. This includes understanding how support can be provided for long-term transactions, involving all actors in the system (Razavi et al 2010). Digital systems and applied digital systems are an emerging paradigm for economic and technological innovation to support cooperation, knowledge sharing and development of open and adaptive technology (Dini 2007). Both the applied and digital systems are composed of heterogeneous devices, resources, companies and autonomous users that interact in a complex, distributed and dynamic environment (Liu, Koskela and Ylianttila 2009). They are therefore heavily interconnected by a network, which forms a complex and dynamic environment in the form of different communities (Liu et al 2009).

Applied digital systems often emerge as a result of the digitalisation process, which makes them interesting to research and monitor, especially as they adapt over time to deliver changing solutions and services (Jacobides, Sundararajan and Van Alsyne 2019). There is no singular definition of a digital system, as it seems self-explanatory and because it is everywhere (Zhang and Jacob 2011). Digital systems therefore can be best described by the connections between networks of platforms, software and users. With some typical attributes similar to that of biological systems including interdependence, heterogeneity, emergence or self-organisation (Briscoe and Sadedin 2009). These systems are comprised of interacting organisations that are digitally connected and enabled by modularity, and are not managed by hierarchical authority (similar to a supply chain) (Jacobides et al 2019).

There are numerous other broad definitions outlining digital and applied digital systems within the literature. The structural and functional perspective view digital system as an open-source network environment for business, mainly small and medium enterprises, to interact with others in an effective and efficient way (Ferronato 2004). Similar definitions of digital systems imply that interacting components in a digital system should be and are connected (Hadzic and Dillion 2008; Serbanatti and Vasilateanu 2011). In contrast, some definitions indicate that participation is based on a specific location in order to be connected (Briscoe and DeWilde 2008). This includes the notion that the community of digital devices and their environment can function as a whole (Kolb 2013) Interestingly, all definitions consider that digital devices provide information to the other components of the system. The digital system simulates the actions portrayed by organisms in a natural system (Hadzic, Dillion and Chang 2007). There are a number of different components often outlined and described within the digital system literature, defined within Table 18.

Table 18. Components Often Described Within Applied Digital Systems Literature

Components/ Sources	Description	Source
Content	Information or services which are of use and available in the digital system.	Yale Digital Corner Centre 2016
Practice	In order for the different species to be comfortable and operate freely practice is required.	Yale Digital Corner Centre 2016
Technology	Hardware and software responsible for the information interchange within the digital system.	Yale Digital Corner Centre 2016

Biological species	People who participate in the digital system.	Chang and West 2006
Economic species	Companies and institutions that participate in the digital system.	Chang and West 2006
Digital species	Digital devices, software and hardware used by people and different companies and institutions that participate.	Chang and West 2006
Digital Environment	Platforms on which digital species interact.	Hadzic and Dillon 2008; Serbanatti, Ricci, Mercurio and Vasilateanu 2011
Security	Protection of resources and species in the system.	Pranata, Skinner and Athauda 2011
Trust	Trust that all species in the digital system are focused on achieving the same goal.	Pranata, Skinner and Athauda 2011

The maturity of digital systems is a more recent measure of the success of a digital system long-term. According El-Darwiche et al (2015), there are four stages a digital system must pass through to become mature. This incorporates depth and diversity of different content and categories and does not need to be limited to a singular country. The first stage is content foundation. This is identified as the transition phase, which is focused on moving from one stage to a point when the right content foundations are in place. This includes the development of the supply driven content creation, which is a system started online. The content created in stage one reaches between 1% and 13% of the target audience (El-Darwiche et al 2015). The second stage is network effect. This is also a transition phase; however, the focus of this stage is leveraging the network effect and ensuring services become more valuable to users as more people use them. This stage reaches an average 13% to 43% of the target audience (El-Darwiche et al 2015). The third stage is monetisation. This transition phase is based on obtaining a sizable user reach and base. Within this stage 43% to 62% of the target audience are reached. For the private sector digital service makers this is the stage where they seek to make their content more profitable. The final stage is content diversification. This transition phase is based on the intensification of content diversification through business services. In this stage, between 62% and 85% of the target audience have been reached (El-Darwiche et al 2015). The maturity of digital systems is a process that can be followed by public sector organisations to ensure that they are providing services and content that meets both the needs and expectations of their users.

2.8.6 Infrastructure System

Infrastructure systems are referred to as the backbone of services and digital systems. They are general terms for the basic physical systems of information technology, electricity systems and communication networks (O’Sullivan and Sheffrin 2003; Nurre 2012). Infrastructure includes the fundamental facilities and systems which serve a country, state or region, and includes various facilities and services required for a government and economy to function (O’Sullivan and Sheffrin 2003). The various components within an infrastructure system are broad, as it incorporates both public and private physical improvements. Infrastructure is often defined into two categories – hard and soft. Hard infrastructure can include telecommunications (e.g., mobile phone towers, internet connection), electricity (e.g., electrical grids, electrical suppliers), water (e.g., supply and storage) and transportation networks (e.g., roads, railways) (Hayes 2005; Nurre 2012). Soft infrastructure incorporates services which are necessary to maintain standards within a community, including economic, health, education, and cultural and social structures. Hard and soft infrastructures complement one another – without soft infrastructure, human capital and governance requirements would render many hard infrastructure projects without appropriate structure to develop. Figure 18 and Table 19 outline the various components within the infrastructure systems.

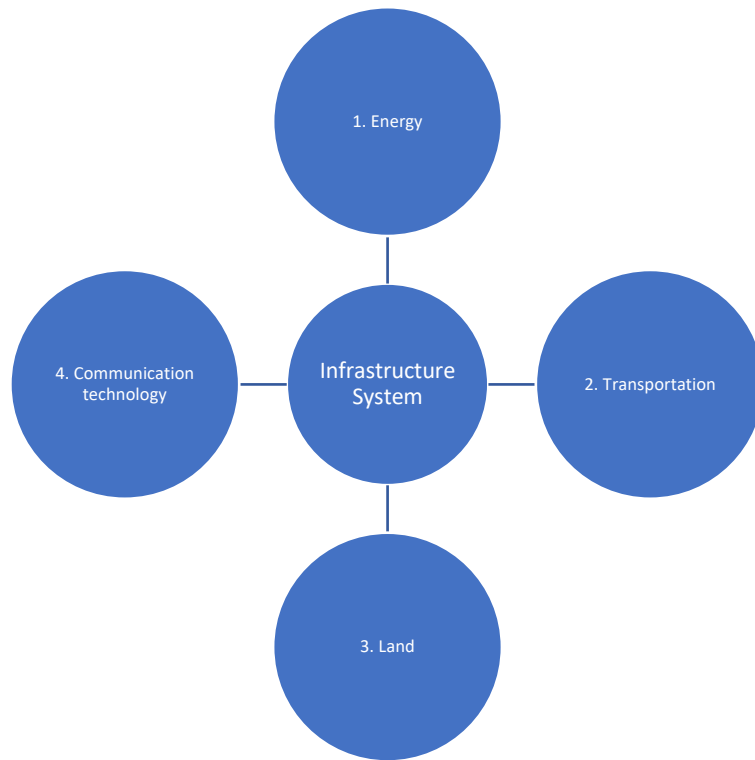


Figure 18. Infrastructure System

Table 19. Components Often Described Within Infrastructure Systems Literature

Components/ Sources	Description	Source
Energy	Power that is produced by mechanical, electrical or other means and used to operate a device.	Merriam-Webster Dictionary, 2020, Energy
Transportation	The action of transporting or moving someone or something or the process of being moved/transported.	Merriam-Webster Dictionary, 2020, Transportation
Land	The resource that encompasses the natural resources used in production.	Merriam-Webster Dictionary, 2020, Land
Communication Technology	Also referred to as information technology, this refers to all equipment programs that are used to process and communicate information.	Thomas 1997

2.8.7 Policy System

Policy is a deliberate system of principles to guide decisions and achieve rational outcomes. A policy is a statement of intent, implemented as a procedure or protocol (Althaus,

Bridgman and Davis 2007). The policy system works with specific content, in which events surrounding a policy issue occur, influences and in turn is influenced by policy stakeholders and public policies (Dye 1978).



Figure 19. Policy System

Table 20. Components Often Described Within Policy System Literature

Component	Description	Source
Law enforcement	This is any system where members of government act in an organised fashion enforcing law, through discovering, deterring, rehabilitating, or punishing people who violate the laws, rules and norms which govern society.	Hess and Orthmann 2008
Welfare	Forms a legislative procedure or process, which has been formed in order to promote the basic social, material and physical well-being of people who require assistance or are in need.	Merriam-Webster Dictionary, 2020, Welfare

Personnel	The employees of an organisation, in this case government agencies, who are engaged in an organised undertaking.	Merriam-Webster Dictionary, 2020, Personnel
Urban	The characteristics of a town, city, state or country.	Boix, Miller and Rosato 2013
Political Parties	An organised group of people who share ideology, or hold the same political positions, which field candidates for election to public office, working to obtain elections of individuals to implement their party agenda.	Merriam-Webster Dictionary, 2020, Political Parties
Legislative systems	Legislation creates a law or policy. Before an item of legislation becomes law, it may be known as a bill, and may be broadly referred to as “legislation”, while it remains under consideration to distinguish it from other business.	Hague 2017
Government	Group of people with the authority to govern a country or state; a particular ministry in office, authority given by democratic votes.	Merriam-Webster Dictionary, 2020, Government
Government Agencies	Appointed by a commission, or representatives of a specific element of government through legislation, these can be permanent or semi-permanent. As part of the machinery of government an organisation is responsible for the oversight and administration of specific functions including administration.	Merriam-Webster Dictionary, 2020, Government Agencies

2.8.8 Cognitive System

The cognitive system, also referred to as an individual mental system, consists of multiple interrelated assumptions, beliefs, ideas and knowledge (Plekhanova 2009). This system is comprised of an individual’s worldviews and determines how individuals act, think and filter information and cues from the outside world. A cognitive system is also defined as a complex system which learns and develops knowledge. This can be human, a group, an organisation, an agent, a computer or a combination (Plekhanova 2009). It is, therefore, an area or space where interconnected items of knowledge and representations of human cognitive processes are studied (Mok 2009). Table 21 and Figure 20 outline the key elements within the cognitive systems.

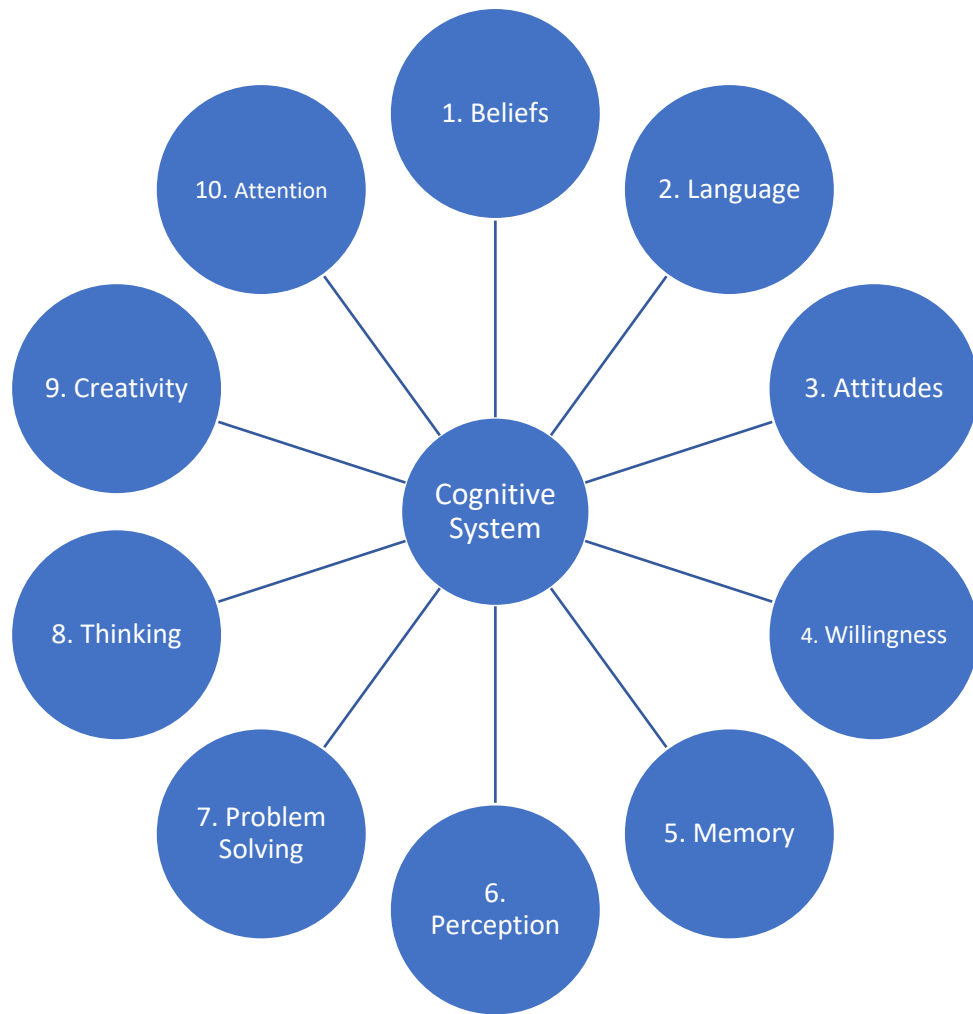


Figure 20. Cognitive System

Table 21. Components Often Described Within Cognitive Systems Literature

Components	Description	Source
Beliefs	Attitude that something is true.	Bell, Halligan and Ellis 2006
Language	Structured system of communication.	Merriam-Webster Dictionary, 2020, Language
Attitudes	A settled way of thinking or feeling about something.	Merriam-Webster Dictionary, 2020, Attitudes
Willingness	The quality or state of being prepared to do something; readiness.	Merriam-Webster Dictionary, 2020, Willingness

Memory	Faculty of the brain which stores, encodes and retrieves data and information when necessary. The retention of information influences future actions.	Sherwood 2015
Perception	How people come to understand the world around them through interpretation of stimuli.	Cherry 2013; Solso, MacLin and MacLin 2005
Problem-Solving	The process of finding solutions to difficult or complex issues.	Merriam-Webster Dictionary, 2020, Problem-Solving
Thinking	Aim oriented flow of ideas and associations that can lead to a reality-oriented conclusion.	Caianiello 1961
Creativity	Phenomenon whereby something new or valuable is formed, these may be tangible or intangible in nature.	Mumford 2003; Sternberg 2011
Attention	State of focused awareness on a subset of available perceptual information.	Anderson 2010; Chica, Bartolomeo and Lupianez 2013

2.8.9 Systems Summary

Systems approaches provide avenues to view the bigger and more holistic picture of the problem space. Therefore, the importance of understanding the various constituent systems within the system of systems and environment, should be identified and explored. By understanding previous literature in the systems space, the systems outlined within this research can be understood and defined more clearly. Combining the understanding of the constituent systems, the system of systems and the environment assists in providing a detailed picture of the problem space and encourages understanding of the various interactions between the constituent systems and the system of systems. Therefore, the use of a triangulated systems approach to identify and outline the key systems and factors is based on the literature outlined within this chapter, especially how it relates to digital transformations, and specifically to ensure fully inclusive and promoted digital adoption for all users.

2.9 Literature Review Summary

This literature review highlighted some of the issues around the process of digital adoption and established an understanding about its implications for eGovernment and how these can

be related to systems approaches. This chapter presented the literature guiding the research and identified gaps to be addressed. The literature demonstrates how public sector services have been falling behind their user's expectations, particularly in how they use data to personalise the services and information provided. Furthermore, public sector entities are impacted considerably by the complexity in the strategic application and creation of digital services, as they do not have sufficient knowledge and information management in place to keep up with technological advancements. This causes issues for digital inclusion, considering that the data and information use does not explore the potential barriers to adopting digital services. It is important to understand how multidimensional exclusion and inclusion are, as they relate to the interrelationships between the various components, especially relating to digital inclusion in eGovernment services.

The literature identifies that public sector services need to understand the expectations of citizens and potential users, especially as these expectations should drive the creation and implementation of provided public sector services. Citizens are more inclined to adopt eGovernment services if they are engaged with other online services provided by either the public or private sectors. Additional research is needed to understand the stakeholders, the citizens, and their degree of involvement engagement. Previous literature argues that through increased levels of public trust, levels of adoption of eGovernment can be observed. Research demonstrates how public value is based on service quality, especially when the services meet the needs and expectations of services. Therefore, public value in eGovernment is clearly linked back to system quality and service improvements. Thus, previous literature demonstrates how government policy needs to ensure that the eGovernment services follow the expectations of citizens to be fully utilised and adopted.

Previous research has applied the TAM and DOI models to explore and understand the potential barriers to digital adoption, challenges to eGovernment services and what encourages people to adopt eGovernment services. Additionally, eGovernment evaluation frameworks have been created to determine the effectiveness, suitability and usefulness of eGovernment services. However, these previous attempts to determine the ongoing effectiveness of digital services provided by government, especially how they relate to adoption, willingness to use and community/social norms associated with their use, have not been fully effective.

The literature review has provided an overview of the stakeholder theory and analysis and identifies that the models in this section have failed to sufficiently address the question of how to analyse the various stakeholders in this particular field, i.e., eGovernment/public sector (i.e. internal, external to this complex environment), thus identifying the need to create a multidimensional analysis and framework.

The complex environment is better studied with a systems approach; therefore the review of systems theory and systems was presented. As a result of the literature review, the researcher decided to use a triangulated systems approach, coordinating SSM, system of systems and EA. The literature review forms the basis for Chapter 3 which outlines the methodology, including the application of these approaches, and discusses the development of the framework and approach. This summary provides the underpinning theory for this research, which argues for the need of a governance framework to assist in the identification of relevant systems and assess their roles and interactions to guide effective digital transformation. Through the literature review, a number of relevant systems and stakeholders were identified, guiding the development of a conceptual model and pilot study. The lack of governance framework in the literature, which includes the multidimensional levels of relevant constituent systems and overarching system, demonstrates a need for the research.

Paper 1 – Conceptual Paper: Digital Interactions Strategy: A Public Sector Conceptual Model

Submitted to Australian Journal of Business and Management Research.

Statement of Authorship

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Principal Author

Name of Principal Author (Candidate)	Samantha Papavasiliou		
Contribution to the Paper	Designed and Conducted the study undertaken. Developed Conceptual model.		
Overall percentage (%)	60%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	14/05/2020

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By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Carmen Reaiche		
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Signature		Date	06/15/20

Digital Interactions Strategy: A Public Sector Conceptual Model

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Abstract— The objective of the public sector as a mandatory service provider is to produce effective services for their users, to make compliance as easy as possible. In the current state however, these services are falling short in meeting the expectations of users. Therefore the purpose of this conceptual paper is to propose a new model to enhance digital adoption in the public sector. The proposed model's initial step is the application of a multidimensional stakeholder analysis, utilising multiple methods to identify and quantify stakeholders. The model incorporates an in-depth analysis of the digital ecosystem affecting the public sector and service users, to provide a clearer picture of the environment impacting stakeholders. Evidence supporting this model is based on a case study of The Australian Taxation Office. Three main implications are discussed: firstly, digital adoption intervention strategies should consider the impact of government and regulations on stakeholders, human capital and culture impacting their capacity to adopt digital services. Secondly, all government organisations should aim to involve all key stakeholders, if aiming for a consistent and meaningful process change. Finally, the areas discouraging digital adoption should be addressed and areas of influence should be leveraged. Exploration for future research taking into account the proposed model should assist in the creation of better public sector policies and guide the strategies into the provision of digital services.

Keywords-component; Digital Ecosystem, Multidimensional stakeholder analysis, Mandatory Systems, Consultation, Participation, Public Sector.

I. INTRODUCTION

Expectations of mandatory public sector digital products and services are scarcely researched in their current form, whereas private sector research demonstrates how high quality, easy and useable digital products and services are a key expectation of their clients. As a result there is increasing pressure on

public sector service providers to meet and understand the changing demands of service users. Current strategies for research do little to incorporate in-depth understanding of stakeholder (user) involvement, how they interact with the digital system, the digital ecosystem and their role in the broader system (Eggers & MacMillian 2015; Lindt 2016, Torfing 2016). This process is to be addressed by this conceptual paper.

Literature highlights the disconnect between the services provided by public sector and the expectations of users; as the focus is often on securing internal buy-in rather than determining user needs (See for example, Eggers & Bellman 2015; Lindt 2016; Eggers & MacMillian 2015). There is a requirement for complex changes in research techniques to encourage a shift to an external focus where customer needs are considered, understood and prioritised accordingly (Eggers & Bellman 2015; Torfing 2016). Research needs to understand expectations of services provided (even in mandatory spaces), issues faced by users and understand the system as a whole. There is a clear disparity between digital services provided by public mandatory services and private voluntary services highlights the failure of the public sector to meet the user expectations (Akeesson, Skalen & Edvardsson 2008). This is considered evidence emphasising the need for change through innovative research to provide recommendations that offer comprehensive insights into the adoption of public sector digital services.

Digital services are more than providing tools and products; it is about business processes and user experiences (Eggers & MacMillian, 2015; Lindt 2016). Therefore, research needs to be conducted systematically setting clear research directions to understand digital service adoption. In a mandatory environment willing participation in the digital service decreases the cost of enforcing compliance, decreases

impacts on the client and assists in streamlining processes.

For this research mandatory environment is where citizens who meet certain characteristics (in this case, earn income in the country of Australia) must by legislation interact with the nation's taxation system (i.e. Australian Taxation Office – ATO) services annually to complete their income tax return. Research into digital adoption does not appear to engage with the concept of mandatory and the impacts of digital first policies on stakeholders required to engage with digital services as a means of compliance with legislative requirements. Therefore, this paper argues for an in-depth analysis of the digital ecosystem affecting the public sector and service users.

Through the use of a systems thinking approach guiding the exploratory analysis and assisting the understanding and identification of stakeholders, this paper will outline a method for a multidimensional stakeholder analysis. The results of conducting a multidimensional stakeholder analysis is proposed as it will prepare the research to assist in determining leverage points to improve the level of digital adoption and the overall client experience. This is based on the inclusion of broader environmental factors impacting the use of mandatory digital services. It will include a number of recommendations of how to view the stakeholders and provide a conceptual model of the digital ecosystem effecting mandatory digital service use. The starting point to this analysis will be an environmental analysis of the public sector in Australia, followed by a multidimensional stakeholder analysis and finally combining these findings into a digital ecosystem model. This model is setting the background to future research to be undertaken through a case study of the ATO. The analysis will adopt the following approach:

The first step is to understand and identify the system under study. For this research the system is the specific digital service provided, the broader environment which includes multiple elements including the public sector, digital ecosystem and the environment the stakeholder sits. Systems thinking, is an optimal approach for the study. It is defined as a holistic approach to analysis that focuses on how parts within a system interrelate and how the system works over time and within a larger system (Luhmann 2013). This approach will underline the integral parts affecting the public sector and interrelations within the

environment and the elements of the ATO digital system.

The next step is stakeholder identification and analysis, which is important especially in a multidimensional view, as they are the users of the services, however depending on their current role within the mandatory system, their characteristics, influence, impact and understanding could be different. Therefore, the stakeholder analysis to be adopted is a multidimensional one and it should be focused on evaluating potential barriers and opportunities within a system (Aarons, Wells, Zagursky, Fettes & Palinkas 2009). Stakeholders considered within the multidimensional analysis this study; are those who have a significant effect on or are affected by the actions of an organisation (Freeman 1984). For this paper a multidimensional stakeholder analysis is defined as, the application of multiple different stakeholder analysis techniques in conjunction with use of qualitative and quantitative techniques to analyse the different stakeholder roles stakeholders, to the provision and use of public sector products and services.

The next stage is to understand the environment in regard to the digital ecosystem affecting adoption. Digital ecosystems are complex, outlining factors impacting stakeholders' capacity to utilise provided digital services (Nachira, Nicolai, Dini LeLouran & Leon 2007). Note that the public sector system and digital ecosystems environment are different to other sectors socio-technological behaviours, including unique elements of culture, human capital, government and regulation (Christensen, Laegreid, Roness & Rovik 2007). Consideration of all these elements is critical for multidimensional stakeholder analysis to clearly identify the relevant stakeholders and their key characteristics (Christensen et al 2007; Aarons et al 2009).

Starting this analysis by understanding how every component of the digital ecosystem impacts the level of stakeholder digital adoption, provides a holistic view of stakeholders. While offering insights into what hinders or supports digital adoption. Although multiple solutions have been trialled to match client expectations and public sector services, such as tailored communication techniques, research and the improved application of data and analytics, these have yet to provide holistic solutions (Torning 2016; Bryson 2018).

Previous research fails to highlight the multitude of factors impacting specific stakeholder capacity to participate in the digital ecosystem and adopt digital services within a mandatory environment (OECD 2016). This is due to a lack of clarity of the factors affecting digital adoption, which has impacted how digital services and products are produced and advertised (World Economic Forum 2016). The purpose of this model is to address these gaps, through investigating factors impacting digital adoption.

Addressing the suggested approach presented above, the focus of this paper is in the following research question:

To what extent a systems and digital ecosystem model could help to identify factors influencing multi-level stakeholders' system adoption?

This paper proposes a method and model to address the identified research gap of limited understanding of digital service adoption within mandatory environments. To set the scene for future research, a case study of the Australian Taxation Office (ATO) will be explored. The paper contributes by increasing understanding of factors impacting digital adoption to mandatory service users and highlighting possible leverage points. This is the first time multidimensional stakeholder analysis has been applied and combined with digital ecosystem analysis in the public sector and mandatory service environment.

Further, utilising a systems thinking and digital adoption approach to analyse the environment provides greater clarity to the issues that could be effecting adoption (positively or negatively and inside or outside the control of the users). Understanding the environment in which a user (stakeholder) sits, assisting in understanding what could prevent them or influence them to adopt digital services. Thus providing a more transparent view of what services could include making them as easy as possible for adoption.

The model proposed will be tested in future research, starting with a pilot and developed further in the secondary study to follow. This paper aims to propose a new model for increasing digital adoption within the public sector. This model is based on the application digital adoption research, systems thinking and ecosystems research. This model should assist the public sector to enhance adoption of mandatory digital services. The next stage and following papers will

involve model testing on the ATO through multiple phases of data collection and analysis.

The structure of this paper is divided into four sections. Section one contains the introduction and literature review. Introducing the topic, discussing contributions and providing basic definitions, while the literature review outlines previous studies providing context to the research. The method follows in section two, outlining steps involved in the creation of the model. Section three describes the model and relates to a case study of the ATO. Section four highlights the implications and future research opportunities arising from this research.

II. LITERATURE REVIEW

Freeman (1984) states that a stakeholder is “any group or individual who can affect or is affected by the achievement of the organisation's objectives” (p. 46). In an extension of his 1984 stakeholder definition, Freeman suggests that stakeholders are defined as “those groups or individuals who are vital to the survival and success of the organisation” (Freeman, Wicks & Parmar 2004, p.32). These include employees, users of products and services, members of the community and government organisations (Freeman et al 2004). Therefore stakeholder analysis is important to the application of new strategies in the public sector, especially in regard to digital adoption (Bal, Bryde, Fearon & Ochieng 2013; Kennon, Howden & Hartley 2009). Appropriate consultation is crucial to obtaining meaningful outputs and engagement strategies. To do this, it is vital to recognise stakeholder roles within the broader system (Helbig, Dawes, Dzhuspova, Klivink & Mkude 2015). This includes, reducing negative influences affecting the digitalisation process (Bal et al 2013; Kennon et al 2009). Furthermore the inclusion of a multidimensional stakeholder analysis identifies numerous elements in the digital adoption process, while determining the participation and consultation process.

A. Systems Thinking

Utilising a systems approach to map and understand stakeholders including their environment, various positions in society and the surrounding complexity, assists in providing a clear multidimensional stakeholder analysis (Sterman 2000). Visually mapping the different stakeholders combined with influencing elements facilitates a clearer analysis (Richmond & Peterson 1997; Arnold & Wade 2015). Thus, ensuring specific and effected stakeholders are understood at various levels prior to implementing new strategy or creating digital services (Sedereviciute & Valentini 2011). A system can be defined as a body

of interrelated and interdependent parts; and is composed of boundaries, that are more than the sum of parts (subsystem/ecosystem) (Arnold & Wade 2015). Thus, changing one part of a system affects other parts and the whole system, as they are made up of predictable patterns of behaviour (Jackson 2009; Arnold & Wade 2015). Successful adaptation of a system or part of is impacted by the environment (Cabrera, Cabrera & Lobdell 2008; Mingers 2010).

Systems thinking is an approach to determine the different dynamics within a system including; constraints, conditions and principles of measurement (Cabrera et al 2008; Mingers 2010). Once this is understood the system can be better measured and maintained (Arnold & Wade 2015; Mingers 2010). Applying systems thinking demonstrates the structure of direct and indirect stakeholders, assisting the creation of appropriate management strategies (Kim 1999; Jackson 2009). Frooman (1999) states, undertaking a comprehensive systems analysis encourages understanding of behavioural and social expectations of users. Thus, applying systems thinking promotes a greater understanding of an entity, composed of interrelated and interdependent components (Kim 1999; Cabrera et al 2008). Therefore, utilising a systems thinking approach can assist in combining findings from multidimensional stakeholder analysis, digital ecosystems analysis and the broader environment into a single picture helping understand all factors impacting specific digital service users. A critical focus of this research.

B. Importance of Stakeholders

The mandatory nature of interacting with public sector organisations and inclusion of stakeholder engagement and analysis has not been a priority in the research arena (see for example, Weimer & Vining 2017; Beach, Brown & Keast 2009; Jeffery 2009). Research demonstrates how applying stakeholder engagement based on analysis of relevant stakeholders assists in public policy planning for social, economic, cultural and political factors (Weimer & Vining 2017; Beach et al 2009). Engaging those affected by public sector decision-making creates transparency and improves relationships between users and providers (Weimer & Vining 2017; Freeman 2010). At a minimum, understanding the environment surrounding stakeholders will assist in encouraging willing participation in a mandatory system. (Bongiorno, Rizzo & Vaia 2017; Weimer & Vining 2017). In

addition co-design techniques can be used to create services at a lower cost and with increase interest (Bongiorno et al 2017; Weimer & Vining 2017).

Understanding stakeholder analysis should not only identify each stakeholder and their role but also the type of engagement required for each. Especially with respect to how they affect and organisation and how they will be affected by policy (Freeman et al 2004; World Bank 2007; Weimer & Vining 2017). Appropriate analysis and application can assist in accommodating different stakeholder needs, including creation of adoptable, realistic and sustainable policies for mandatory digital services (Groff 2013; Weimer & Vining 2017; World Bank 2007),

Changes in culture and society have altered stakeholder expectations, with many actively seeking opportunities to consult with organisations through social and digital media (Aula 2010; Karakiza 2015). Through new digital avenues engagement with organisations have become easier, and is considered to have impacts on how organisations view stakeholders (Mitchell, Agle & Wood 1997; Karakiza 2015). Encouraging them to adopt and follow new trends through seizing opportunities to make and adopt change (Aula 2010; Karakiza 2015).

Understanding and including all relevant stakeholders is defined as stakeholder inclusiveness (Eslerod, Huemann & Ringhofer 2016; Steyn & De Beer 2012). Whereby stakeholders are all seen as equal, and analysis addresses needs and expectations, through encouraging organisational planning based on systems analysis and multiplicity (Eslerod et al 2016; Steyn & De Beer 2012; Neville & Menguc 2006; Oates 2013).

Viewing stakeholders as a system identifies interactions between stakeholders and opportunities for communication (Neville & Menguc 2006; Oates 2013). This view identifies three elements for stakeholder analysis: (1) stakeholder interdependences; (2) relationships and interactions; (3) dynamics of stakeholders or changes over time (Mok & Shen 2016). Viewing stakeholders as part a system assists in focusing on connections between stakeholders, better equipping organisations to respond to how stakeholders adopt digital services even in the mandatory space (Elias 2017; Peters 2014).

C. Digital Ecosystems

Extensive review of the literature highlights the importance of and complexity involved with understanding the environment in which a digital service sits (Immonen, Ovaska & Paaso 2017).. services operate within a complex space, balancing the needs of users, capability of the organisation and needs to fit within the digital ecosystem. The provision of services has shifted from physical locations to one based in the digital space (OECD 2016; European Commission 2015; Codagnone & Martens 2016). A digital ecosystem is an open community, with no centralised control or fixed roles, defined as a combination of self-organising systems, forming multiple architectural models (Briscoe & Marinos 2009; Razavi, Moschoyiannis & Krause 2009). These are compiled and work collectively through interactions between each element of the ecosystem (Wu & Chang 2007; Dong, Hussain & Chang 2007). Understanding interactions within digital ecosystems helps explore collective behaviours encouraging problem solving without centralised and control systems (Salameh, Chbeir, Camblong & Vechiu 2017; Briscoe, Sadedin & DeWilde 2011; Miskiewicz & Juchnieqicz 2015).

Investigating digital ecosystems impacts on mandatory service providers is vital to the success of their digital service offerings (Boley & Chang 2007; West & Chang 2006). Digital first policies in Australia (e.g. Digital Continuity Policy 2020) have made it a necessity for public sector service providers, to provide accessible digital services (Damiani, Uden & Trisnawaty 2007; Boley & Chang 2007; NAA 2015).

The digital adoption process in the private sector (voluntary) digital services has been researched extensively and is a process based on five stages, illustrated in Figure 1 (Bourne 1959; Nakata & Weider 2011; Reinders, Frambach & Schoormans 2010). Firstly users' first exposure to the product called awareness. Interest is the second stage, seeking additional information. Thirdly, evaluation occurs and consumers determine if the product is worth utilising. Fourth stage is limited product trailing (Bourne 1959; Nakata & Weider 2011; Reinders et al 2010). Fifth is adoption where the consumer decides to utilise the product. However, rejection occurs at any stage of the process (Bourne 1959; Nakata & Weider 2011; Reinders et al 2010). The adoption process outlined in Figure 1 relates to voluntary digital products and services, these also relate to mandatory services however they appear differently and are dependent on where the stakeholder is within the digital ecosystem (Barrett, Davidson, Prabhu & Vargo 2015).

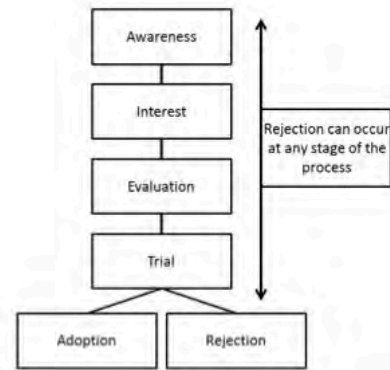


Figure 1 Digital Adoption Process (source: Bourne 1959)

Figure 1 highlights why organisations need to understand what influences users willingness to adopt (Shaikh 2016). Increased access to information on digital products and services has improved comparability of available options, causing difficulties for public sector services (Yannacopoulos, Manolitzas, Matsatsinis & Grigoroudis 2014). This however only highlights part of the complexity facing the public sector. Private sector organisations provide voluntary services with greater capacity to experiment, be more flexible and utilise progressive implementation (Clark 2016; World Economic Forum 2014; Yannacopoulos et al 2014). In contrast public sector mandatory services require relevant solutions for the wider population, with less available funding and resources (Clark 2016).

Increased research into components of a digital ecosystem impacting users is vital to ensuring success and willing participation (Briscoe & Marinos 2009; Briscoe et al 2011). Digital ecosystems are comprised of networks of social and economic stakeholders, reliant on technological architecture to spread information, finances and services (Briscoe et al 2011). A digital ecosystem is composed of numerous digital platforms, creating a digital environment; understanding this encourages greater collaboration between providers and users, promoting innovation (Briscoe 2011; EY 2017). However, strict regulations and legislation, budgetary constraints, ageing infrastructure and growing populations are slowing the innovation of public sector digital services (EY 2017).

Organisational adoption of digital technologies, data and information, impact their strategies regarding services, digital, data and stakeholder engagement externally (Groff 2013). Organisations with high adoption often have adaptable leaders, utilise workplace skills effectively, user-centric designs and workplace cultures conducive to change (Horth & Buchner 2015; Groff 2013). However, Wauters (2017) states public sector organisations globally do not have sufficient knowledge and information management to keep pace with technological advancements, causing complexity in strategic application of digital services. Thus

emphasising how vital knowledge and information sharing is to the success of public sector digital services (OECD 2016; Wauters 2017; Groff 2013).

Public sector digital services and policies are impacted significantly by the population accessing the provided services (OECD 2003; OECD 2016; Mullich 2013). Lack of comprehensive data usage has been an ongoing criticism of the public sector, especially comparative to private sector organisations (OECD 2016; Mullich 2013; Groff 2013; Cong & Pandya 2003; Kolsaker & Lee-Kelley 2008). There is no denying the benefits to undertaking broader population research, sharing data and knowledge. Comprehensive data use improves efficiency, effectiveness and transparency; while providing informed policy-making and understanding social climates (Janssen & Kuk 2016; Cong & Pandya 2003).

Through understanding stakeholders and their environment, greater collaboration can be encouraged (Blok, Hoffmans & Wubben 2015; Bryson & Roering 2007), which in-turn minimises organisational discontent, social media complaints (Karakiza 2015; Sedereviciute & Valentini 2011) and protects and organisations reputation (Aula 2010). This literature demonstrates how increased use of data and research in the private sector emphasises the need for public sector to understand their users.

Utilising systems thinking to view stakeholders, requires a multidimensional approach to stakeholder analysis, to provide an appropriate holistic view of potential stakeholder expectations, behaviours and the environment they reside (Lienert, Schnetzer & Ingold 2013; Monat & Gannon 2015). Will assist the multidimensional stakeholder analysis understand and map factors (digital, environmental, stakeholder and organisation specific) impacting mandatory digital service adoption.

As earlier discussed, this paper proposes applying multidimensional stakeholder analysis, which is an emerging concept; combined with findings of the digital ecosystems and systems environment analysis to create a rich picture analysis. Using this approach will provide a clear analysis of influences and interconnections of mandatory public sector services.

III. MODEL AND METHOD

A. Proposed Model

Through a systems approach to analysing various factors influencing stakeholders, the model in Figure 2 is proposed to assist the initial multidimensional stakeholder analysis process. Figure 2 highlights the relationship between each component in the system that should be addressed to improve mandatory digital service adoption.

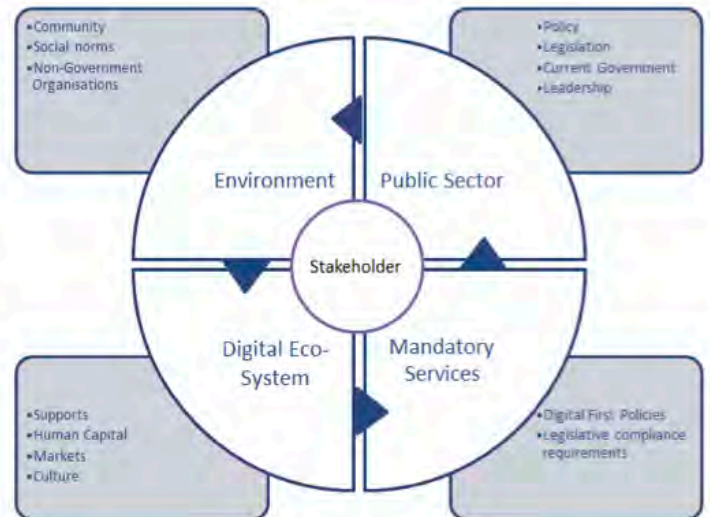


Figure 2 Proposed Model

To create Figure 2, a comprehensive review of the different environments affecting the multitude of stakeholders was developed. This included analysing digital, business, technology, social and innovation environments (Wu & Chang 2007; Dong et al 2007; Skilton 2016; Heikkila & Kuivaniemi 2012; Basole, Russell, Huhamaki, Rubens, Still & Park 2012; Wareham, Fox & Giner 2014; Nambisan & Baron 2012; Autio & Thomas 2014; Mercan & Gokas 2011). Each environment was analysed in relation to public sector digital adoption, including numerous internal and external components, within and outside the control of organisations.

Figure 2 demonstrates the four elements which emerged from the environmental analysis impacting and influencing users of mandatory digital services, forming the background research for policy planning. These elements include the environment (e.g. interactions with other people) specifically culture and social norms as they outline perceptions of the environment (Herrera et al 2016; Hall & Khan 2002). Digital ecosystems (e.g. how digital products are accessed) including human capital impacting user's capacity to interact with the system (Buchanan et al 2016). Public sector requires understanding the responsibility of government and their agencies to implement and regulate policies enforcing mandatory services (Bach et al 2012). Finally mandatory services (e.g. differ from voluntary) and the role public policy and sector entities have enforcing such services (White & Heckenberg 2012; Yildiz 2007). These elements interact in difficult and unpredictable ways and should be explored and considered in-depth, especially when it relates to policy planning. Therefore applying the high level understanding in Figure 2 encourages exploratory research design ensuring all research priorities are met. Thus, the multidimensional stakeholder analysis should be

conducted in parallel with the systems and digital ecosystems analysis of the surrounding environment. Successful digital adoption of mandatory services must be guided by understanding who services are for, common expectations, appropriate resources and provision of support at all stages of service use (Bourne 1959; Reinders et al 2010; Nakata & Weider 2011).

B. Multidimensional Stakeholder Analysis Approach

To determine attributes of specific stakeholder interest groups, applying a multidimensional lens highlights the complexities within the stakeholder group (Kivits 2013); achieved through applying numerous techniques in parallel comparing stakeholders' specific characteristics. As mentioned previously, a multidimensional stakeholder analysis has not been investigated in the public sector space, and could assist in creating new policies, strategies and provided services (Kivits 2013). The steps this model proposes starts by identifying all stakeholders and their role within the system, even the multiple roles should all documented (Mok & Shen 2016). Stakeholder identification should be undertaken through consultation with frontline staff dealing directly with clients, literature analysis, business documentation review and other jurisdictions data to appropriately acknowledge all stakeholders. The proposed process involves identifying the stakeholders and determining where they fit in the questions outlined in Figure 3.

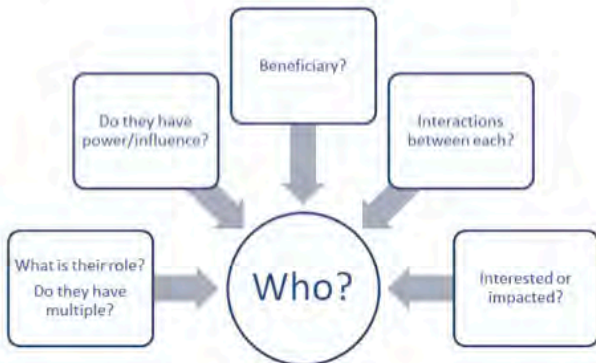


Figure 3 Stakeholder Identification Questions (Mitchell, Agle & Wood 1997; Mendelow 1991; Jacka & Keller 2009)

Figure 4, outlines three specific stakeholder analysis techniques recommended for this research. The Power Interest Matrix, a simple tool used to identify the power and interest of each stakeholder in relation to the area (Mendelow 1991). The Stakeholder Salience Model identifies stakeholders per three elements. Legitimacy of the stakeholders, Urgency the capacity for immediate action of stakeholders and Power the different levels and types (Mitchell et al 1997). Finally the RACI model, used to determine which stakeholders are responsible, accountable,

require consultation or require information provided to them (Jacka & Keller 2009).

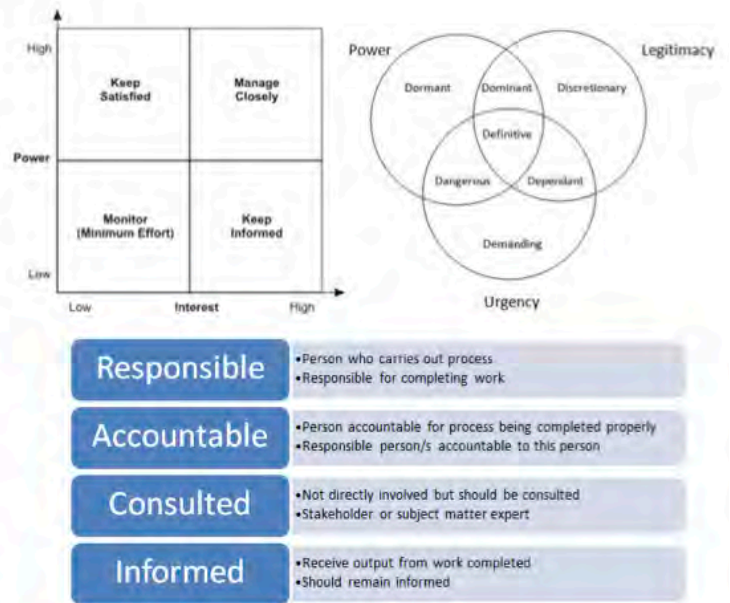


Figure 4 Stakeholder Analysis Tools. Top Left - Power Interest Matrix, Top Right - Stakeholder Salience Model. Bottom - RACI Model

Integrating multidimensional stakeholder analysis will assist in understanding the digital ecosystem and the broader public sector system, emphasising the need for this research. The intention of this research is to use multidimensional stakeholder analysis to assist in building a holistic conceptual representation of the system and ecosystem. A critical approach is needed, with emphasis on the elements within Figure 2. The introduced model assists in understanding broader public sector systems, creating a consultancy approach.

IV. A PUBLIC SECTOR CASE STUDY: THE AUSTRALIAN TAXATION OFFICE

Increased visibility, as a result of digital and social awareness, has increased expectations on the services provided by the ATO to taxpayers (ATO 2015). There is a growing pressure to meet the changing requirements of service users (ATO 2015). Largely due to ongoing developments in the provision of products and services provided by private sector companies only increasing users social expectations (Damiani et al 2007). Technological advancements, improved internet access and reduced ongoing costs of digital products and services has impacted the ATO and the public sector as a whole (ATO 2015).

Significant policy changes to the Australia Public Sector (APS) have overhauled how services are provided, with the default products and services to be digital (NAA 2015). The

ATO was one of the first APS organisations to undergo changes to provide digital services to users (ATO 2015; ATO 2017). The ATO is in a unique position, with interactions required by legislation, ranging from annual reporting for most individuals to monthly reporting for some businesses (ATO 2017).

The ATO, like all APS organisations is challenged to meet strict regulations, based on legislation, current government, creation of public value and meeting national goals (ATO 2015; Australian Public Service Commission (APSC) 2015). The APS reform and the Digital Continuity Policy caused the ATO to undergo Reinvention to digital first platforms (ATO 2015). The 2015 Digital Continuity Policy 2020 (DC2020), planned optimising the delivery of government services and programs, enabling simpler information sharing between government agencies, and providing security for Australian citizens (NAA 2015). DC2020's policy pushes APS departments to transition to digital first service platforms by 2020 (NAA 2015). The ATO Reinvention and DC2020 highlight changes requested by client research which determines negative impacts of going digital (ATO 2015; NAA 2015). This research demonstrates that consumers want to feel that their needs are understood and experiences, products and services are tailored to their needs (ATO 2015).

For this ATO case study, Figure 5 was created to provide a holistic systems view of the ATO, identifying the different sources and elements impacting the system. Demonstrating the links between the four elements outlined in Figure 2. The system demonstrates how the ATO system (shown as the "ATO organisation as a whole" and "ATO services") creates the mandatory system. This interacts with the public sector (includes "government and regulation", "policy", "current government" and potentially other government entities), the digital ecosystem and environment, as well as the taxpayers who interact (composed of elements within the boundary (the bold square)). It is understood that when scanning the public sector areas cannot be changed but can be understood (including policy, current government). The fulfilment of policy creates the mandatory services/system (specifically how digital services are built), which in this case is completed by the ATO and ATO services. The public sector and mandatory services forms the input to the left of the boundary. The environment and the digital ecosystem components are much more complex, as they interrelate considerably. In this model, the environment and digital ecosystem are within the boundary while also influenced by additional variables associated with them.

V. POLICY IMPLICATIONS AND FUTURE RESEARCH

The proposed model utilises a comprehensive range of strategies to enhance digital adoption in the public sector. The steps for model implementation outlined within this paper, starts with the application of a multidimensional stakeholder analysis, requiring numerous steps to identify

and quantify stakeholders. Once identified stakeholders require scrutiny ensuring all stakeholders are covered, including those influenced by and interested in the public sector. This analysis utilises multiple perspectives determining who are the most influential (in terms of financial return, social influence, etc.), the largest groups (numbers represented) and different characteristics of each group (including; income bracket, industry, reporting platforms, etc.). By doing this, policy makers are better informed and have a clearer understanding of the key factors influencing the digital adoption process in different levels of stakeholders.

Clearly the application of this methodology would help identify the diversity of barriers presented in the process and various levels of the digital adoption system operates. We also recognise that developing digital adoption solutions to improve government department operation and cost reduction involve all stakeholders, including government departments in this case ATO, industry, and the wider public. We suggest that there are two implications of this study. Firstly, we suggest that the digital adoption intervention strategies consider the human capital, government, regulations, and culture of the stakeholders. Secondly, the attempts involving stakeholders will be more effective if they are part of, and appear to be part of, a coherent and consistent process change.

In order to develop appropriate policies, there is a need for basic information provision to understand the characteristics of the system and stakeholders. Additionally, the use of different channels to communicate the information will be related with the type of stakeholder, allowing transfer of information in an accurate and appropriate manner. The use of different marketing techniques will help to change stakeholders' difficult behaviours, but basic information such as culture and level of education can help to provide the relevant context. In addition, we suggest utilising social media as a medium for educating stakeholders about the system.

The use of multidimensional stakeholder analysis provides government entities with an enhanced understanding of the strengths and weaknesses of different relationships. Encouraging public sector organisations to consider all stakeholders, including those not commonly understood or researched. Decision-making about product and services offering will be impacted by this research, as this will provide justification to further research. This research will also highlight the relationship between public sector organisations and the digital ecosystems. The results will utilise available qualitative and quantitative data, to validate the findings of the multidimensional stakeholder analysis. As much of the research being utilised was undertaken in isolation, this research will provide a holistic picture of the stakeholders influencing public sector organisations.

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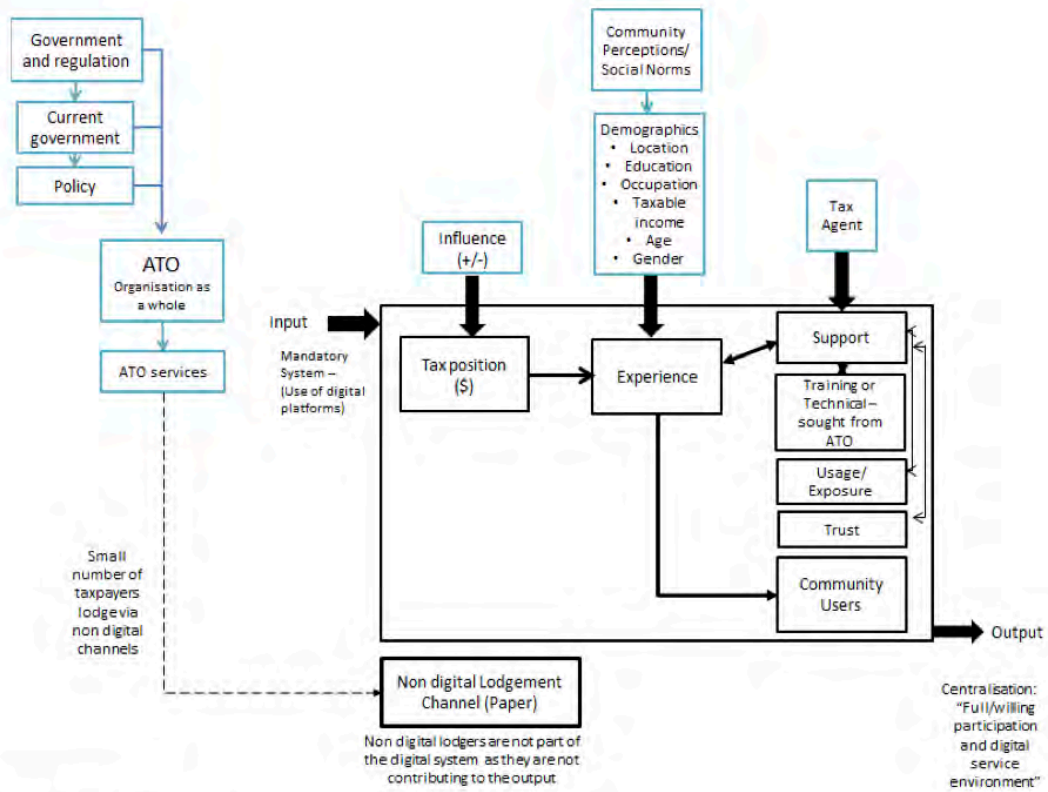


Figure 5 ATO Systems View

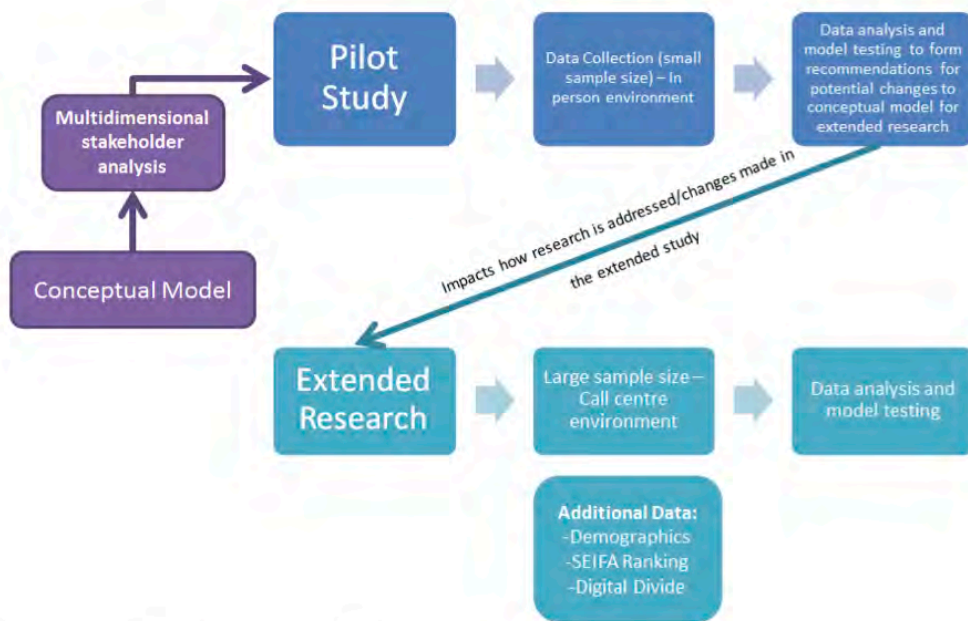


Figure 6 Steps for model implementation

Purpose of Paper 1 – Digital Interactions Strategy: A Public Sector Conceptual Model

This conceptual paper was used to conceptualise the problem space, to understand the literature, government research and expert opinions used to form the background of the problem space. The researcher was better able to understand the problem space, specifically what was already known about digitalisation and digital adoption within the public sector, how this relates to the Australian perspective and the ATO case study. The conceptual paper was used to inform the observational study, and to identify the validity of the conceptual model. Through the use of a thematic analysis, the conceptual paper was used to explore how additional research could be conducted to support the views of the conceptual model.

To validate the problem space, the conceptual model was used to identify the need for data collection. This paper was used to guide the exploration and data collection conducted, seeking to understand why people seek assistance and what the elements that cause individuals to struggle with the use of the digital services provided by the ATO. The data collection guided by the conceptual model, was used to explore how digital adoption could be affected by assistance seeking behaviours, especially when individuals do not identify the assistance received as answering their questions or concerns. The purpose of the conceptual paper was to guide additional research to explore how high digital adoption and low assistance seeking requirements could be reflective of more effective digital transformation. Paper 2 “Digital Interactions Strategy: A Public Sector Case”, explores the observational data collection and analysis and how it relates to the conceptual model.

Paper 2 – Digital Interactions Strategy: A Public Sector Case


Papavasiliou S, Reaiche C and Ricci P, 2019. 'Digital Interactions Strategy: A Public Sector Case', *The Thirteenth International Conference on Digital Society and eGovernment*, pp. 19-23. ISBN: 978-1-61208-685-9

This paper was presented at the *13th International Conference on Digital Society and eGovernment*. The researcher was then invited to extend the presentation paper so that it could be included as a journal article in the conference issue of the *International Journal on Advances in Information Technology*.

Statement of Authorship

Title of Paper	Digital Interactions Strategy: A Public Sector Case
Publication Status	<input checked="" type="checkbox"/> Published <input type="checkbox"/> Accepted for Publication <input type="checkbox"/> Submitted for Publication <input type="checkbox"/> Unpublished and Unsubmitted work written in manuscript style
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Name of Principal Author (Candidate)	Samantha Papavasiliou		
Contribution to the Paper	Designed and Conducted the observational study undertaken as part of the pilot study. Developed the Conceptual 'User Centred Model' used for testing. Completed the data analysis.		
Overall percentage (%)	60%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
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Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Name of Co-Author	Peter Ricci		
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Digital Interactions Strategy: A Public Sector Case

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Abstract— The public sector’s role as mandatory service provider is to produce effective services for users, and to make compliance uncomplicated and straightforward. However, at present, public sector services appear to not meet these user expectations. The purpose of this research is to explore ways to enhance digital adoption in the public sector by further understanding who these users are, when and why they seek assistance, and the various potential outcomes post-assistance. Evidence to support this research will be provided via a case study from the Australian Taxation Office. This research project will be presented in three sections. Firstly, the researchers describe a conceptual model they have created, which places the user at the centre of the research and policy direction. Secondly, results and some critical findings will be presented, of a pilot study which was conducted to test the model on a small scale. Thirdly, the researchers will outline planned extended research which proposes to validate the pilot findings and explore the service users in greater detail. The extended research utilises additional demographic data to better understand the greater system dynamics. This research is ongoing and forms part of a PhD dissertation.

Keywords— Mandatory Systems; Digital Service; Digital Ecosystems.

I. INTRODUCTION

Increasing digital service adoption and the provision of a better digital client experience is vital to any successful government digital service platform. To achieve this success, research needs to identify and understand the users, including understanding why users seek assistance, and leverage points to maximise the users’ capacity to complete their interaction. A recent study conducted by the Australian Digital Transformation Office [1] suggests that there is evidence that further research is required to address how to maximise digital service adoption. Improved understanding of issues users may have with specific public sector digital services has become increasingly important in Australia, with changes to service provision from in-person/call centre to digital. This research seeks to address knowledge gaps regarding who the users are, why they need assistance and where self-service assistance can be provided. This research

will be based on a case study conducted by the Australian Taxation Office (ATO). Through consultation with the ATO staff and examining company and academic literature, a clear gap was identified between what was known about mandatory digital service use and the users required to use them. Currently, standard methods for evaluating government services include interviewing or surveying users about services provided. This often results in biased results, as users often display expected behaviours [2]-[4]. Accordingly, research thus far has ignored a multitude of factors that impact adoption, and failed to identify barriers to adoption within a mandatory environment, and how different experiences with digital services can impact long-term adoption and when and why users seek assistance.

The creation of the Digital Continuity Policy 2020 mandated digital first platforms for all public sector services [5], causing significant challenges to service providers and users. For the purposes of this research, mandatory users are defined as citizens who meet certain characteristics, which including earning an income in Australia, and submit an annual income tax return to the ATO. Research into digital adoption does not engage with the concept of mandatory services and the impacts of digital first policies on users required to engage with digital services to comply with legislative requirements [6]. To address these concerns, analysis techniques should be holistic and adaptive, in order to incorporate an understanding of how a variety of factors can prevent or encourage users to go digital. This research utilises a holistic approach to analyse factors impacting users through the application of Systems Thinking and the testing of a conceptual model for analysing stakeholders/users in a multidimensional manner.

This paper is divided into six sections. Section one contains the introduction, section two presents the literature reviewed, section three discusses the research significance, section four outlines the research methods undertaken, section five highlights the results to date, and section six offers some conclusions.

II. LITERATURE REVIEW

Citizens expect digital services to be useful, accessible, easy to use and functional [7]. The goal of eGovernment is to create additional public value, by increasing stakeholder inclusiveness and encourage equal access to services [8].

The purpose of utilising e-government is to provide transparency and cooperation, improve government process, and provide digital services [9], all of which require continuous monitoring and assessment [8]. Furthermore, more needs to be done to understand the structural inequalities that affect the use of digital services, to prevent the issues becoming more intense and ingrained [10]. There is also a concern that social inequalities may be perpetuated online, given that those who are already in more privileged positions are more likely to use the medium [11]. These important factors highlight the value of researching barriers which prevent individuals from accessing government services.

The most common definition of adoption refers to continuous use of a digital service or innovation [12]. For digital services to be sustainable, they should be appealing and useful [13]. Shareef et al found in their research that perceived usefulness, perceived ease of use, perceived security and perceived reliability positively impact an individual's intention to adopt digital services [14]. Hargitti argued that not all online activities are equally important to enhancing one's human, financial and social capital [15]. This research determined that there is a strong relationship between level of education and type of digital services used [15]. Access to technology no longer determines inequalities alone – exposure to experiences which increase the digital participation and literacy are vital [15].

Research highlights four kinds of barriers to digital access: (1) lack of elementary digital experience due to lack of interest, (2) no computer access, (3) lack of digital skills, and (4) lack of significant usage opportunities [16]. Further barriers identified within the literature include lack of internet access, lack of awareness, language, user friendly websites, lack of trust, and security fears [9]. Researchers still need to understand the digital divide within the social, psychological, cultural and non-technological access context [17]. The challenge going forward is to determine the resources and functions that can be developed and provided to support positive user behaviour [7]. eGovernment aims to provide information and public services to citizens and encourages citizens to participate in different platforms [7].

Existing research does not focus on the multitude of factors impacting users' capacity to adopt and participate in a mandatory digital ecosystem, and there is little discussion around how digital adoption in mandatory spaces is different from adoption in other contexts. A thorough review of the literature identified the factors within a user's environment which have a significant impact on a user's capacity or willingness to adopt digital services within a mandatory space. For this research project, numerous different ecosystem styles were analysed, including digital, business, technology and innovation ecosystems.

Through the creation of a testable conceptual model, it is proposed that through the use of client-centric research, policy can better understand and support different stakeholders/users.

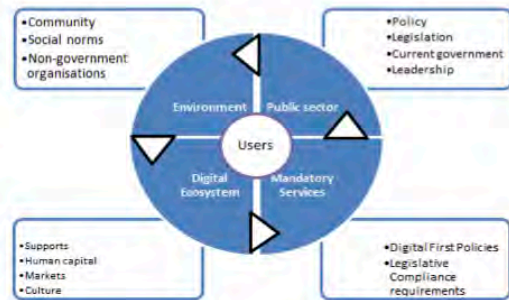


Figure 1 Conceptual Model with the User at the Centre

This conceptual model was created through the application of numerous stakeholder analysis techniques, combined with an analysis of the environment (based on Systems Thinking analysis) and digital ecosystems literature. The proposed conceptual model is highlighted in Figure 1. The four elements which capture the system are the Environment (including interactions with other people), Digital Ecosystem (including how digital products are accessed), Mandatory Services (including how they are different to voluntary services), and Public Sector (including the elements that make the services mandatory). Along with results of further research, this will be used to build an in-depth model.

III. SIGNIFICANCE AND RESEARCH GAP

This research will extend current understanding about the variety of factors impacting mandatory digital service adoption, bridging a gap in knowledge. The conceptual model in Figure 1 tests how policy can put the user at the centre, and help develop a better understanding of the user. Understanding digital adoption in the mandatory space should include how, why and when users adopt digital services, and in contrast when, how and why they do not, and in the latter case how they fulfil their mandatory compliance obligations. This research is based on understanding the outcomes of those users who actively seek assistance when using digital services, mapping the links between non-digital and digital issues, while also measuring outcomes. The application of a Systems Thinking approach will be applied to provide a more transparent view of the system, to understand the process holistically, per individual components and key interactions within the system. Therefore, the overarching aim of this research is to understand areas which may require intervention or can be leveraged to assist citizens adopt public sector mandatory digital services. This research proposes the model in Figure 1 to be tested through the collection and analysis of supporting data.

Previous research has applied a client-centric view to researching digital adoption; however, based only on voluntary digital services or those provided by the private

sector [18]-[22]. Prior research has identified that there are a number of socioeconomic, cultural and intrinsic values that influence whether or not an individual will accept digital services [23]-[26]. This has been, to a certain degree, ineffectively applied to public sector research on digital adoption [1]. When mandatory digital services *have* been researched, the outcomes commonly revolve around acceptance of e-government services; results are based on survey responses specifically related to trust and innovation factors [27]-[31]. Previous research does not appear to have addressed the issues around adoption in a mandatory space, why users do and do not adopt these services, and how they comply with legislative obligations when they do not utilise digital services. Research has not included in-depth exploration about why users seek assistance when utilising digital services from the supplying entity and the outcomes post seeking assistance. This is critical for successfully adopting and sustaining commitment in mandatory digital systems. Previous models too, fail to explore the issues and environments associated with mandatory digital service adoption. The application of the proposed model helps fill some of these gaps and provide greater clarity on these potential blockers.

IV. APPROACH

The research approach used in this research has been exploratory in nature, allowing for ongoing developments as the findings developed. The researchers initially had a liberal set of goals, with the intention of allowing the data collected to further refine the specific questions, direction and analyses. The data collection was implemented in two phases. First, a pilot study was conducted to determine the validity of the proposed model for stakeholder/user inclusiveness. The second phase involved the data collection for the extended research. Only the pilot results are included in this paper, with plans in place to examine the second phase with different analysis techniques.

A. Data

Two qualitative datasets were collected during the pilot and extended research period. The pilot study was conducted over a 3-week period (July 2017) to validate the conceptual model. This was conducted by 2 researchers, located in an ATO shopfront environment (in-person assistance) in South Australia; 234 cases were collected. The second and more extensive dataset was collected by 11 ATO officers over 4 weeks (July 2018). Data was collected from numerous ATO call centres across Australia, with 3990 valid cases collected. From the 3990 cases collected, additional quantitative data was obtained. This data includes three years' worth of results for callers' including their income, income type, occupation and how they lodged their tax return. This data was joined to the qualitative data to provide a richer picture of the callers, specifically identifying why they sought assistance and how that

impacted their lodgement. All data was anonymised to ensure confidentiality and anonymity of participant data.

B. Methods

Two qualitative methodologies were applied to explore the data – firstly, Gioia’s method for qualitative rigour and secondly, a Systems Thinking Approach. This enabled the researchers to find structure in unstructured qualitative forms, as it is a systematic approach. Firstly, the Gioia method [32] [33] requires the researcher to step back, and then categorise the accounts into three different phases (First, Second and Third order). The first order, ‘Concepts’, is the ‘voice of the user’ (also known as ‘voice of the customer’). The second order, ‘concerns and statements’, identifies specific sentences from participants which are then grouped together to discover the themes and patterns in events and accounts. These create Themes that are more generalised underlying explanatory dimensions, to test consistency and patterns [32] [33]. Finally, the third order ‘aggregate dimensions’, identifies the generic themes encompassing all of the first and second order data [32] [33]. Significance was measured through counting occurrences of first, second and third order elements to identify themes and patterns throughout the different accounts. The patterns in the text were then linked by connections, highlighting key features and emergent concepts or themes that require further analysis.

Secondly, Systems Thinking analysis was applied to systematically identify and order findings into their respective components of the process [34]. This helped to identify the points within the process and system that are causing the most issues and where support can be implemented. Systems Thinking was used to visually convert the findings into simplified figures that highlight key emergent findings. Our analysis will focus on profiling participants to identify relationships between why users seek assistance, their demographics and how/if they lodged a tax return.

V. RESULTS

Results from the pilot demonstrate that there are many components of the system which are hindering the successful adoption and use of ATO digital services for users lodging tax returns. Specifically, without support many taxpayers would have been unable or would have struggled to lodge their documents.



Figure 2 Pilot results - Lodgement Process Assistance Points

As highlighted in Figure 2, this is the first view of the system where intervention points are possible. Lessons learnt from this research demonstrate that, on average, taxpayers who sought assistance required it for more than one element of their tax return. Systems analysis demonstrates that there are more than one intervention points pre/during/post lodgement that should be leveraged for education and assistance. However, this research does understand that not everyone will be able to lodge digitally, and not everyone who needs help seeks help. For the purpose of client experience, it is important to recognise that negative experiences within the system will impact willingness to obtain assistance and advice in the future.

Descriptive analysis of the pilot data indicates that of the individuals who sought assistance utilising digital platforms for lodgement, the most frequent age group was 18-29 year olds (53.5%). This finding was unexpected. The other significant trend within this data was the high frequency of the pilot population seeking assistance who were in different life transitions (25.65%) (e.g., rental properties, deductions, income sources, retirement, etc.). Of the pilot population, those who had self-reported language barriers (17% of those seeking assistance) were more inclined to utilise paper solutions for lodgement rather than digital means. There is a concern that this will deter them from utilising digital means, and future research will determine whether or not digital or non-digital lodgement patterns are habitual, and if there are identifiable clusters of the population or demographics that are more inclined to behave in this manner.

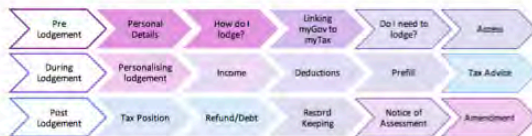


Figure 3 Extended research - Lodgement Process Assistance Points

Results from the extended research are still under development; however, preliminary results show how detailed follow-up research can improve the level of detail of the lodgement process systems view diagram, as shown in Figure 3. The current findings show that this process of analysis provides a more transparent view of the system, identifying the issues and points of the system that can be leveraged. This research has highlighted the links between digital and non-digital components of the tax system, e.g., understanding of tax and needing assistance. Figure 3 highlights the level of complexity associated with digital services in mandatory environments, especially when considering how adoption is impacted considerably by a multitude of factors. Implications of the extended lodgement process in Figure 3 are still under exploration.

This research is ongoing with additional research underway, including modelling of key outcomes, with a

number of analytical techniques being explored. As is, the research continues to justify and validate the model outlined in Figure 1. Suitable methodologies to support the quantitative data analysis are currently being explored. This research can be applied to other areas of the public sector, especially those areas that have or are introducing mandatory digital services. With the transition of private sector entities to digital first platforms, the financial services sector, for example, could benefit from this style of research.

VI. CONCLUSION

This research seeks to understand the different barriers affecting adoption of mandatory digital services. The preliminary results highlight findings that need to be explored in further detail. The conceptual model will assist in identifying the interactions between the different elements outlined within the model, as well as increased details built within a systems view. Through ongoing data analysis and future papers, this model will be tested further. Future research will identify specific areas of assistance that are required going forward.

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Purpose of Paper 2 – Digital Interactions Strategy: A Public Sector Case

Paper 2 outlines the results of the observational study (pilot) which led to the extended study. This extended study sought a larger sample size with which to conduct a thematic analysis, to understand in greater detail the digital adoption behaviours of users of digital services in the ATO and the assistance-seeking behaviours of the individuals using the services. The purpose of paper 3 was to extend the generalisability and validity of the conceptual model.

The themes that resulted from the data collection of the pilot and extended study demonstrate that the conceptual model outlines a number of the constituent systems that were relevant for the adoption of digital services in eGovernment.

The overarching purpose was to explore the adoption and assistance-seeking behaviours of the individuals on a larger scale. As shown in paper 2, a key barrier to digital adoption is the ineffective digitalisation of information (on how to conduct tax lodgements) and information about how to access the services. The researcher sought to identify if this was a common problem within the extended study. Paper 2 provides a starting point for the data collection process undertaken in paper 3, to identify in greater detail how high rates of digital adoption (specifically long-term or multiple use) could link back to effective digital transformation processes.

Paper 3 – Digital Adoption Strategy: A Public Sector Ecosystem

Papavasiliou S and Reaiche C, 2019. 'Digital Adoption Strategy: A Public Sector Ecosystem', *International Journal on Advances in Internet Technology*, vol. 12(3), pp. 96-108.

This paper was invited for publication from the *13th International Conference on Digital Society and eGovernment 2019*.

Statement of Authorship

Title of Paper	Digital Adoption Strategy: A Public Sector Ecosystem
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Principal Author

Name of Principal Author (Candidate)	Samantha Papavasiliou		
Contribution to the Paper	Designed and Conducted the observational study undertaken as part of the pilot study, and the survey instrument used for the extended study. Developed the Conceptual 'User Centred Model' used for testing. Completed the data analysis.		
Overall percentage (%)	70%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	14/05/2020

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Carmen Reaiche		
Contribution to the Paper	30% Supported the data analysis, assisted with the validation of the results and assisted with theoretical underpinnings		
Signature		Date	1/6/20

Digital Adoption Strategy: A Public Sector Ecosystem

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Abstract—The shift of public sector service provision to digital first, has had a considerable impact on how individuals interact with public sector entities. Therefore, this research argues for a systems approach to explore and understand different assistance-seeking behaviours. In particular, there is a need to understand the critical points within the system at which assistance is sought and the changing behaviours correlated to post assistance-seeking outcomes. Evidence for this research is presented through a case study on the Australian Taxation Office. Observations of the digital lodgement channel were undertaken to evaluate the components in which individuals sought assistance. Through the application of systems thinking and process mapping, this research highlights the critical points in which assistance was sought within the lodgement process. The results of this research lead to the recommendations that ongoing education should be provided for four years post first lodgement, and that education should occur at change of circumstances. Through the use of strategically placed self-help assistance throughout the lodgement process, it is anticipated that individuals will be less likely to seek assistance. However, this research demonstrates the importance of maintaining human interfaces for assistance-seeking to maximise an individual's capacity to interact with the system successfully.

Keywords- Assistance seeking; Digital Ecosystems; public sector; digital lodgement.

I. INTRODUCTION

The ongoing attention on the importance of a successful public sector service offering, and to improve and enhance digital service adoption within the public sector, is based on the provision of a better client experience. To achieve this, public sector entities are putting increasing resources into understanding their clients and providing services to meet their expectations. This has had an impact on the manner in which services are designed, the manner in which data is used and shared to increase ease of use, and how entities plan future services. With the increased attention on the services, the next stage is to understand the human interaction components, which include assistance-seeking behaviours, why individuals seek assistance, and the points in the process that are more likely to require assistance. Since the shift to digital first service policies in the public sector, increased pressure has been placed on both the service user and provider to understand both the process and the digital environment [1]. Even with high adoption rates of digital

services, there are still individuals not interacting digitally and those who require ongoing support and assistance once going digital.

The aim of this paper is to identify and understand public sector service users, which includes identifying the potential barriers to digital adoption, followed by understanding why various users seek assistance, and post assistance-seeking outcomes. This paper argues that mandatory public sector services need to be inclusive, including digital and non-digital options, this extends to how assistance is provided. This research forms part of a PhD and findings and recommendations are ongoing.

Research by the Australian Digital Transformation Agency (DTA) [2] indicates the necessity of further research of this type, to proactively address digital adoption, specifically increased use. In Australia the purpose of the DTA is to improve services for the community, expecting government to protect citizens personal data and deliver digital services [3], and to ensure that digital services keep up with ongoing technological change and development. Having an increased understanding of the issues facing public sector digital service users is of increasing interest in Australia, with ongoing service delivery changes from in-person/call centre (also referred to as analogue) to digital. With the growing complexities in the environment, the factors that impact why a service user may require assistance and their post assistance-seeking outcomes are becoming more influential in their perception of the digital services provided by government generally. Therefore, it is vital that research understanding digital adoption provides a more holistic view of the various issues facing service users, particularly focusing on understanding why they seek support. This paper seeks to address knowledge gaps that have been identified in the literature, including exploring what the barriers to digital adoption are in this specific case, why assistance was sought and how the assistance sought influenced their service use.

Through building and encouraging a user centric approach to researching the various interactions between individual public sector entities and users, the barriers to digital adoption will become more apparent. This is becoming increasingly more important due to regulatory changes in the public sector space as a result of the inclusion of 'digital first' policies, which have shifted mandatory

services online. These policies have fundamentally changed the manner in which service users interact with public sector services. For this research mandatory environments are classified as “Public Sector Organisations who must by legislation provide Digital Platforms for their services” [1] [4]. While mandatory interactions are defined as “Users who meet certain characteristics and must by legislation interact with the public sector service provider to meet these obligations” [1] [4]. Therefore, users must engage with providers, but under the digital first mandate expectations around how they do so has changed.

This paper focuses on a public sector case study – the Australian Taxation Office (ATO) – that was impacted by the introduction of the Australian Digital Continuity Policy 2020, which mandated the use of digital first channels for all public sector services [5]. Through the examination of previous literature, ATO corporate research, data analysis and responses from ATO staff, a gap was identified between what seems to be common knowledge about the mandatory digital service user and the profiles of the actual users who are required to use them. The impact of shifting mandatory public sector services to a digital first platform is still unknown. As digital first service provision is the way forward for all public sector organisations (especially in Australia), a holistic view of users is needed. This paper aims to provide this view. Research needs to support and assist users, improve services and inform policy to increase long-term voluntary compliance obligations in a mandatory service space.

This paper will review previous literature focusing on digital transformation, digital adoption, digital ecosystems and eGovernment to understand the background of digital transformation in Australia and the basis for digital adoption and eGovernment worldwide. At present, the standard methods used for evaluating government services are based on interviewing or surveying users about their opinions and experiences of services provided. However, this style of research often results in biased results, as users feel pressured to display expected behaviours [6-8]. As a result of this contentious and possibly flawed data collection, previous research appears to have ignored a number of factors which impact service adoption, and seems to have failed to identify the barriers to adoption within mandatory environments. There is also a gap in understanding how different experiences with digital services (both in the public and private sectors) can impact long-term adoption and the reasons for when and why users seek assistance. The focus of this research is on applying systems thinking and digital ecosystems theories to understand and validate the need for a holistic view of the users and the system, especially when seeking to understand assistance-seeking behaviours.

In this research, systems thinking, particularly a soft systems methodology, has been used as a way to understand the behaviours and actions in complex public sector environments. An important principle is the concept that each action within the system causes a reaction in the system. These reactions can lead to unintended consequences, ones

which are critical to explore [9]. This approach has been used to explore the planning process the ATO undertook to minimise the barriers experienced by taxpayers when submitting their returns. Keeping in mind that a core aim of the research is to understand the connections within the system, and the way in which each part of the system influences and is influenced by other parts, systems thinking is considered the most appropriate method. Systems thinking seeks connections between solutions, systems and society, identifying components of systems and intended and unintended outputs of the system, providing a holistic view of the problem.

This research explores the assistance-seeking behaviours of individuals when they are lodging their income tax returns with the ATO. The purpose is to understand the impacts of assistance-seeking on lodgement outcomes. Of the over 3 million individuals who lodged in July 2018, 5.3% sought assistance at some point throughout the process. The aim is to understand the different drivers of assistance-seeking behaviours within a mandatory system. Therefore, this research addresses two primary research questions:

- 1) What are the critical points in the lodgement process/system that are causing individuals to seek assistance?
- 2) What are the potential policy implications of understanding assistance seeking behaviours?

In applying a systems lens to these two questions, we ultimately seek to understand how and why the system as a whole functions as it does.

We have adopted a mixed methods approach to data collection and analysis with systems thinking to support the end-to-end research. That is to say, identifying who is most likely to contact the ATO for support and the critical points of assistance-seeking, and understanding post assistance-seeking behaviours and outcomes.

The overall approach applied to this paper incorporated multiple stages to provide the greatest depth of analysis and provide a holistic understanding of the assistance-seeking behaviours within the case study. First, systems thinking was used to assist with determining links between the different components, and understanding the different elements within the system and the effects each element could have on the outcome. Second, a thematic analysis was used to outline the common themes within the assistance-seeking behaviour, and understand the points in the system requiring the most assistance. Finally, a statistical analysis was considered appropriate to determine the behaviour of the actors within the system. Specifically, summary statistical methods was used to explore the population and understand who may be more inclined to require different kinds of assistance, in an attempt to provide policy recommendations for self-help prompts provided to individuals who meet certain characteristics.

This paper is divided into six sections. Section one contains the introduction, section two presents the literature review, section three presents the conceptual model, section

four outlines the research methods undertaken, section five highlights the results and addresses the research questions, and section six offers policy recommendations.

II. LITERATURE REVIEW

Previous research demonstrates that the purpose of undergoing a digital transformation in the public sector is to increase access to provided services, including through digital services [10]. This is achieved through a better understanding of citizens and service users to improve their outcomes, making digital services easier to access, and improving the client experience [10]. An interesting challenge for the public sector, however, is to overcome the clashing expectations over private versus public services, which are personalised, modern and responsive. Therefore, the public sector must consider the end-to-end digital services in line with the private sector. Through the application of advanced analytics, governments are able to leverage the data collected from users to improve the services provided. The purpose of transitioning to digital services is to provide public sector services more effectively and efficiently to increase public value. For this research public value is ensuring that all mandatory public sector services provided are inclusive with both digital and non-digital options, ensuring equal access for all.

It is important to consider the variety of challenges facing public sector digital services. Firstly, the public sector takes advantage of technology that is popular within other industries; however, they do not have the time or finances to compete with the services provided by private sector entities. Secondly, governments are not always able to engage with citizens and service users to provide products and services in the manner expected. Finally, there are numerous regulatory restrictions which complicate the process. Therefore, digital technologies provide an opportunity to explore new channels for service provision, to improve resource management, increase access for users, and boost accountability and trust. Digital technologies deliver benefits across the economy and society [11], however, government services need to keep pace with the opportunities that digital transformations provide (including increased value for money for the community).

Digital transformation has empowered users and providers, making it possible to choose how services are accessed or delivered, how to communicate, when to engage

on policy areas or issues, which social groups to join or business areas to invest in, and how to participate more actively in local, national and global challenges [12]. Research demonstrates that governments need to understand that going digital is no longer an option, but rather an imperative maintaining their legitimacy [12]. The adoption and use of digital technologies requires applying data more efficiently as part of their strategic components to modernise the public sector. Technologies are increasingly being used to digitise existing government processes and to offer public services online [12]. There has been a shift from a government-led to a user-driven administration, which is focused on end users and citizens expectations [12]. There are numerous challenges facing digital transformation, specifically around improving the digital experience. These include citizen security, cultural barriers to engaging with digital services, regulatory and legislative barriers (including those that restrict data sharing between government agencies), resource barriers and capability barriers (both public sector employees and users).

Research shown in Figure 1 outlines the progression towards digital transformations in the public sector [12]. The process started as analogue, which focused on in-person service delivery and paper-based processes. The second stage was eGovernment, which was the first stage of digitalisation, with the progressive inclusion of digital processes and procedures, including services provided to the users. The final stage in the progression is digital government, which is predominately based on digital first service provision, maximising user-driven approaches and citizen centric designs. This iteration highlights the value of inclusion, whereby exclusion from the digital world can exacerbate other forms of social exclusion such as unemployment, low education and poverty [11]. Every Australian should benefit in the shared digital future, which means that every member of the community provides insights into how they would like the service designed. This includes incorporating the user's views in the designs of processes and interfaces. The incorporation of users views, expectations and requirements into the design ensures that provided digital services take into account the different life stages and level of digital ability of users [11]. The application of systems thinking can assist in providing a different viewpoint of the potential barriers and their effect on digital adoption.

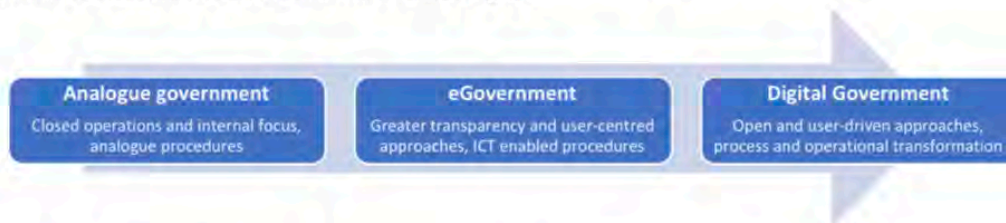


FIGURE 1. PROGRESSION TOWARDS THE DIGITAL TRANSFORMATION OF GOVERNMENTS [12]

A. Digitalisation

The evolution from traditional analogue services to electronic government services, to digital societies of interconnected and multichannel digital services has placed increased pressure on governments to provide high quality and easy to access public sector services [13]. This includes overcoming the challenges of meeting service user expectations, who commonly benchmark all services provided by public sector entities against those of the private sector. Users expect convenience and diverse communication channels with tailored information [13]. The development of digital services has impacted society considerably, specifically with the creation of eGovernment platforms, the shifting expectations to provide efficient, transparent and effective services, and to include open data (and transparency) and cross channel service options. With this shift to digital, the aim of public sector entities utilising these channels should be based on creating more efficient governments which offer service user's better services, enhancing the services already provided and aiming to increase all citizens' quality of life [14]. This is not a simple process, however; the use of digital processes and organisational change is the first step to ensure the successful implementation of digital first policies. It is shown that in countries that have successfully implemented digitalisation (e.g. Estonia), the government is able to provide services that meet the expectations of users, empower users, and increase their engagement with government [14].

The literature suggests that technology holds the key to shaping the world around us, as it enhances governments', businesses' and individuals' opportunities to integrate themselves within the global digital society, and enhance ongoing inclusion [15]. However, to become a high functioning digital government within the global digital society, digital adoption needs to be high, therefore, a key factor requiring consideration is the user's perspective. The most common determinants of eGovernment and digital government services adoption include the level of awareness and level of satisfaction of eGovernment services, both linked to intention to use [13]. Awareness relates to the extent users are aware of the eGovernment services [16] [17]. User satisfaction is being used to assess the continual use of eGovernment services and the success and failure of new eGovernment platforms [16] [18].

Digital or e-government adoption is most commonly defined as the continuous use of a digital service or innovation [19]. Therefore, for adoption to be achievable and sustainable, the digital service needs to be both appealing and useful [20]. This requires consideration of how a user may perceive the level of usefulness, ease of use, security level and reliability [21]. Furthermore, not all online activities are deemed to be of equal importance to an individual, especially when they are considering their personal level of human, social and financial capital [22]. Research suggests that there is a strong relationship between a person's level of education and the type and frequency of digital services utilised [22]. It

is important to understand, when considering inclusivity of services, that technology access does not determine an inequality alone, whereby increased experience, exposure, digital participation and digital literacy are vital [22].

Previous research has identified four key barriers impacting digital access: (1) lack of basic digital experiences due to lack of interest, (2) no computer access, (3) lack of digital skills, and (4) lack of opportunities to use digital services [23]. Additional barriers impacting digital access include lack of access to internet, lack of awareness, language barriers, user-friendliness of websites, levels of trust and security fears [24]. Therefore, the digital divide is still an area that requires understanding and consideration when planning digital service provision in all contexts, including social, psychological, cultural and non-technological [23]. Thus, with the application of a systems view, a holistic understanding of these factors can be provided.

The challenges facing policy-makers going forward is understanding and determining the appropriate resources and functions necessary in digital services to provide a foundation for and to support positive user behaviour [25]. This requires ensuring the creation of digitally inclusive services. Digital inclusion ensures that all individuals and groups (including the disadvantaged), have access and the skills to use information and communication technology (ICT), and are thus able to participate in and benefit from the growing reliance on the digital knowledge and information society [26]. Thus, digital inclusion encourages increased access to information and communication technology, with the aim of increasing social and economic benefits. Digital inclusion links back to the digital divide, which is the gap between people who have effective access to digital technologies and those who have limited or no access. Access and cost become barriers impacting digital inclusion, however individual factors associated with engagement and confidence are affected by digital literacy, relevance, motivation, trust and safety. Therefore, the aim of eGovernment and digital government services is to provide information and public services to citizens in an easy to access manner that encourages platform participation [25]. This highlights the vital importance of understanding the users of services, the application of systems thinking to break down the different interaction points, potential barriers and so forth, so that services that meet the needs of the users can be provided. It is also important to consider the digital ecosystem impacting the users, which includes where the services fit within the broader environment, including public and private sector services. This links back to the importance of understanding different factors impacting the user's ability or willingness to utilise a digital service provided by the public sector.

B. Digital Ecosystem

When exploring the impacts of digitalisation on public service adoption, there are multiple components that need to be understood and these elements are commonly identified

within the digital ecosystem. There are multiple definitions of digital ecosystems, however one of the most widely used defines a digital ecosystem as an “open, loosely coupled, domain clustered, demand driven, self-organising agents’ environment, where each species is proactive and responsive for its own benefit or profit” [27, p. 3]. Therefore, each species or user who works within or utilises a digital ecosystem, is a participant who uses the system with a specific goal in mind [28–30]. Therefore, a digital ecosystem can be characterised as consisting of organisational interactions, connected digitally, which are enabled by modularity, and are not managed by a hierarchical authority. Regardless of the definition, ecosystems are large, and they encompass numerous interactions between producers, suppliers, innovators, customers and regulators, shaping a collective outcome [31].

An ecosystem therefore emerges as a result of digitalisation, and through this process it becomes possible to connect a broad set of users together through the delivery of a singular digitalised customer solution. Thus, demonstrating the importance in understanding the creation of digital ecosystems within this research. As to ensure multiple external factors influencing user’s ability are understood and incorporated into the design and planning of public sector digital services and policy.

There are two definitions applied by this research. The first defines a digital ecosystem as “an interdependent group of actors (enterprises, people, things) sharing standardised digital platforms to achieve a mutually beneficial purpose” [32, p.1]. The second definition defines a digital ecosystem as, “a network of digital communities consisting of interconnected, interrelated and interdependent digital species” [33, p. 249]. Both definitions include the stakeholders, institutions and digital devices situated within an environment, that interact as a functional unit and are linked together through actions, information and transaction flows. These definitions imply that all of the connections made by service users to achieve their specific goals within a digital platform are incorporated within the digital ecosystem. Therefore, digital ecosystems are shared communities, with scalable resources used to pursue challenges of specific goals and objectives [34]. Finally, the level of complexity within a digital ecosystem can be attributed to the differences between the participants taking part in the system and their objectives [35] [28].

The different components relevant to the inner workings of a digital ecosystem are outlined in Figure 2. At the base are the users, who are the people, businesses and entities. They consume the services from the available channels (through digital platforms, directly or through other channels) [36]. The first level is the government, which includes the federal, state and local authorities who influence policies and legislation, as well as departments, organisations and entities that implement policies and provide services to fulfil mandatory obligations [36]. The second level is the market, which refers to the non-government entities (e.g. academics,

not-for-profits), intermediaries (such as health providers, tax agents), service providers (such as technology companies) and industry (such as banks, commercial entities) [36]. Finally, the third level is the environment, which includes the social norms, cultures, societal interactions and the access to the information and technology made available by the other levels [36].

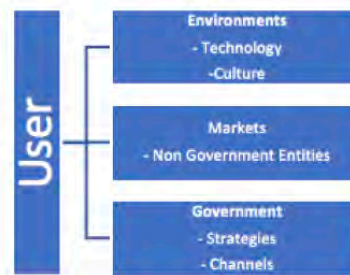


FIGURE 2. COMPONENTS OF A DIGITAL ECOSYSTEM [36]

Considering the different levels and the elements within the digital ecosystem under exploration, assists in ensuring a holistic understanding of the problem or situation under exploration. Through the exploration of the specific digital ecosystem relevant to a mandatory system, a testable conceptual model was created.

III. CONCEPTUAL MODEL

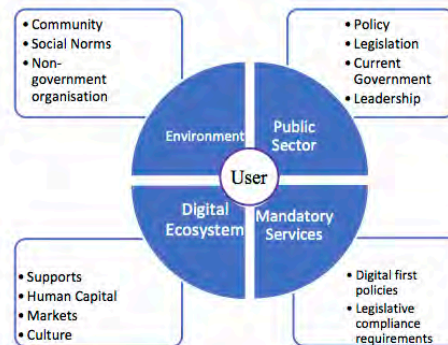


FIGURE 3. CONCEPTUAL MODEL WITH THE USER AS THE CENTRE FOCUS [3] [4]

A testable conceptual model was designed as a result of the analysis of digital, business, technology and innovation ecosystems. The purpose of the model is to provide user-centred research to guide policy and better support and understand the different users. Previous research does not focus of factors which impact a user’s ability to adopt and participate within a mandatory digital ecosystem. The existing research provides minimal discussion on how digital

adoption can differ in mandatory and voluntary environments. Through a thorough literature review, a number of factors within a user's environment were identified as having considerable impact on willingness or capacity to adopt mandatory digital services.

This research is focused on understanding the Digital Ecosystem quadrant in Figure 3, to explore the elements of supports and human capital within this quadrant, to determine what impact different elements components have on the Mandatory Services and Public Sector quadrants.

IV. METHOD

The motivation for this study originated from a desire to understand barriers to digital adoption in the public sector. A comprehensive literature review of research centred on environmental ecosystems [1] [4] has revealed that there is a lack of inclusiveness in the current mandatory system. The method outlined below outlines how the analysis provided the rationale for the proposed conceptual model: A Digital Ecosystem Quadrant (see Figure 3).

A. Case Study

The use of a case study method has been applied to this research to understand the different issues affecting digital adoption in the Australian Public Sector environment. The ATO case study was selected for numerous reasons. Firstly, the ATO is the lead in the public sector service provision (as the first Australian Public Sector (APS) organisation to adopt the digital first policy in Australia) [37]. The ATO collects considerable amounts of data, including interaction level data and mandatory interaction requirements data. The purpose of undertaking a case study is to explore and understand the uniqueness of a single case, while also understanding how findings from a specific case links to similar organisations or situations facing similar issues [38][39]. The use of a case study encourages greater in-depth exploration of the complex issues impacting digital adoption in that case. Therefore, by understanding the distinctiveness of the specific entity and users within the case under exploration, further research can also determine similarities to other cases (and their users and entities) [38] [39].

A mixed methods approach was applied to this research, which was appropriate for ATO case study. Therefore, the application of mixed methods encouraged the integration and interpretation of qualitative and quantitative data. This research carried out exploratory summary data analysis, text mining and thematic analysis, and hypothesis testing based on experimental design, to understand results from the data collection. This approach was applied to obtain an understanding of the key barriers impacting digital adoption and how they could be overcome. The starting point for this research analysis involved a qualitative method to explore and understand the different meanings and themes individuals or groups link to a problem [40]. An inductive

approach was applied to this research, which involved a process of searching for patterns within observations, which was then used to develop explanations or theories, and from which a series of hypotheses were created [41] [42]. The application of a combination of mixed methods and inductive approaches, allowed for the emergence of research questions to assist in the identification of themes within the results. A pilot study was conducted in 2017, in order to validate the umbrella research questions and guide future research directions. This included informing feasibility and testing the research design. The purpose of the pilot study was to identify the potential problems and thus assist with designing and undertaking a larger and more informative study [1] [4]. The pilot data and analyses [1], informed a number of research questions and hypotheses as part of a larger study completed in June 2018. This data collection focused on quantitative data (both experimental and survey conditions). The application of a quantitative approach has been used for testing objective theories, through the examination of the multitude of relationships between the variables [39].

Data collection for this study occurred during a 4-week period at the beginning of 2018 Tax Time. This included a survey form which consisted of questions, both qualitative and quantitative, designed in a manner to explore different components and characteristics of a random assortment of callers (n = 3,990). The survey queried the reason for call, the caller's demographics, and why assistance was sought. To achieve randomisation, the survey collection was provided to 11 call centre operatives. All assistance-seeking phone call data was also collected. This information included what type of assistance was being sought, basic demographic information and post call outcomes. The total call centre population (n= 188,971) provided a large sample to complete further quantitative data analysis.

Post data collection, data was anonymised and categorised based on areas of interest and demographics. The first analysis utilised descriptive statistics (e.g. mean, median, proportions) to identify and understand the features within the sample population. Furthermore, through a thematic analysis of collected qualitative data, the different reasons assistance was sought were identified. The study findings address specific factors in relation to the purpose, timeframe, lodgement behaviour and number of individuals seeking assistance at various points of the lodgement process. The key questions used to collate the collected data are provided in Table 1.

TABLE 1. EXAMPLE OF THE QUESTIONS USED TO COLLATE THE DATA

Questions	Themes Factors
Why do individuals seek assistance from the ATO?	Assistance Seeking/ purpose/ intentions/ motive
Within the lodgement process where do individuals seek assistance?	Assistance seeking/ lodgement behaviour/ source of support

How many questions were asked per call? How many individuals contacted the ATO more than once?	Types of queries/ individual profile/ assistance seeking behaviour
What are the effects of assistance-seeking on lodgement timeliness?	Lodgement behaviour timeframe
How did they lodge post assistance-seeking?	Prediction adoption behaviour

B. Thematic Analysis

A thematic analysis or topic modelling was conducted on the qualitative data collected within the survey. The analysis was conducted utilising Python statistical software and the Natural Language Toolkit (NLTK) package for natural language processing. Through the use of this toolkit, the different themes or topics were identified and grouped together to create broader categories [43]. An extension of the standard approach to Gioia analysis was undertaken utilising statistical software to validate the process (see [4] for the initial Gioia analysis). When conducting the Gioia method for qualitative rigour [44] [45], the researcher categorised the accounts into three separate phases (first, second and third order), however these steps were conducted out of order. The first order, 'Concepts', is the 'voice of the user' (also known as 'voice of the customer'). The second order, 'concerns and statements', identifies specific sentences from participants which are then grouped together to discover the themes and patterns in events and accounts. These create themes that are more generalised underlying explanatory dimensions, to test consistency and patterns [44] [45]. Finally, the third order 'aggregate dimensions', identifies the generic themes encompassing all of the first and second order data [44] [45]. Significance was measured through counting occurrences of first, second and third order elements to identify themes and patterns throughout the different accounts. The patterns in the text were then linked by connections, highlighting key features and emergent concepts or themes that require further analysis.

Starting with the third order or 'aggregate dimensions', generic themes and topics were identified by word frequency through the application of Latent Semantic Analysis (LSA). LSA is based on the use of a distributional hypothesis, whereby words and expressions occurring within similar parts of text have similar meanings [46]. The significance of each of these themes was tested in the following stages of analysis, whereby counting occurrences identified themes and patterns throughout the different accounts. The second order was completed next, which seeks 'concerns and statements', which identify key sentences or phrases through the use of Latent Dirichlet Allocation (LDA) to understand themes and patterns within the accounts. LDA utilises mathematical probabilities to help define the unknown words that represent a known topic, by mapping the known elements

to the unknown elements in a way that provides the probability of a word belonging to a particular topic [47]. These were used to create themes which are generalised underlying explanatory dimensions that demonstrate consistencies and patterns within the data [44] [45]. Finally, the first order 'concepts', or 'voice of the user' were identified, through the use of Text similarity Metrics. Jaccard Similarity calculates how similar two sentences are by determining the size of the intersection and the size of the union of two sets, identifying the number of words in common between sentences and providing a numeric output [48]. This identification process was simplified by the application of information obtained in the LSA and LDA processes. The patterns in the text were linked together manually to identify connections, and to highlight key features and the emergent concepts or themes not picked up by the analysis.

The results were validated by another independent researcher, who conducted their own analysis of the data provided and obtained equivalent outputs.

C. Systems Thinking

Systems Thinking analysis was applied to systematically identify and order findings into their respective components of the process [49]. This helped to identify the points within the process and system that are causing the most issues and where support can be implemented. Systems Thinking was used to visually convert the findings into simplified figures that highlight key emergent findings.

Process mapping and systems thinking principles were utilised to understand the relationships between the different steps of the lodgement process and where the different assistance-seeking behaviours sit within that process. The application of systems thinking, broken down into four key steps, was used to assist in providing a clearer understanding of the situation. Firstly, how people seek assistance to meet their mandatory ATO lodgement requirements was explored. This recognised and explored the role of digital systems, non-digital systems and assistance seeking in the process. Secondly, analysis of the assistance-seeking behaviours was conducted to understand the decisions and user in greater detail. Thirdly, a process map was drawn, which outlined the system and how assistance-seeking fits within it. Finally, the process map was used to inform the research question idea. This final part was an iterative process that was altered and added to as understanding about the users experience emerged. Process mapping is used to demonstrate, using a pictorial representation, the sequence of actions and responses between the start and end of a process [49]. This is commonly used to determine where there might be issues, inefficiencies or opportunities within the current process [49].

V. RESULTS

Results from this research demonstrate that there are multiple reasons why individuals seek assistance when undertaking their annual tax lodgement, including both digital and non-digital queries. As indicated in a previous pilot study [4] many taxpayers would have been unable or would have struggled to lodge their tax return without obtaining assistance.

A. Individuals Seeking Assistance

Firstly, there is no unique type of individual who seeks assistance – they differ in age, gender, income, occupation and even how many times they have lodged previously. As for age, as shown in Figure 4, 49% of individuals were aged between 18 and 29 years old, demonstrating that younger people are more likely to seek assistance to complete their tax return. The least likely age group to ask questions were those above 65+ years. In most of the comments from the phone contact, the individuals in both age groups, only sought assistance due to a change in their circumstance or because they were attempting an online lodgement for the first time.

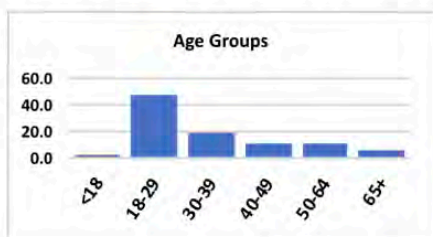


FIGURE 4. ASSISTANCE SEEKING BY AGE GROUP

Interestingly the overall the distribution of genders is relatively similar, with slightly more females (48.8%) than males (45.1%) seeking assistance overall, as shown in Table 2.

TABLE 2. AGE DISTRIBUTION

Female	Male	Undisclosed
48.8%	45.1%	6.1%

In the breakdown of the population by occupation codes in Table 3 [50], individuals who indicated being Community and Personal Service Workers (10.8%) and Labourers (13.1%) sought assistance most frequently. In comparison, Trainees, Apprentices and other related workers (3%) and Machinery Operators and Drivers (4%) sought assistance less frequently than other individuals.

TABLE 3. OCCUPATION CODES

Occupation	%
1 - Managers	4.7%
2 - Professionals	9.2%
3 - Technical and Trades Workers	5.2%

4 - Community and Personal Service Workers	10.8%
5 - Clerical and Administrative Workers	7.1%
6 - Sales Workers	7.8%
7 - Machinery Operators and Drivers	4%
8 - Labourers	13.1%
9 - Trainees, Apprentices and other related workers	3%
? - Not stated	35.1%

TABLE 4. INCOME RANGE

<\$18,200	\$18,201-\$37,000	\$37,001-\$90,000	\$90,001-\$180,000	>\$180,001	?
28%	21%	21%	4.4%	1%	34.1%

As per the ATO income tax brackets [51], the income range of individuals who sought assistance is demonstrated in Table 4. The majority of individuals who sought assistance earned less than \$90,000 in the previous financial year.

TABLE 5. LODGEMENT

First Lodgement Year	Under 5 years	Greater than 5 years
7.7%	27.6%	64.7%

Table 5 demonstrates the number of years individuals who sought assistance had been lodging their tax return. 7.7% were undertaking their first lodgement, and 27.6% had been lodging their tax return for under five years. Interestingly, the majority of assistance was sought by individuals who had been lodging for greater than five years. The analysis was used to determine whether there was a relationship between the first year of lodgement, and how many people sought assistance.

B. Reasons For Seeking Assistance and Source of Assistance Seeking by Individuals

Through the use of a Gioia and thematic analysis, the common themes as to why individuals sought assistance were identified. As shown in Figure 5, the results demonstrate that the majority of individuals (83.7%) sought assistance for utilising digital services (including platform support and technology support from the ATO). 10.3% of individuals sought tax advice (including system education, platform awareness and advice). Additionally, 2.9% contacted the call centre to obtain paper forms. In most cases individuals sought paper forms due to lack of computer skills, a preference for utilising paper and language barriers. Finally, 3.1% of queries were not related to lodgement of tax returns (including pre-lodgement and post-lodgement related queries). The thematic analysis demonstrates that at multiple points of the process individuals would not have been able to lodge their tax return without assistance.

Once the analysis was completed, a process map was created to outline the multiple interaction points within the system and where the different assistance-seeking points fit within it, shown in Figure 6. The diamond shaped points are decision points, rectangles are points of the process, and the oval shapes are outcomes. There are four key decision points where assistance is commonly sought. Contact point 1 is commonly where digital service support is sought. This is the first component of successfully interacting with the mandatory system. Without the appropriate access and support, some individuals who are not able to continue the digital process or who need to obtain a tax agent or request a paper form, do not lodge. Contact point 2 is where individuals contact the ATO for assistance in obtaining paper forms (publication ordering). Contact point 3 is referred to as the component when individuals require tax advice during their lodgement process.

There is a feedback loop associated with this contact point (which forms contact point 4) when an individual requires additional assistance either for the same or a different issue and contacts the ATO again for assistance. The other options for obtaining tax advice is to source the information through a google or ATO website search or obtain from a tax agent.

C. Number of Queries Per Call

As highlighted in Table 6, even though the majority of callers asked one question on average, in 48.4% callers had multiple questions. Interestingly 8.3% had four or more questions. For individuals who asked more than one question, in 92% of cases the questions theme changed. In 78% of these instances, the question was not one that had been prepared.

TABLE 6. NUMBER OF QUESTIONS PER PHONE CALL

1	2	3	4+
51.6%	26.8%	13.3%	8.3%

D. Repetitive (Returning) Individuals

Of the individuals who contacted the ATO seeking assistance, 38.7% did so on more than one occasion within the one-month period of data collection. Of those individuals, 69.9% contacted the ATO twice, 19% three times and 11.1% four or more times. Interestingly only 1.2% proceeded to lodge through paper forms. Of those remaining, 29.2% shifted to the use of a tax agent or intermediary, 32% lodged digitally and 37.6% had not yet lodged by October 31st 2018.

E. Impact and Effect of Lodgement Timeliness and Lodgement Process Post Assistance-Seeking

TABLE 7. POST ASSISTANCE SEEKING INTERACTION/LODGE MENT CHANNEL

	Total
Not lodged	23.7%
Digital lodgement	51.7%

Tax agent or intermediary	22.7%
Paper	1.9%

TABLE 8. POST ASSISTANCE SEEKING INTERACTION/LODGE MENT CHANNEL BY ASSISTANCE TYPE

	Digital	Advice	Other	Publication ordering
Not lodged	11%	24%	80.7%	32.5%
Digital lodgement	67.7%	31.1%	11.7%	9.4%
Tax agent or intermediary	20%	43.5%	6.6%	23.2%
Paper	1.3%	1.4%	1%	34.9%
Total	100%	100%	100%	100%

Individuals may lodge their tax return in Australia via a number of avenues. If an individual chooses to self-prepare they can lodge at no cost, through the Digital myTax channel, via a paper form and in some cases over the phone. If they choose, however, an individual can obtain an intermediary or tax agent to lodge on their behalf. Individuals who choose to complete their lodgement this way, pay for the service. The results of the thematic analysis demonstrate that assistance-seeking fit into four key categories: Digital Services, Tax Advice, Publication Ordering and Other non-lodgement queries. As shown in Table 7, of those who had sought assistance 76.3% had lodged within the expected timeframe, and 23.7% had not lodged on time. On-time lodgement indicates that an individual has lodged their income tax return prior to October 31st 2018, as per legislative requirements. The results of the thematic analysis demonstrate key elements outlining why individuals sought assistance.

The majority of those individuals who had not lodged on time were seeking support on other non-lodgement related queries (including obtaining a tax file number, superannuation queries and deceased estates), and in many cases those individuals were not required to lodge a tax return at all. As highlighted in Table 8, the majority of assistance seekers (51.7%) lodged through the digital platform, and the majority of these individuals sought assistance for digital issues followed by tax technical advice. Interestingly, only 11% of individuals seeking advice on digital matters had not lodged on time; however, 21.3% lodged through non digital means, which could imply that they were not able to obtain a solution. In contrast, 24% of individuals seeking tax technical advice had not lodged on time, and the largest portion of these individuals lodged through a tax agent or intermediary. This could demonstrate a lack of understanding of the system and the confidence they obtained by seeking additional support. For those requesting paper forms, 34.9% lodged through that method, whereas 32.5% of those individuals requesting paper forms had not lodged on time. This could be attributed to the additional processing time required for a paper form

(approximately 50 days, as opposed to 14 days for digital and tax agent lodgements).

VI. POLICY IMPLICATIONS AND RECOMMENDATIONS

There are a number of potential policy implications and recommendations that have been determined within this research. However, it is important to add that this research highlights that assistance provided, no matter how well presented and in what format, may not provide the information in a manner that resonates with the individual seeking it. Therefore, it is important to provide a number of different channels for information, including different languages, the use of visualisations, and a combination of over the phone and in person assistance where needed. Furthermore, of all individuals who utilise the digital system, the number of individuals who sought assistance as part of digital system use is low, however we argue that this population is still important to understand and explore.

Our research found that the majority of assistance-seeking individuals were those who had been lodging for greater than five years. Therefore, the education provided to the individual regarding system use needs to be on a long-term basis, on an average of four to five years based on the evidence above. Training and policy design should also consider providing training to individuals when they have a change in circumstances or role in the system to ensure they have all information needed to successfully interact with the system. This falls into the concept of predictive adoption and assistance-seeking which will be explored in future research.

From the thematic analysis the majority of individuals sought assistance for digital advice, including system education and platform awareness. While the minority sought non-digital means for lodgement due to lack of computer skills and a personal preference towards utilising paper means of lodgement. This indicates that individuals require education systems that are accessible and relevant. Furthermore, incremental digital adoption requires system education at the point in time that the user requires it. The thematic analysis demonstrates that there are multiple points at which, without assistance, individuals would not have been able to lodge. Therefore, a critical aspect to consider for policy design is the identification and full systems integration of these key assistance trigger points. For policy-makers it is important to consider stronger investment of resources in support mechanisms at various points of lodgement (i.e. points identified with the system approach and thematic analysis. The process map shows where the different assistance seeking points fit within the system. Through this visual mapping process, it is possible to identify the correlations between where assistance was sought and the different stages of the lodgement process. These correlations highlighted the key points where self-help options or additional education could be provided, and this could assist in minimising the number of individuals who are required to contact the ATO for digital service issues.

Profiling individuals based on query behaviour will not be effective, as there is strong evidence to suggest that variations of queries and unpredicted types of questions emerge through the dialogue. This demonstrates the value of human interface (via phone, in person and chat windows) as these support services provide ongoing support and education. This research provides support for the notion that not everyone will adopt a fully digital system from public sector service providers. As highlighted, many individuals who sought assistance were able to determine multiple areas within the process that they required greater understanding, which was possible as a result of a dialogue with a human interface (or person).

This was demonstrated through the analysis of individuals who called numerous times, to obtain additional support from a human interface, even though additional information was available from other digital means. As a result of these human interactions, 32% of individuals who sought assistance more than once, shifted to digital lodgement from non-digital means the year before. Therefore, repetitive advice can be designed to target individuals needing reassurance of processes. This component of the research is still underway and will form part of future research. Finally, when understanding the individual's post assistance-seeking outcomes, the summary statistics demonstrate that additional research and profiling is required to understand in depth the different needs of the population. Future research will explore predictive adoption and assistance-seeking in post assistance-seeking outcomes.

The framework being developed within this research, which will result from more testing of the conceptual model, can be applied more broadly within the public sector digital services space. This research has explored in detail the Digital Ecosystem quadrant of the conceptual model, which outlines the importance of supports and human capital on digital service use. By providing public sector service designers with more information about the service users, the greater the level of understanding they will have which should lead to more inclusive services. This research framework has been applied more broadly to the adoption of digital health platforms, specifically exploring the different user views and support requirements to utilise and engage with these style services. This includes exploring how different types of assistance provided by an organisation, supports or hinders the use of a service, including available information, call operatives providing advice and other support services available outside of government. Understanding the broader implications of this research on other public sector services is underway and ongoing. Further research is being conducted to understand how the model fits within the social services space.

This research and the policy recommendations and implications are aimed at providing advice that encourages mandatory public sector services to be inclusive, utilising both digital and non-digital options, including the provision of assistance.

The policy implications from this study are fundamental and rich with possibilities for future longitudinal research. The most basic finding is that perceived human support is the main predictor of the intent to adopt a digital mandatory system, with relevance as the major constituent driver of perceived understanding of the digital government system.

VII. LIMITATIONS

This study has potential limitations. The first limitation is that this research is being conducted as part of a PhD. Therefore, the research is ongoing and progressive. The second potential limitation is the use of qualitative data and analysis may limit the generalisability of the specific findings within the research to other areas. The third potential limitation is the data collection was conducted within the period tax lodgements were due for the Australian Taxation Office, therefore some of the results are specific to lodgement of income tax returns. Lastly, the results of this research may not be completely generalisable. Additional research is underway to explore different public sector services and build a framework that is relevant across multiple channels and public sector services.

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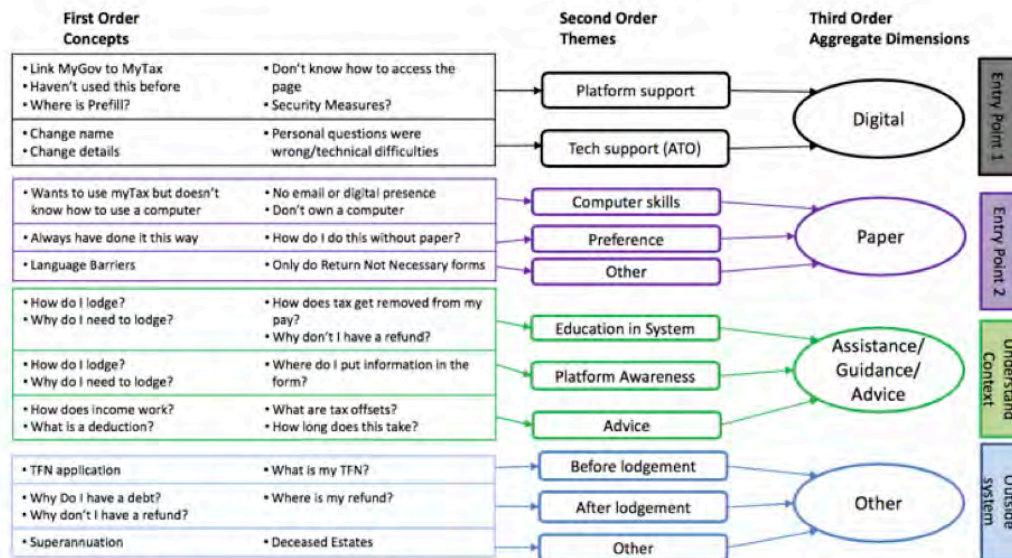


FIGURE 5. RESULTS OF THE GIOIA AND THEMATIC ANALYSIS

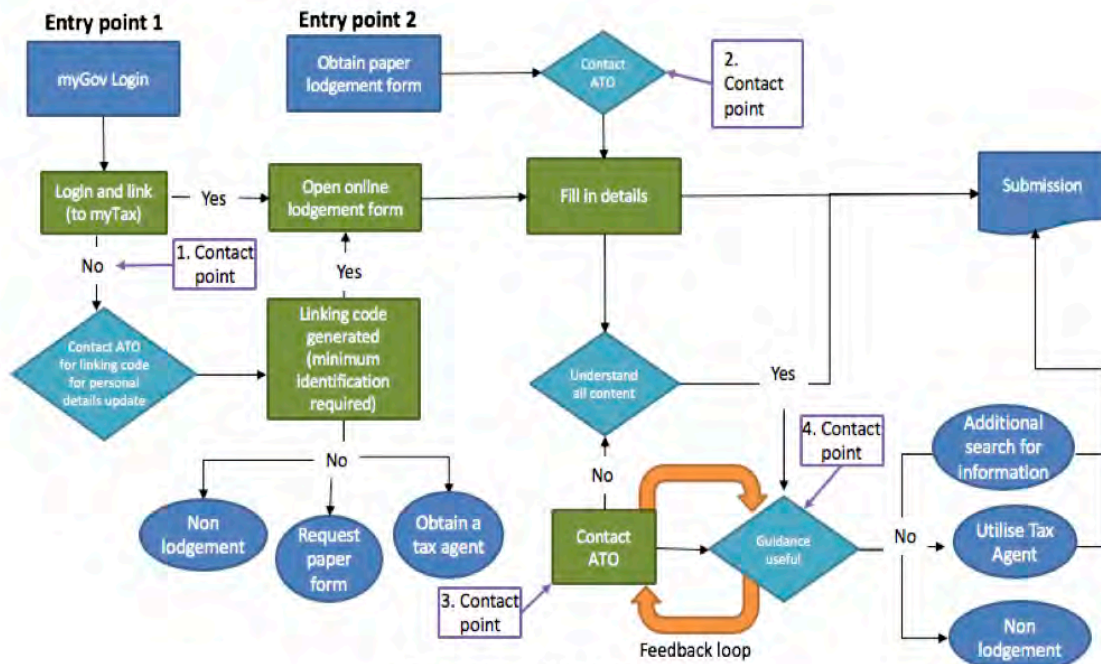


FIGURE 6. PROCESS MAP OF LODGEMENT PROCESS

Purpose of Paper 3 – Digital Adoption Strategy: A Public Sector Ecosystem

Paper 3 reports the qualitative and thematic results of the extended study data collection, exploring the various reasons why individuals sought assistance. Paper 3 was used to validate the results of the observational study, to demonstrate the relationships between digital adoption, high and long-term use of digital services, inclusivity of digital services based on positive feedback and how that relates to effective digital transformation. An extension of this study was needed to explore the role of communicating the various digital service options and the provision of proactive support and guidance to switch otherwise non digital service users to digital.

Further data analysis outlines a number of themes in the extended study. Additional themes and systems arose outside the systems identified within the conceptual model; therefore, additional data analysis was conducted to better understand the system as a whole, specifically how various systems or behaviours impact digital adoption. Paper 4 was used to understand if behaviour can be changed with greater and targeted information provision. This research provided the basis for understanding how and why the governance of various systems interacting with the system is important. Specifically, how are the interactions between the constituent systems altered by informing the individuals of available services.

Paper 4 – Digital Adoption the Need for Truly Inclusive eGovernment Services

Papavasiliou S, Reaiche C and Ricci P, 2019. 'Digital Adoption for Truly Inclusive eGovernment Services', *Proceeding of the 2019 International Conference on E-Learning, E-Business, Enterprise Information Systems and E-Government*, pp. 43-49. ISBN: 1-60132-495-2

Statement of Authorship

Title of Paper	Digital Adoption: The Need for Truly Inclusive e-Government Services
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Publication Details	S. Papavasiliou, C Reaiche and P Ricci, 'Digital Adoption: The Need for Truly Inclusive e-Government Services', Proceeding of the 2019 International Conference on E-Learning, E-Business, Enterprise Information Systems & E-Government. pp. 43-49, 2019. ISBN: 1-60132-495-2

Principal Author

Name of Principal Author (Candidate)	Samantha Papavasiliou		
Contribution to the Paper	Developed survey instrument used to collect data. Developed the Conceptual 'User Centred Model' used for testing. Completed the data analysis.		
Overall percentage (%)	60%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	14/05/2020

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Carmen Reaiche		
Contribution to the Paper	20% Supported the analysis and theoretical underpinning the research framework.		
Signature		Date	14/05/20

Name of Co-Author	Peter Ricci		
Contribution to the Paper	(20%) Supported the study design, data analysis and application of logistic regression.		

Signature	
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Date	15/05/20
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Please cut and paste additional co-author panels here as required.

Digital Adoption: The Need for Truly Inclusive e-Government Services

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Abstract – The role of the public sector as a service provider is to ensure services are inclusive for everyone; however with the shift to digital first services this is becoming increasingly complex. Inclusive public sector organisations require understanding and incorporating the views and requirements of their users. The purpose of this research is to understand the different assistance-seeking behaviours of individuals, through testing a conceptual model. To achieve this, a case study was undertaken in the Australian Taxation Office, to determine why individuals sought assistance with their annual income tax lodgements. To address the key issues, three questions were posed. First, what are the outcomes post assistance-seeking at the different stages of lodgement? Second, why do individuals seek paper instead of digital lodgement solutions? Finally, what is the impact of prompting individuals to use digital lodgement channels, when they call to seek paper forms? An additional analysis was undertaken to understand the role of emotions in post assistance-seeking outcomes. Results from the analysis demonstrated that timeliness of assistance-seeking impacts digital adoption, this can be linked to encouraging the use of digital services. Furthermore, the most common factors for paper lodgement were preference, willingness and ability to use the platforms. Finally a positive impact of encouraging individuals to shift from paper to digital services was identified. This encouragement also included outlining the benefits to using digital services. These research questions sought to identify the importance of understanding the assistance-seeking behaviours of individuals, as well as understanding the non-digital lodging population. The results of the influence of emotion on post assistance-seeking outcomes demonstrated that positive emotions (e.g., happy with outcome), led to higher rates of

lodgement within two months post call. Further research is underway to understand the impacts of assistance-seeking more generally, and understand the broader conceptual framework referenced within this research.

Keywords- Digital Inclusiveness, Assistance Seeking, Digital Adoption

I. INTRODUCTION

The transition to digital first services within the public sector has significantly impacted the manner in which organisational inclusiveness is viewed and measured. The public sector experiences organisational inclusiveness differently, comparative to that of the private sector, especially when viewing digital inclusiveness. Whereby, inclusive public sector organisations are those that consider the public, who are the users of the services provided, as well as their employees. Therefore, this paper argues that to be truly inclusive, public sector organisations should provide services that meet the needs and expectations of multiple stakeholders, with particular attention given to the public as the key stakeholders: the users. Public sector organisations have been impacted by increased visibility and expectations as a result of enhanced digital and social awareness [1]. In conjunction with ongoing external influences from private sector comparisons, technological improvements and reduced costs of digital products and services [1:2], the impacts of digital first policy requirements are affecting ongoing service provision for the Australian Tax Office (ATO) [1:2].

Enhanced understanding of the users for specific public

sector digital services has become increasingly important in Australia, with changes to public service provision from in-person/call centre to digital. This research seeks to understand who the users are, why the user required assistance, and the outcome post assistance, and to provide recommendations for self-service assistance options. This research will be based on a case study of the ATO. A gap was identified within the literature and internal research between what was known about mandatory digital service users and non-users. Whereby, current research ignores a multitude of factors impacting adoption, failing to identify barriers to adoption within the mandatory environment, and how and why digital service impacts long-term adoption and when and why users do seek assistance.

The implementation of the Australian Digital Continuity Policy 2020 pushed services to digital first platforms for each public sector service [3], impacting service providers and users. This research defines mandatory service users as “individuals who meet certain characteristics, this includes earning income in Australia, and must by law submit an annual income tax return to the ATO”. Digital adoption research does not explore the concept of mandatory service users, along with the impacts of digital first policies on users who must engage with digital services to comply with legislative requirements [4:7]. Techniques used to analyse this should be adaptive and holistic in nature, to assist in understanding inclusive digital services and the factors that promote or block digital usage. This research seeks to understand the digital assistance-seeking behaviours and outcomes post assistance, based on testing a conceptual model previously developed by an environmental and ecosystem analysis (as illustrated in Figure 1).

II. LITERATURE REVIEW

Inclusion is broadly defined as utilising individual differences to benefit an organisation or community [8]. Inclusion links strongly to equal participation opportunities, which are based on awareness, acceptance, respect and understanding [8:9]. Inclusive organisations are commonly

identified as those that encourage everyone to participate, regardless of characteristics, backgrounds and ways of thinking [8:9]. Therefore, inclusive organisations ensure that everyone feels valued, listened to and respected, irrelevant of differences [9]. All organisations should recognise this; however public sector organisations require more comprehensive understanding outside of the organisation’s walls. It is important to consider all stakeholders (internal and external), but especially external stakeholders who should be understood based on their impact on the organisation [10]. It is vital to address stakeholders; however, it is insufficient to only prioritise internal stakeholders (who are often the employees that serve the organisation). Organisations that incorporate external stakeholders into their planning often provide better services to meet the needs of the users (especially in the public sector) [10]. Creating inclusive public sector services is a complex process, especially with the transition to digital platforms. Therefore, this paper further argues for inclusive e-government systems that cater for all stakeholders. Multiple components within a digital ecosystem will be discussed in this paper, to assist in understanding digital inclusiveness as a more complex issue.

To achieve equal access between the different public services and social groups, simply addressing the practical concerns, as has been done in previous research, does not address the variety of environmental factors for building inclusive services. Tailored community engagement is required to not marginalise or negatively impact users; to achieve this providing basic community access is insufficient, especially as society is not homogeneous. Research indicates that when people fall behind the majority of the community using digital platforms, many social and economic issues can be amplified and increase their issues of exclusion. Actively engaging in co-design efforts and viewing users as more than service targets is especially relevant for public sector organisations to ensure they see the community members as agents. This will promote “inclusion”. The aim of this research is to understand and to

identify individuals within the community who may be disengaged. Particularly, users that as a result of a lack of understanding of e-government and other digital systems may disconnect and highlights the critical need for research to understand why and when users may seek assistance.

Digital inclusiveness is defined as accessing information and communications technology, resulting in social and economic benefits for the user, based on having basic digital skills, connectivity and accessibility [11:12]. Furthermore, digital skills incorporate the capacity to utilise technology to connect to the services (computer and internet), having access to connect to the internet (the infrastructure), and user-friendly digital services for assisting accessibility to the services [11]. Addressing the digital divide is an important part of digital inclusiveness in public sector services, defined as the gap between groups or individuals with limited access to digital services and information, compared to those who have access [11]. Digital services and information not being completely inclusive only magnifies the need to build inclusive digital services. This is becoming increasingly difficult for public sector services to overcome with the change to digital first platforms, limiting access to those who have the capacity to connect, access and utilise the technologies required to access the services.

Shifting to digital services assists in building a new e-government model which is simpler, efficient, transparent, inclusive and user-friendly [13]. Therefore, public sector e-services should be delivered to users to improve internal government culture and the efficiency of public sector organisations [13]. Research demonstrates numerous positive outcomes resulting in the transition to digital services, including improvement in services, efficiency and evasion detection techniques [13:14]. Public service sectors should view inclusiveness as multidimensional and ensure that services go beyond just a basic provision. Public service sectors should view inclusiveness as multidimensional and ensure that services go beyond just a basic provision. This could be achieved through building closer relationships

between the organisation and the users [13:14]. Evidence-based research needs to be undertaken for co-design and for incorporating the key social elements within the public sector to create effective e-government systems that enable truly digital adoption. The creation of these systems requires rethinking the manner in which users are understood and services are built [13:14]. To achieve this, inclusion should be viewed as multidimensional and incorporate an environmental and stakeholder analysis. For the purpose of this research, environmental analysis involves understanding the variety of elements within a users' digital ecosystem and their environments. This is vital to create highly effective services, while fully understanding the potential barriers of use, and for providing critical assistance in areas needing closer attention.

III. CONCEPTUAL MODEL

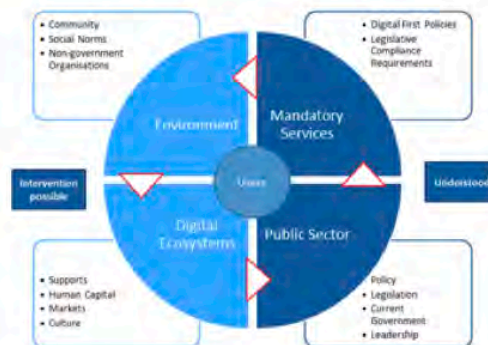


Figure 1 Conceptual Framework

This paper tests the Digital Ecosystem quadrant of the conceptual framework proposed in Figure 1. The purpose of this framework is to build a client-centric approach to research, and implement policy going forward. The client-centric approach is based on ensuring that the services are based around the requirements, wants and barriers of the different users' services. A client-centric approach is expected to provide different ongoing recommendations to encourage self-service and proactive assistance options to users and to also help them to understand the non-digital options.

As per Figure 1, there are four elements that capture the system including the Environment, Digital Ecosystem, Mandatory Services and Public sector. This conceptual framework was created through the analysis of numerous literature sources to understand different ecosystems (including digital ecosystems literature). An environmental scan was also conducted to understand the different factors specific to the public sector. The important factors were identified through the application of numerous stakeholder analysis techniques used to validate the different influences on stakeholders within the public sector (including service users, employees, designers and policymakers) [15]. The four elements encapsulated within the framework capture the public sector system and are being used to build a testable model. These elements include: The Environment (interactions with other people and entities), Digital Ecosystem (incorporating how digital products are accessed and factors influencing use), Mandatory Services (includes how individuals interact with services that have mandatory interaction requirements) and Public Sector (includes the elements that make the services mandatory (e.g., policy)).

This research bases organisational inclusiveness on the shift to digital first policy provision, demonstrating how organisational inclusiveness in the public sector differs to that of the private sector (linking back to Figure 1). Where the services provided by the organisation often have mandatory components, within the digital ecosystem there are assistance options available to those who require them. Finally, the environment quadrant highlights the multiple different external factors which have an impact on or are impacted by the user.

This paper addresses the Digital Ecosystem quadrant, specifically understanding the supports and human capital components; this research aims to understand the different assistance-seeking behaviours and outcomes within the ATO during tax time. The overarching aim is to understand the individuals utilising digital services and the assistance the users require. Furthermore, it seeks to understand the assistance required by different users, especially the impact

of the assistance provided on the post assistance-seeking outcome (e.g., post call, did they lodge their return? If so, how?). For digital services to be truly inclusive, the public sector entity needs to ensure that they are well equipped to deal with the needs of the users, from basic systems access issues all the way to non-willingness to utilise and participate in digital services offerings.

IV. METHODOLOGY

This study originated from the motivation to understand digital adoption barriers in the public sector. From observations and a clear perception of a lack of “inclusiveness” in current mandatory systems, a comprehensive literature review and an environmental ecosystems analysis provided the rationale for the proposed conceptual model: A Digital Ecosystem Quadrant (see Figure 1).

The adoption of a case study method was applied to this research to understand the issues affecting digital adoption within the Australian Public Sector Environment. The ATO was selected for a number of reasons, but especially because it is at the forefront of public sector service provision (e.g., it was the first organisation to adopt the Australian Government’s digital first policy). The ATO was also selected due to the manner in which data is collected and the ongoing and mandatory interaction requirements. Research highlights that the purpose of undertaking a case study is to explore and understand the uniqueness of a single case, while also understanding how findings from one specific case could impact other similar entities facing similar issues [16:17]. Furthermore, the use of a single case study provides an opportunity to explore the complex issues around digital adoption to a greater extent than would otherwise be the case. The primary aim of utilising a case study is to understand the distinctiveness of the specific entity and users involved, and then later to understand the similarities to other entities and users. The focus of the case study is to determine specific issues and opportunities, rather than the general issues within the areas [16:17].

This research utilised a mixed methods approach (qualitative and quantitative). Appropriate for an ATO case study, an integration of interpretative, exploratory data analysis and hypothesis testing based on experimental design principles was applied to obtain an understanding of the key barriers to digital adoption and how they could be overcome.

The research started with a qualitative method to explore and understand the different meanings individuals or groups ascribe to a problem [18]. The approach used within this research was inductive, which is a process involving a search for patterns within observations, which develop into explanations or theories, which then become a series of hypotheses [19:20]. By utilising both a mixed methods and inductive approach, the research questions emerged gradually and numerous different analysis techniques were applied to ensure that the research identified particular themes. In 2017 a pilot study was conducted to validate the research questions previously formulated; inform the feasibility, research design, and assessment of specific research questions; and to identify potential problems with undertaking a larger and more informative study [15]. The pilot data and analysis provided a number of research propositions that were tested in the larger study that was undertaken in June 2018.

In addition to qualitative techniques, the 2018 study also had a strong focus on quantitative data collection with both experimental and survey conditions in place. The quantitative approach was used for testing objective theories, by examining the relationships among variables [17].

This study collected client data during a 4-week period at the beginning of Tax Time 2018. A survey form, consisting of both quantitative and qualitative questions, was used to explore different facets and characteristics of a sample of callers ($n = 3,990$). The survey form was provided to 11 call centre operatives who populated the fields outlining the reasons for calls and demographics of callers, to understand why people sought assistance. Once collected, the data was

anonymised and grouped into logical categories to support the analysis and further breakdown the data (e.g., age and occupation groups). Basic descriptive statistics (such as the mean, median, standard deviation, proportions and percentages) were used to identify and understand important features of the sample population. To further understand the different issues facing users, a thematic analysis was completed using the qualitative data obtained.

The study findings are addressed through answering four specific research questions:

(1) What is the impact of the end of call emotional state on lodgement outcomes? The survey form provided a number of tick boxes that operatives marked when individuals stated their emotion at the end of the call. These included confused, embarrassed, satisfied, upset. The operatives were only required to fill in the emotions component when the emotion was stated clearly and specifically by the caller (e.g., "I am confused").

(2) At what stage of lodgement is assistance sought and what impact does this have on their lodgement outcomes. Each caller's reason for calling and requiring assistance was recorded. These reasons were then categorised by where they fit within the lodgement cycle. Further analysis was conducted one month post call and 6 months post call, to understand the post assistance-seeking outcomes. These outcomes were either lodged or not lodged. When lodgement occurred, the means employed to complete lodgement was recorded. Text mining and topic mining analysis techniques were applied to understand the different themes within the responses. Consistently tracing post call data could be used by the ATO to determine whether follow up could be appropriate. Topic modelling, using the Latent Dirichlet Allocation (LDA) and Natural Language Toolkit (NLTK) packages in Python, identified different themes within the responses, defined as repeating patterns of continuously occurring terms [21 :22]. Topic modelling is a statistical modelling technique that is used for discovering the patterns within a number of documents. LDA is a

common modelling technique used to classify text within documents to build a model outlining themes.

Topic mining is a process of identifying topics within a text and to derive hidden patterns within the text, through an unsupervised approach to find and observe the clusters of words in the texts explored. Further analysis will be completed at a later date to understand the different characteristics of the individuals and their different post assistance-seeking outcomes.

(3) Why were paper lodgement forms sought? To determine why individuals sought paper forms, analysis of their answers was undertaken using text mining (word frequency) and (topic mining) thematic analysis techniques. During calls, clients were asked about why they requested the paper forms. These answers were recorded and through the application of the same analysis techniques outlined in research question 2, key themes were identified.

(4) What was the impact of encouraging the use of digital options to potential paper lodgers on digital adoption? The final question was posed to explore the outcome of encouragement of a digital option to requestors of paper forms. This question was investigated through a quasi-randomised control trial (RCT) design. This is different to a regular RCT, where the sample sizes are predefined prior to conducting the trial, and the individuals involved are randomly allocated into the control and treatment groups [23]. In this study, only the number of call centre operators were assigned to the treatment group (11 operators). The number and nature of calls within the 4-week period, for both treatment and control groups were random (e.g., the number of calls requesting paper forms was random). Due to random allocation in both groups, this trial is deemed to be equivalent to an RCT, however due to the lack of control of sample sizes it is being labelled as a quasi-RCT [23]. An examination of the key caller characteristics (including age, gender, occupation, income and percentage of returns lodged), was conducted to ensure that the groups were similar. All 11 operators recruited to the 4-week study were asked to actively encourage paper

form requestors (N=248) to consider a digital option. The control is all other call centre operators where digital adoption was not actively encouraged to paper form requestors (N=2,594). The intervention was the “active encouragement” group. The aim of the randomised control study was to determine whether a prompt would encourage the individual to shift to digital lodgement channels or a tax agent. To determine the level of affect, individuals who contacted the call centre seeking paper returns were only included in both the control and treatment populations if they had lodged via paper in the two years prior. Analysis was also undertaken to understand the differences and similarities between the treatment and control groups.

V. RESULTS

This research determined that seeking assistance when interacting with public sector services is common. Furthermore, it identified that when assistance is sought, the expectation is that the issue will be resolved, and in situations when it is not there are issues for long-term use. Assistance-seeking is defined within this research as “help sought by individuals in situations when they are experiencing difficulty completing their mandatory obligations”, while post assistance-seeking outcomes are defined within this research as “the result of the individual seeking assistance, specifically how an individual completes their mandatory obligation”. After analysing the outcomes post assistance-seeking when emotion was indicated by the caller. A association was found between the post assistance seeking outcome, how they felt at the end of their call. Firstly the analysis highlighted the importance of leaving a caller satisfied post call (67% (N=2,520) lodged two months post call, 79.2% (N=1,996) digitally lodged their return). In comparison, of those callers who indicated being confused at the end of the call, 40.6% (N= 32) had not lodged two months post call, and of those who had lodged, 29% (N= 13) had done so through a tax agent. Furthermore, of those callers who indicated feeling upset post call (in most cases related to a debt), 35% (N=35) had not lodged two months

post call, and of those who had lodged, 38.70% (N=31) did so through a tax agent. This finding highlights the importance of ensuring an individual is satisfied with the assistance provided post assistance-seeking, as it seems that giving them greater assurance that they are completing their lodgement correctly results in a greater number of individuals doing so. Therefore, understanding the emotional state at the end of the call will assist the ATO in understanding how well they are providing assistance. For example, if individuals are confused or struggling with the process, then the ATO can provide additional assistance or follow-up to reduce confusion and increase digital adoption.

Tax lodgement can be broken down into three key stages: pre-lodgement during lodgement and post lodgement. Individuals also sought assistance unrelated to the lodgement process. This research determined that assistance sought at different stages of the lodgement process yielded different outcomes. Firstly, 73.2% (N=2,920) of queries were about pre-lodgement issues, and 72.6% (N=2,120) of individuals with these questions lodged two months post assistance-seeking. Secondly, 7.5% (N=300) of queries involved issues during lodgement, and 88.9% (N=267) of these individuals lodged two months post assistance-seeking. Thirdly, 13.4% (N=537) individuals called with post lodgement queries, and 76.5% (N=411) of these lodged two months post assistance-seeking. Interestingly, in 23.5% of cases individuals were seeking assistance on their post lodgement outcomes, before they lodged their income tax return, in many cases they were not comfortable with the outcome of their lodgement (e.g., debt). Finally, 5.8% (N=233) were other questions outside of specific lodgement issues (e.g., Superannuation, Deceased Estates, Withholding variations, etc.). The results indicate that the individuals who had issues occurring during lodgment had the highest lodgment percentage – 88.7%, 10% higher than pre and post lodgement questions. In most cases this was due to obtaining assistance at the point of time the information was being inputted into the

system. This is expected since they were in the process of lodgement. The other groups (pre and post lodgement) have similar percentages, 72.6%, and 76.5% respectively, and some may be yet to start their lodgments. The theoretical and practical implication of this finding for e-government is to consider early intervention to truly enable “inclusiveness” in the use and adoption of digital systems. From the evidence provided above, the following proposition emerged:

Proposition 1. Users are more likely to adopt strong digital capabilities if they receive assistance at the right time.

Proposition 1 will be tested further to determine whether it is possible to understand who are seeking assistance, the factors causing assistance-seeking, and why they seek assistance through the means of a call. Furthermore, understanding the post assistance seeking-outcomes will be important for determining whether or not users who feel that the assistance was sufficient are more likely to feel comfortable completing their mandatory obligations.

A thorough text mining analysis highlighted the most common themes around reasons for lodging paper forms. The most common theme was lack of access, such as limited computer skills, limited computer and/or internet access (38.33%, N=95). Of these individuals, 60% (N=57) were aged 65+. Personal preference was the second most common theme (29.16%, N=73), with these users indicating an unwillingness to alter their lodgement pattern, where 60% (N=43) of individuals in this category were aged 65+. The other themes were lodging old returns (5.8%, N=14), and other reasons (tax agents, business use and internationals) (26.6%, N=66) had. The theoretical and practical implication of this finding is that, to truly enable “inclusiveness”, the ATO need to scan the environment for accessibility and feasibility of use and adoption of digital technology. Furthermore, research is underway to understand the different characteristics of the individuals

who seek assistance from the ATO, so as to better understand and focus on individuals who may require similar assistance and whether proactive services may be feasible in these circumstances. From the evidence provided above, the following proposition emerged.

Proposition 2. The greater the user’s reliance on paper systems in general, the less willing they are to alter their lodgement platform. There are no electronic incentives for digital adoption. The quasi-RCT was undertaken over the first four weeks of the 2018 Tax Time, to assess if active encouragement could improve digital adoption. The treatment consisted of 248 paper lodge requests compared to the control group with 2,594 paper lodge requests. Table 1 through to Table 5 demonstrate the characteristics of the treatment and control group population across lodgement rates, age distribution, occupation codes, gender distribution and amount of reported income. These tables highlight similarities across the populations, which validates the use of the quasi-RCT methodology.

Table 1 Lodgement Rate distribution by Treatment and Control Group

	Lodged	Not lodged
Treatment	60.9%	39.1%
Control	62%	38%

Table 2 Age group distribution by Treatment and Control Group

	U18	18-29	30-49	50-64	65+	Not stated
Treatment	2%	19.8%	33.1%	14.1%	28.8%	2.2%
Control	3.3%	17.3%	31.1%	15.8%	32.5%	0

Table 3 Occupation code (1 digit level) distribution by Treatment and Control Group

	1	2	3	4	5	6	7	8	N/S
Treatment	2%	4.8%	3.6%	4.8%	3.6%	2.4%	2.9%	4.1%	71.8%
Control									

Control	2.5%	4.7%	3.7%	5%	3.9%	2.9%	3%	4%	70.3%
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Table 4 Gender distribution by Treatment and Control group

	Female	Male	Not Stated
Treatment	50.4%	46.4%	3.2%
Control	48.5%	47%	4.5%

Table 5 Income distribution by Treatment and Control group

	<\$18,200	\$18,201-\$90,000	>\$90,000	Not lodged
Treatment	28.2%	40.3%	2.5%	29%
Control	26.9%	37.8%	5.5%	29.8%

Individuals in the treatment group were asked why they sought a paper return and were then provided with information highlighting the digital service availability, faster turn around and ease of use. An 18% change was observed. Of those individuals in the treatment group who in the previous year had lodged via paper, 18% eventually lodged online. In the control group, of individuals who sought assistance and were not provided the information, 5% eventually lodged online. An additional 24% in the treatment group shifted from paper lodgements to seeking a tax agent to lodge on their behalf, compared to 4% in the control group. A Chi-square test was used to statistically assess how likely we would expect these differences between the treatment and control groups if the treatment had no effect. The P<0.027 value for the test indicated a statistically significant relationship between the encouragement to use digital services and the use of digital service use. This prompted a third proposition.

Proposition 3. The greater the personalised communication and the more the message of “inclusiveness” is delivered, the greater users’ willingness to become truly digital adopters.

The results for proposition 3 demonstrate the impact of incorporating information highlighting the availability of online services. Although the sample size in

the treatment group was not particularly large, this study is the starting point to ongoing research to support the implementation of information encouraging nondigital lodgers to move to digital platforms.

VI. FUTURE RESEARCH

As this research forms part of a PhD, additional data analysis and modelling will be undertaken to address the other quadrants of the conceptual model. The next step is to understand the entire tax paying population, exploring the different facets of assistance-seeking including understanding assistance seeking within Tax pop ups (in shopping centres), social media requests for assistance or complaints, and generic complaints mechanisms. Understanding this data will provide greater understanding of the different users and the issues they face, and highlight different insights that could become solutions. Future research is required to test the themes arising from the qualitative data.

This research also has potential policy implications moving forward. Specifically, understanding how and why individuals seek assistance and when proactive solutions could yield better outcomes. Furthermore, the use of information to encourage individuals to shift from paper tax returns to digital forms, was shown to be affective in this case and should be explored in future research. Although further research should be undertaken to test the types of information that provide the best outcomes.

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Purpose of Paper 4 – Digital Adoption the Need for Truly Inclusive eGovernment Services

Paper 4 identifies the need for a systemic approach to digital adoption research and how it links to digital transformation within the public sector. The research has been used to provide advice and guidance to the ATO, on the various digital adoption behaviours, providing information on how individuals seek assistance and how it is received by users (e.g., does it result in their use of the digital service or not). Paper 4 demonstrates the links between issues associated with eGovernment services, associated with the effective digital transformation process and how assistance is provided. This links to whether or not there is a manner to predict an individual's response to communicating the availability of services and support. Specifically, the researcher used predictive analytics to test if there were specific characteristics of individuals more likely to shift, while also identifying if there was any purpose in continuing the predictive analysis.

Paper 5 – eGovernment Digital Adoption: Can the Adoptive Behaviour of Individuals be Predicted?

Papavasiliou S and Reaiche C, 2020. 'eGovernment Digital Adoption: Can the Adoptive Behaviour of Individuals be Predicted?', *Proceedings of the 18th International Conference of e-Society*, pp. 11-18. ISBN: 978-989-8704-14-6

This paper won an “Outstanding Paper Award” at the *International Conference of e-Society*. The researcher was invited to extend the paper in the *IADIS International Journal on WWW/Internet* so that it could be included as a special issue journal article (article not completed).



Statement of Authorship

Title of Paper	Egoverment Digital Adoption: Can The Adoptive Behaviour Of Individuals Be Predicted?
Publication Status	<input checked="" type="checkbox"/> Published <input type="checkbox"/> Accepted for Publication <input type="checkbox"/> Submitted for Publication <input type="checkbox"/> Unpublished and Unsubmitted work written in manuscript style
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Contribution to the Paper	Designed and Conducted the QRCT, completed the data analysis and tested the hypothesis		
Overall percentage (%)	70%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	14/05/2020

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Carmen Reaiche		
Contribution to the Paper	30% Supported the data analysis, assisted with the validation of the results and guided the theoretical underpinnings		
Signature		Date	1/6/20

EGOVERNMENT DIGITAL ADOPTION: CAN THE ADOPTIVE BEHAVIOUR OF INDIVIDUALS BE PREDICTED?

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ABSTRACT

The shift of public sector services to digital platforms has had ongoing impacts on individuals interactions with government entities and services. This research explores the effectiveness of encouraging non-digital service users to shift to digital services to lodge their annual income tax return in Australia. Through the application of a quasi-randomised control trial, tested whether or not encouraging historically non-digital lodgers will shift to digital channels for a treatment group compared to those who did not receive the message. This small study suggests that individuals are encouraged to use digital services by Government support, are more likely to change from non-digital to digital. Furthermore, there are two characteristics which predict the who will shift. Through the use of strategically placed encouragement and digital assistance, makes an individual more likely to shift to digital channels. However, this research demonstrates predictive analytics has a place in the long term adoption of eGovernment services.

KEYWORDS

eGovernment, Digital Adoption, Predictive Analytics

1. INTRODUCTION

As the Australian Federal Government mandates the transition within the public sector to digital first service provision, there have been considerable implications to services provided to users in mandatory environments, especially those users who are historically non-digital service users. Service provision in government and the public sector must remain inclusive, and allow for and enable access for users that may prefer or rely on alternative formats. Along with the transition to digital first, the impacts of ongoing technological advances have influenced how governments and public sector organisations are using collected data to provide information and support to their citizens. Many of these trends are following the manner in which private sector organisations utilise data, provide services and use predictive analytics. Predictive analytics is the application of several analytical techniques by utilising historical data and behaviours to try and predict the future of behaviours of clients (Nyce 2007; Eckerson 2007). Through the use of predictive analytics different patterns within historical data can be used to identify risks and opportunities for different clients or customers. These patterns are often used to build models to capture the different relationships across factors to identify the set of conditions that could influence future decision making of clients (Coker 2014).

This research tests the potential use of predictive analytics for the provision of advice and information about digital services to historically non-digital service users. Based on the results of a small-scale study to identify the feasibility of the application of predictive analytics (in this case logistic regression) to the public sector. This research was based on the results from a case study on the Australian Taxation Office (ATO), who have been impacted by the creation of the Australian Digital First Policy. The Digital First Policy requires all public sector services to provide digital services as the first point of contact for all organisations (NAA 2015), a policy that was first implemented by the ATO (ATO 2015).

Therefore, this research aims to explore predictive behaviour by addressing the following question:

To what extent can an individual's change from non-digital to digital services be predicted?

In order to address this question, the testing of the following two propositions were undertaken:

P1: Individuals encouraged to use digital services by Government support, are more likely to change and provide significant factors enabling predictive profile data.

P2: Characteristics of individuals will predict digital adoption.

The characteristics identified for the purpose of this study are gender, occupation, income, age, tax deduction outcome, and the interaction behaviour with the system.

To appropriately implement predictive analytics, a greater understanding of the users of public sector services (both digital and non-digital) is required. This research seeks to explore the potential impacts of providing information about digital services to otherwise non digital service users, specifically looking at those requesting paper tax return forms and contacted the ATO within a four week period. In Australia, lodgement of individual income tax returns is mandatory for all individuals and entities who earn or derive income within Australia. Within the literature a gap was identified between what is known about mandatory digital service users, non-users and potential users. As currently research does not focus on the factors which impact adoption or factors that can be used to predict the transition from non-digital to digital mandatory service use. This research defines mandatory environments as “Public Sector Organisations who must by legislation provide Digital Platforms for their services” (Papavasiliou, Reaiche & Ricci 2019; Papavasiliou, Reaiche & Ricci 2019A). While mandatory interactions are defined as “Users who meet certain characteristics and must by legislation interact with the public sector service provider to meet these obligations” (Papavasiliou et al 2019; Papavasiliou et al 2019A). Thus, within mandatory environments individuals must engage with the providers, a process which has evolved since the transition to digital first. Research often does not explore digital adoption or predictive analytics within the mandatory environment; this is where approaches incorporated could aim to be more holistic and inclusive. A holistic and inclusive approach can promote the use of these mandatory digital systems and assist in understanding who of the end users are most likely to change behaviours.

2. LITERATURE

2.1 eGovernment

Increased pressure has been placed on governments with the transition from traditional analogue services to electronic or digital services (Yang 2017). Digital societies are comprised of interconnected and multichannel digital services, for governments to successfully perform within these digital societies they must provide high quality and easy to access public sector services (Yang 2017). A key part of this challenge is to meet the service user expectations, while utilising private sector as a benchmark; whereby users expect convenient and diverse communication channels including tailored and proactive information provision (Yang 2017). The societal impacts of the introduction and development of eGovernment services have been considerable. This includes changing the expectations of potential service users including the need for efficient, transparent and effective services as well as utilising all data sources to provide cross channel services. The aim of public sector services is to utilise appropriate channels (including digital) to create more efficient government services, which include providing better and more accessible services and enhancing the quality of life of users (Corydon, Ganesan & Lundqvist 2016). The digital transformation process is far from simple, however governments who aim to provide services which meet user expectations, empower their users and increase citizen engagement with government, a much more successful long-term approach (Corydon et al 2016).

Technology has enhanced governments businesses and individual opportunities, including how they integrate within the global digital society, and enhance ongoing inclusion (World Economic Forum 2018). In order to become a high functioning digital government, high digital adoption rates are necessary, thus requiring understanding the user’s perspective. The key factors impacting eGovernment and digital government services adoption include the level of awareness and level of satisfaction of eGovernment services, factors both linked to intention to use (Yang 2017).

Adoption of eGovernment services is defined as the continuous use of a digital service or innovation (Rogers 1995). To ensure ongoing achievable and sustainable adoption, the digital service needs to be appealing and useful, based on user expectations (Ziembra 2018; Shareef, Dwivedi, Laumer & Archer 2016). Research has demonstrated that there are several factors that impact a person’s willingness to adopt a service, including; human, social and financial capital, level of education and frequency of other digital service use (Hargitti & Hinnant 2008). A key part of successful and effective eGovernment services are those that are

inclusive, which goes beyond access and includes level of digital experience and exposure, digital participation and digital literacy (Hargitti & Hinnant 2008). Previous literature identified four primary barriers impacting digital access: (1) lack of basic digital experiences due to lack of interest, (2) no computer access, (3) lack of digital skills, and (4) lack of opportunities to use digital services (Van Dijk 1999). Furthermore additional literature outlines other barriers which impact digital access including lack of access to internet, lack of awareness, language barriers, user friendliness of websites, levels of trust and security fears (Ziemba, Papaj & Zelazny 2013).

The two primary challenges which impact policy-makers are the allocation of appropriate resources and creating the most effective digital services to support user behaviour (Sawalha, Al-Jamal & Abu-Shanah 2019). The aim of eGovernment and digital government services is to provide information and public services to citizens in an easy to access manner that encourages platform participation (Sawalha, Al-Jamal & Abu-Shanah 2019). Therefore it is vital that the service users are understood, to ensure that the potential barriers and factors predicting adoption are known to service designers and policy makers.

2.2 Predictive Analytics

Research suggests that when predictive analytics are appropriately implemented, there are considerable benefits for organisations (Attaran & Attaran 2019). Research suggests that it is important for organisations to explore the opportunities and challenges of the implementation of predictive analytics into standard organisational applications, by presenting the findings to their leaders, administrators, managers, clients and policymakers (Attaran & Attaran 2019).

With the rise of big data and its analysis, the use of predictive analytics has become increasingly evident within our everyday lives, from online finances and networked sociality to consumer practices and cultural participation (Barnes & Wilson 2014). Big data and the application of predictive analytics are a primary component of services including; Google, Netflix, Facebook and Amazon. These services are often used to document everyday activities, classify potential tastes for future options and employ predictive analytics to provide recommendations profiling user's future options (Beer 2013). Predictive analytics has become part of the norm for many organisations, especially in the public sector (Mackenzie 2012). The emergence of big data has had considerable impacts on business, governments, research and society, particularly for analysis' techniques and applications to day-to-day operations (Williamson 2016). Big data is referred to as datasets that contain high volumes of data, which have a comprehensive scope (Kitchin 2014).

Big data and predictive analytics have become a considerable component of government services and citizens' activities, and these have since contributed to digital governance and data driven decision making (Williamson 2014; Lyon 2014). Furthermore, government based big data includes the collection of data that measures, monitoring and governing individuals behaviour (Ruppert 2012). Research by Davies (2012) outlines the emergent style of government whereby ongoing behavioural analysis is undertaken, through advanced analytical techniques to understand, measure and manage the different behaviours of individuals and groups. Furthermore, Bowker (2005) states that this type of governmental analysis and organisation, is one that is more engaging, is closely tied with the world and citizens and represents the real world more closely. In the predictive analytics space there is considerable research exploring its application in different domains, based on different factors and in different countries, these are outlined in Table 1. This literature highlights the variability in the application of predictive analytics in both private and public sectors.

Table 1. Literature on Predictive Analytics

Research	References
Researched whether they could predict a customer's intention to switch a mobile service provider, they found that if the barrier to switching is high they will not.	Shin & Kim 2008
Explored the role of big data and predictive analysis on increasing cybersecurity, this research was based on understanding the role of behavioural analytics.	Eastman, Versace & Webber 2015
Conducted research applies learning analytics to track and predict student performance, with results helping to inform educational policy.	Williamson 2015

Explored the willingness of individuals to utilise mobile government applications, using UTAUT for predicting acceptance criteria (strongest being performance expectancy and trust).	Sharma, Al-Badi, Rana & Azizi 2018
Explored the factors that can assist in the predictive of adolescence remission of internet addiction, finding several factors including low interpersonal sensitivity and hostility predicted remission.	Ko, Yen, Yen, Lin & Yang 2007
Found seven factors that predict adoption of assistive technology in people with dementia.	Zhang, McClean, Nugent, Donnelly, Galway, Scotney & Cleland 2014
Predicting policing was used in Kent County Police, which found that past conditions and adoption strategies play a crucial role in the acceptance of new and innovative work practices that utilise ICT.	Asquer 2015
Predicted the adoption of IT in SMEs based on a model utilising social, economic, psychological and environmental variables.	Ukoha, Awa, Nwuche & Asiegbu 2011
Found that the telemedicine Service acceptance model predicts the factors for the acceptance of telemedicine services in physicians.	Rho, Choi & Lee 2014
Found that cognitive and affective gratification-seeking factors were strong predictors and adopter attributes were moderate predictors of online service adoption as a result of advertisements.	Lin 2001
Found that three separate IS models all provide different explanatory variables for the adoption of eBusiness services (these included; the technology-organization-environment model, the task-technology-fit model, and the unified theory of acceptance and use of technology).	Trang, Zander & Kolbe 2014
Found that one trust related construct (perceived credibility) and two resource related constructs (self-efficacy and perceived financial resources) predict consumers' intention to use mobile services.	Wang, Lin & Luarn 2006
Utilising Technology Acceptance Model found that by adding three factors: experience, trust and time, they could predict the acceptance of M-government services.	Airowili, Alotaibi & Alharbi 2015
Found that perceived usefulness was the strongest predictor of intention to use information systems in the Indonesian Government Agency.	Mardiana, Tjakraatmadja & Aprianingish 2015

3. METHOD

This study utilised a Quasi Randomised-Control Trial (QRCT) and case study on the ATO to understand the impact of encouraging the use of digital services to otherwise non-digital service users. A section of the results of this data collection were also outlined within Papavasiliou, Reaiche & Ricci (2019A), however additional analysis was conducted to determine if the behaviours could be predicted and if so what individuals (based on specific characteristics) were more likely to change behaviour. A QRCT differs from the standard RCT, as there is no set sample size and the allocation to treatment and control group is random (Gribbons & Herman 1997).

The QRCT was conducted in July 2018 (over a four week period). To conduct this study, 11 call centre operatives in the ATO were provided a script to use as a 'treatment'. The number of participants (calls) were random, to be selected for treatment the participant needed to call the ATO and request a non-digital lodgement option for their 2018 tax return. If the participant was put through to one of the treatment call centre operatives, they would be informed of the digital service offer, the benefits and be aided to complete their lodgement. Whereas if they were not put through to one of the treatment operatives they were provided no information about digital services and sent out the paper lodgement forms.

To ensure the validity of the treatment and control group, the basic participant demographics were compared to one and other to ensure similarities between the groups (e.g. age, gender, occupation and income). After the four week period the treatment group was comprised of N=254 and the control group was comprised of N= 2534 participants. Therefore, this QRCT was testing whether through an encouragement (i.e. eGovernment support) an individual who previously lodged via non-digital means (with no previous history of lodging through digital channels) would shift to a digital lodgement channel. Therefore addressing the research question highlighted above.

3.1 Logistic Regression

Through the application of a binomial logistic regression, the analysis was able to explore who was more likely to shift to digital services after obtaining the treatment. A logistic regression was utilised to describe the data and explain the relationship between one dependant variable (binary variable) and an independent variable (either ordinal, interval or nominal) (Menard 2002). The purpose of applying a logistic regression is to measure the unique impacts of each independent variable on the dependent variable. Through the use of a binomial two dimensional logistic regression means that the dependent variable is binary, meaning that the variable only has two possible values (Harrell 2015). The interpretation of the binary logistic regression is to predict which of the two groups the binary dependent variable individuals sit within (Harrell 2015). The logistic regression was conducted in R statistical software, utilising the glm function for binomial logistic regression. To create the model, the dataset was split into a training and test group (75% training and 25% testing). A number of different independent variables were tested to determine the most useful variables for predicting the outcome.

4. RESULTS

The first part of the analysis was to determine if the encouragement to use Digital Lodgement had been effective. Table 2 shows the count of the individuals who used each method of lodgement for both the treatment and control groups. It appears that the treatment group (those encouraged to use the digital service) contains more individuals who lodged digitally than the control group.

To formally test this, a Chi-squared (χ^2) test was applied to these data resulting in a p-value of 0. For the individuals within the treatment group, those who lodged their return using either a Tax Agent or Digital Lodgement was far higher than otherwise expected, and the number who completed the Paper Lodgement was far lower than otherwise expected. The control group had the inverse effect. This strongly suggests that the intervention of encouraging individuals to use the digital service was effective.

Table 2. Digital and non-digital lodgement by treatment and control group

	Paper lodgement	Tax Agent Lodgement	Digital Lodgement
Treatment	149	61	44
Control	229	14	10

The next analysis was to break down the demographics of each group to investigate whether these could be used to understand which individuals were likely to respond to the treatment. Table 3 outlines the demographic information that was collected for each individual and indicates whether or not it was used in the logistic regression. This information also highlights the characteristics evaluated that could be significant in predicting digital adoption.

Table 3. Demographic variables tested in the logistic regression

Independent Variable	Definition	Included/Excluded	Why Excluded
Gender	Three categories: Male, Female and Not Stated	Excluded	Not enough variability in the distribution
Dependent indicator	Y or N field that indicates if the individual has dependents (e.g. children)	Excluded	All individuals had N
Supplementary Income Indicator	Y or N field that indicates whether an individual has supplementary income (e.g. rental, dividends or shares).	Excluded	Only a small number of individuals had Y
Occupation Code Group	10 categories (1-10) that outlines which occupation the individual is within	Excluded	Too much variability and grouping together decreases the amount of available information

Government Income Indicator	Y or N field that indicates if the individual received government income or pension	Excluded	Predominately Y indicators
Spouse Indicator	Y or N field that indicates if the individual had a spouse	Excluded	Provided an insignificant result
Age Range	3 categories: <45, 45-64 and 65+ Grouped in this way due to the small sample size	Included	
Deductions Indicator	Y or N field that indicates if the individual had claimed deductions on the tax lodgement	Included	

A binomial logistic regression model was used to investigate which characteristics were significant in switching away from Paper Lodgement. The type of lodgement in 2018 (1 for Digital and Tax Agent lodgement, and 0 for Paper lodgement) was predicted by Gender, Age Range, Supplementary Income Indicator, and Deduction Indicator.

As outlined in Table 3 a number of variables were found to be insignificant in this analysis. Table 4 shows the final results of the model and the coefficients of the characteristics which were found to be significant.

Table 4. Results of the binomial logistic regression

Category	Option	Coefficient	P-value
Age Range (Years)	45-64	-1.1157	0.005
	65+	-1.9484	6.64×10^{-6}
Deduction Indicator	Y	2.5629	4.36×10^{-10}

The Age range coefficients were found to be significant for predicting the switch to the Digital Lodgement. As the model uses a logit link, the coefficients are exponentiated to get a measure of the change involved. Thus, individuals younger than 45 years were 3 times more likely to switch to Digital Lodgement than individuals aged 45-65 years. Individuals younger than 45 were 7 times more likely to switch to Digital Lodgement than individuals aged 65 years and over. The Deduction Indicator was also found to be significant. Individuals who claimed deductions were almost 13 times more likely to switch to Digital Lodgement than those individuals who did not claim deductions.

The results of this study demonstrate that the intervention works well and could be extended to additional populations. Interestingly, the results of the regression shows that the intervention is working better for some individuals in comparison to other, namely young people and people who claim deductions within their tax lodgement. The results also demonstrate that there is no significant difference between the change to digital service behaviours of males or females. There was also no difference between people with supplementary income and those who don't have supplementary income in whether they changed their lodgement practice

The results of this study demonstrate a correlation between a number of factors making an individual more likely to change from non-digital to digital services with encouragement. However, the research question remains unanswered and the hypothesis is neither disproven nor proven in this instance, as the predictive power of data is not clear.

5. IMPLICATIONS AND FUTURE RESEARCH

The findings of this study demonstrate proposition 1 is supported, that is the effectiveness of encouraging historically non digital service users to transition to digital services for the lodgement of their annual tax returns in Australia. The results demonstrate a number of factors which make an individual more likely to change their behaviour with encouragement. The research suggests that more encouragement could be provided to individuals aged between 45 and 64 years old to explain the benefits of utilising digital services and even

extending to provide greater assistance. The intervention would require alterations to be more tailored to the individuals aged 65 onwards.

Proposition 2 was partially supported, as it was found that Age and Deduction indicator were two main characteristics enabling a digital predictive behaviour. However, further research is required to predict the correlation of these two main characteristics and the significance of eGovernment support / encouragement. In particular, future research is proposed to address who out of the encouragement trial group would be most effective in adopting digital services and who in long term sustains a digital behaviour across various digital services.

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Purpose of Paper 5 – eGovernment Digital Adoption: Can the Adoptive Behaviour of Individuals be Predicted?

Each paper contributes to the culmination of the research outlined in paper 6, with the data collection and analysis focusing on the various components of the systems impacting digital adoption or assistance-seeking behaviour. This research highlights what elements are not currently working in the digital transformation space within the ATO case study, and how that relates to the measurable components of digital adoption and assistance. An understanding of the various themes outlined within the data collection and analysis process has indicated which systems were involved.

The results of papers 1 to 5 highlighted the limitations of the proposed conceptual model. The data collection showed that the four systems were not sufficient to analyse the problem, as they were all too broad or too narrow. The four systems identified too many components, creating difficulties for the evaluation of the interactions between systems, the views and goals of the systems, and how they impact the digital transformation system of systems. In contrast, the systems were too narrow in that they were not inclusive of all constituent systems which could impact that digital transformation process. Therefore, the data collection and analysis suggested that additional constituent systems needed to be considered and understood in order to effectively govern digital transformation processes.

Table 22 outlines the links between the themes documented within the data analysis in previous stages of the research, demonstrating the links between the research and the framework. Table 23 outlines the counts of the thematic analysis as they relate to the identification of the constituent systems impacting digital transformation. The results demonstrate the prevalence of the themes within the data analysis of both the pilot and extended study, with 10,625 responses indicating specific issues with digital services. Themes were allocated (based on the literature review outlining various constituent systems) to their relevant constituent system, with 6 key systems emerging from the results. This was used to develop the framework for effective digital transformation.

As for the guidelines for application, the questions were derived from the five Ws and H of systems approaches and the basis of EA. The questions were linked back to a number of the

themes, the types of assistance sought by the individuals using digital services, the previous literature and research by the Australian Taxation Office.

Table 22. Constituent Systems Outlined in Framework Linked to High Level Previous Data Analysis

Constituent system	Themes within the research
Cognitive	Literacy and numeracy skills (self-reported), skills associated with understanding taxation obligations, and willingness to use digital services or government services generally.
Social	Social norms, role of community support.
Digital	Access to technology, internet access, digital skills.
Infrastructure	Black spots, digital divide (literature indicating that the whole of Australia is not completely covered when it comes to access to infrastructure).
Business	Also taxpayers, key part of the economy (e.g., sales of goods and services).
Policy	Role of government, policies impact on how services are provided, how data is used and shared within and across government.

Table 23. Constituent Systems Outlined in Framework Linked to Previous Thematic Analysis

Constituent systems	Themes	Counts	Comment
Cognitive	Literacy skills.	269	3,414 respondents of both the pilot and extended study indicated that they were impacted by an element of the cognitive system.
	Understanding of taxation.	1,259	
	Willingness to adopt services.	319	
	Preference to use non digital.	174	
	Language barrier.	1,393	

Social	Australians have largely embraced digital services, and would prefer more online services in the future.	1,185 (59% of people surveyed)	As per Dan (2017), 2,009 people surveyed for a digital innovation in government report.
	Digital government services are viewed as convenient, cost-effective and the “way of the future”, although concerns remain over privacy and security of information.	1,506 (75% of people surveyed)	
	It is everyone’s responsibility to contribute to tax and superannuation.	1,380 (64% of people surveyed)	
	Tax system unfairly advantages big business and wealthy people.	1,208 (56% of people surveyed)	
Digital	Not using digital is the only option.	156	3,062 respondents of both the pilot and extended study indicated that they were impacted by an element of the digital system.
	Discomfort using technology.	190	
	Lack of computer skills.	2,479	
	Security concerns.	237	
Infrastructure	Lack of internet access.	420	2,450 respondents of both the pilot and extended study indicated that they were impacted by an element of the Infrastructure system.
	No computer at home.	2,030	
Business	Questions on how to manage business.	939	1,699 respondents of both the pilot and extended study indicated that they were impacted by an element of the business system.
	Registering to start a business.	760	

Policy	Role of government.		As this research focuses on eGovernment services, the underlying role of government and change in policy needs to be understood when undergoing digital transformation. Although this system was not present within the thematic analysis, the relevance of policy and government is very high for digital transformation to eGovernment services.
	Change in policy.		

The creation of the governance framework and guidelines for application are outlined within Paper 6. This includes the literature used to inform the development of the questions used to guide the application of the governance framework.

Paper 6 – A System of Systems Management Framework for Digital Transformation in eGovernment

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Statement of Authorship

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By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
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A System of Systems Management Framework for Digital Transformation in eGovernment

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Abstract— Ongoing advances in technology have had a considerable impact on how government services are provided. Despite multiple benefits of digitalization, digital transformation has proven to be challenging with over 70% of initiatives failing. A key reason for this is a lack of an effective management framework for eGovernment digital transformation. This paper proposes such a framework by using the system of systems methodology. The framework allows eGovernment decision-makers to effectively identify various constituent systems and examine how they interact with each other to form a system of systems. This systemic analysis provides an opportunity for more holistic management of digital transformation in eGovernment, including being more risk aware, dynamic, flexible, and resilient. A case study of digital transformation at the Australian Taxation Office has been used to illustrate the application of the proposed framework.

Keywords—System of Systems, Digital Transformation, eGovernment

I. INTRODUCTION

Rapid progress in technology and subsequent organisational digital transformations have led to increasingly greater degrees of interconnectedness and complexity. Technological advances allow individuals and organisations to adopt technology to transform to be more effective in multiple domains [1], including eGovernment service provision. As a result, digital transformation in all industries and sectors has become the norm, as technology becomes more widespread [2]. However, this sweeping change has brought about challenges for the creation of effective eGovernment services for such areas as management, interfaces, lack of commonalities between users and service providers, different layers of obstruction for different eGovernment services [3] and governance and integration of several interconnected systems to achieve a common objective. eGovernment services are building more efficient channels for service delivery, shifting towards a citizen-centred service delivery approach [4-5]. eGovernment platforms are complex because of involvement of numerous stakeholders, business processes, and technologies. Each component needs to be integrated into a singular platform, which meets government and user needs.

Research suggests many eGovernment initiatives fail due to a lack of understanding of the eGovernment concepts, processes, and functions, restricting the range of opportunities the eGovernment can offer [6]. While citizens are the primary stakeholders and main beneficiaries of the eGovernment services, they are not homogenous [7]. Therefore evaluation and tailoring of services in the eGovernment is required. The

purpose of evaluating eGovernment services is to ensure services meet the expectations and requirements of citizens, while being high quality and efficient for both the objectives and strategies of the government organisation [8]. Furthermore, the evaluation of eGovernment services is complex as a result of various perspectives complicating the measurement of potential benefits of eGovernment services [9-11], although numerous evaluation frameworks which have been created to measure the effectiveness of eGovernment services from multiple perspectives.

Digital transformation is a significant challenge facing enterprises, a process which is also impacted by the need to become more people-centric and service-oriented [12]. Interestingly these challenges have had an impact on the level of success of the digital transformations, whereby 70% of digital transformations fail to meet their stated goals [13]. This is often related to mismanagement, minimal record keeping of the system changes and lack of understanding of the role of people undertaking it [13]. Thus, identifying the need for a holistic approach to understand the various constituent systems which could influence the success of the digital transformation.

Currently, there is limited research on the development of a holistic eGovernment platform for both the evaluation and creation of eGovernment services. This paper outlines a holistic framework for the creation of effective eGovernment services, viewing digital service provision as a system of systems (SoS), whereby each participating system in the SoS is considered separately and as a collective. The application of this framework is illustrated through a case study of the Australian Taxation Office (ATO).

II. EGOVERNMENT

eGovernment is defined commonly as a government's use of Information and Communications Technology (ICT) and organisational digital transformation to improve the structures and operations of government and provision of services [14]. The overarching purpose of eGovernment is the provision of services and transformation of the interactions between citizens, businesses and governments [15-16]. A growing trend is the creation of citizen-centred eGovernment services worldwide [17], which is an approach driven by the creation of services that meet both the demands and expectations of the citizens (or potential users) [17]. Therefore, governments are focusing on the needs and expectations of their citizens in the delivery of government services [18]. This has promoted the use of eGovernment and digital transformation within government, especially for the creation of service delivery

platforms that build better interactions with citizen. According to research by Bwalya [19], eGovernment has been identified as one of the most efficient platforms for the delivery of appropriate, transparent and participatory services and governmental decision-making. However, this comes with challenges, particularly since successful eGovernment does more than just transition legacy services into digital platforms, but also includes the restructuring of administrative processes and shifting of the focus towards citizen and customer-oriented service provision [20].

A. Digital Transformation

The trend towards eGovernment service provision is based on the ongoing digital transformation in service provision in the public sector, often reflecting the transformation that was undertaken in the private sector. Digital transformation is the process in which an organisation implements digital technologies to either create new services or processes or modify legacy systems [21]. This relates to enterprise transformations that are defined as fundamental changes to the manner in which an organisation operates (also referred to as a business transformation) [22].

There are a number of different frameworks that have been previously developed that evaluate the efficacy of eGovernment services. However, the majority of these focus on specific elements of the process or on a particular platform [23]. The most commonly applied forms and methods for evaluation include Wimmer's [24], Zachman [25], and Systems Thinking 5 W's and H [26]. Firstly, Wimmer's [22] Holistic reference framework for eGovernment evaluation provides a three dimensional model for evaluation of eGovernment platform. Zachman's model [25] is another evaluation method used to outline the key factors requiring consideration by service or platform designers. Finally, the 5 W's and H of Systems Thinking which poses who, what, when, where, why and how questions to understand the 'mess' or unclear problem space [26]. The Zachman framework has been found suitable for understanding complex systems, including SoS, as it incorporates different elements of each constituent system and understanding the various stakeholders [27]. Zachman framework has been used to provide a means for creating a standard and logical structure for classifying and organising the descriptive representation of the enterprise [28]. These methods are especially relevant when it comes to understanding the effectiveness of a digital transformation within and outside of an organisation.

1) Benefits

Digital transformation offers numerous benefits to users and service providers, including the increased level of transparency since it provides an avenue for the public to be informed about the government's current work and policy direction [29]. Furthermore, digital transformation facilitates greater communication between government, businesses and the public [30]. As for the service provider, there is greater efficiency for both cost effectiveness and time saving [29]. Finally, digital transformation contributes to increased accessibility for both service providers and users, while the provider is not limited to how they provide services to users [31]. These benefits represent considerable incentives for service providers to undergo digital transformation and for users to adopt services provided.

2) Challenges

Despite the benefits of digital transformation, there are also considerable challenges for service providers and users [6]. Among these obstacles is the digital divide, whereby not everyone who needs to access a digital service has access to the network or technology required [32]. Additional impediments include the lack of awareness and lack of trust from the user perspective. The service provider could be influenced by resistance to change within the organisation at different levels, which can have an impact on the effectiveness of eGovernment services [31]. The service provider is further influenced by the level of security and privacy as both provided and perceived by users [30-32]. Ensuring that the legal and regulatory requirements by national and international legislation are met is yet another difficulty [31]. Clearly, these and other complex challenges can cause a variety of issues for service providers and users adopting services.

This demonstrates the need for an appropriate and integrative SoS framework to effectively guide the development of eGovernment services through digital transformation.

III. DIGITAL SERVICE PROVISION AS A SYSTEM OF SYSTEMS

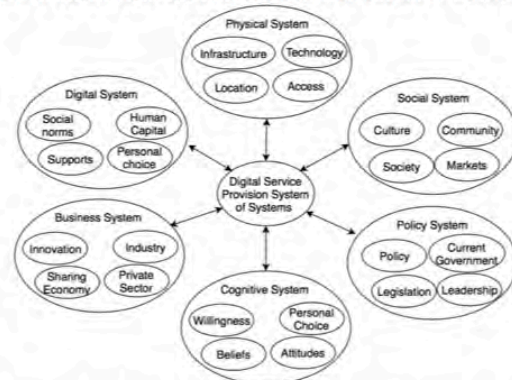


Fig. 1. Digital Service Provision System of Systems

Figure 1 presents the results of an extensive literature review, which demonstrates the importance of a variety of constituent systems that could affect the digital service provision and transformation in the public sector. A system refers to a collection of interrelated elements, these relationships and interactions are not always hierarchical and are often products of emergence [35-37]. Emergence is the result of the cumulative actions and interactions of the various constituent systems within the SoS, therefore understanding and supervising the emergent behaviour which affect the success of the SoS [37]. By outlining the various systems and the whole SoS, which could impact the transformation to digital service provision, a holistic understanding can be obtained to improve the digital service provision. In addition to the elements mentioned in Figure 2, there are a number of external factors that could have an impact on the efficacy of digital service provision. Figure 2 depicts the systems that are both systems individually and part the broader SoS.

A representation of several of the constituent systems that influence the digital transformation process in the public sector in a vertical and layered approach provides a separate view of each system. This includes the possible external factors that affect the SoS and the constituent systems, such as

environmental (e.g. ecological) and health (e.g. health of the users). This holistic visualisation of the constituent systems allows for emergent properties to appear as it is more representative of the problem space. A SoS is defined as a set of systems which in their interactions add a unique contribution through their interaction, which none of the constituent systems can achieve on its own [36]. All constituent systems are independent and autonomous. However, when they choose to be part of the SoS (in this case the digital transformation), they give up some of their autonomy to join. Therefore, for digital transformation to be effective, adequate incentives for all of the constituent systems

to join the SoS need to be available. Interestingly, while the whole system is greater than the sum of its parts due to the systems becoming integrated through interactions within and between one another, this leads to a paradox, with the participating constituent systems collaborating and competing with one another. In many cases, despite different individual purposes, these work together and create a unified SoS direction. Within the digital transformation example, the autonomous constituent systems with separate objectives integrate to fulfill a common purpose. Figure 2 shows how each constituent system changes the entire SoS while simultaneously remaining independent to achieve the shared goal of bringing about effective digital transformation.

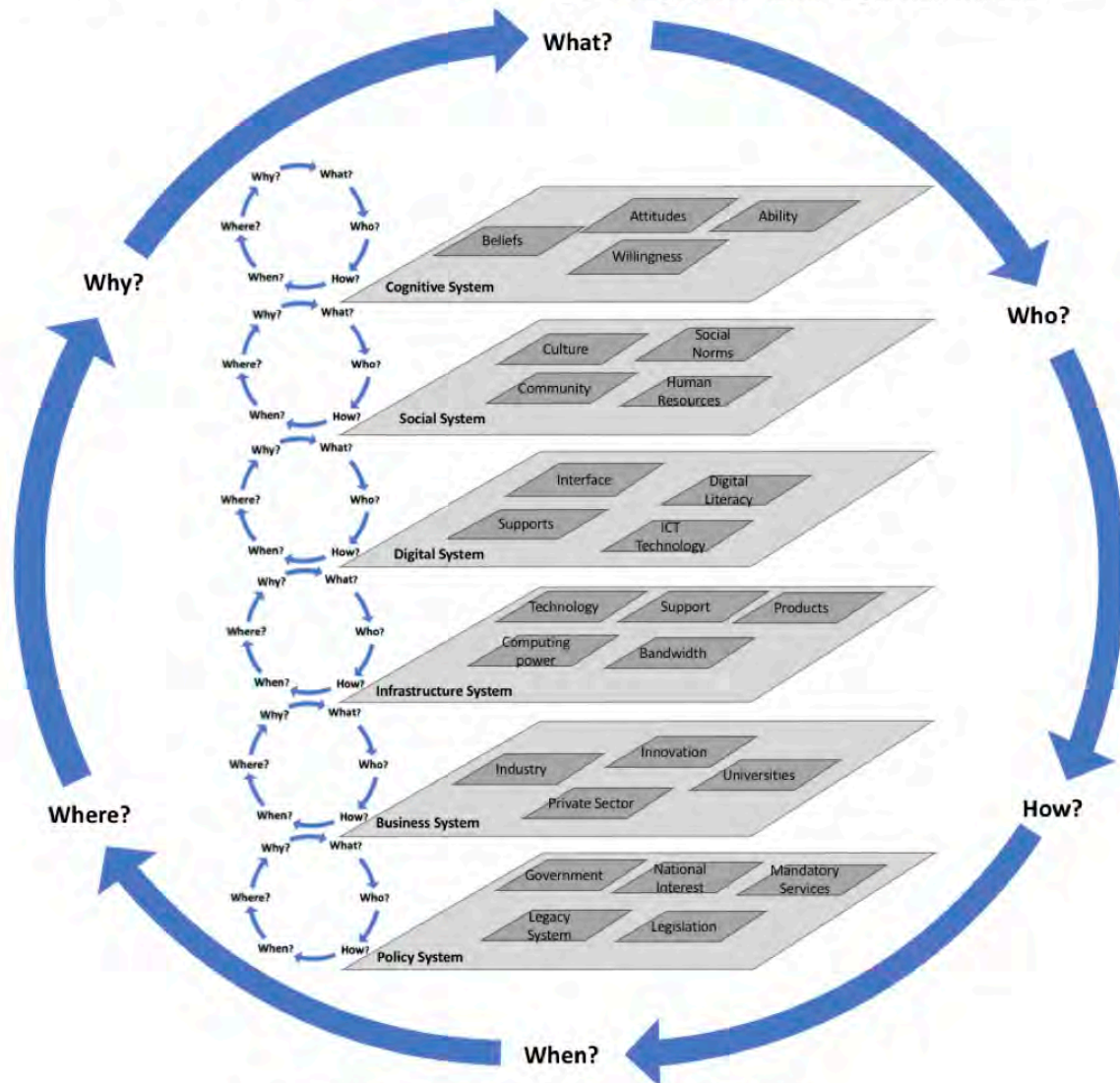


Fig. 2. System of Systems Framework for Effective Digital Transformation

What?	How?	When?	Who?	Where?	Why?
What is the purpose of the system?	How external factors might affect the system?	When do reviews occur?	Who are the stakeholders in this system?	Where in the system is the feedback coming from?	Why is this approach meaningful to stakeholders?
What are the areas in the system that need development?	How well can the approach perform in this system?	When is feedback provided?	Who are the decision makers in the system?	Where are the boundaries of the system?	Why this approach was chosen?
What is the approach?	How is feedback provided?	When is feedback received?	Who is responsible for providing support?	Where are the constituent systems within their respective lifecycles?	
What are the known constraints/risks?	How are the needs being met?	When is change documented?	Who manages risks in this system?	Where are the interfaces between systems?	
What's the role of people?	How management constraints are taken into consideration?	When is system intervention most effective?	Who will use the system?		
What's the role of technology?	How do constituent systems interact with each other?	When interactions between constituent systems occur?	Who defines success measures in this system?		
What are the characteristics of an acceptable solution?	How is emergent behavior documented and observed?	When are legacy components considered?			
What are the measures of success in the system?	How are risks addressed within this system?				
What are the incentives for the constituent systems to belong to the SoS?					

Fig. 3. Approach for using the System of Systems Framework addressed as part of evaluation of digital or enterprise transformation.

IV. APPROACH

TABLE I. AS DESCRIPTION OF EACH KEY QUESTION

Questions	Purpose
What?	These questions highlight the approach and purpose of each constituent system and how they relate to different measures of success, specifically related to the constituent systems and the SoS under review.
Who?	These questions outlines the various actors involved, specifically the decision makers, users and service designers and how they relate to the constituent system and the SoS under review.
How?	These questions summarise by what means the performance will be measured and actors will be identified and engaged in each constituent system and the SoS under review.
When?	These questions highlight at what time performance reviews will occur and feedback provisions will improve the approach and how they relate to the constituent system and the SoS under review.
Where?	These questions determine the boundaries of the constituent system and SoS under review and where the approach will be located and how that relates to the specific constituent system and the SoS under review.
Why?	These questions outline the motivation behind the approach being applied and how it relates to the specific constituent system and the SoS under review.

Delineated in Figure 3, the proposed approach is comprised of six main questions and a number of sub-questions to identify key components that need to be assessed for effective digital transformation. Each question guides the service designer or policy maker to consider the diverse views and stakeholders that are relevant to the transformation. The proposed approach was developed based on the enterprise architecture literature including Zachman's Framework [25] evaluation of eGovernment services, including Wimmer [24], and the five 'Ws' and 'H' of Systems thinking, including Hester and Adams [26]. Zachman's framework was used as a guide to develop an approach to respond to the SoS framework outlined in Figure 2. The practicality of Zachman's framework was followed to provide a set of questions that build a holistic view of the various constituent systems and the SoS. This research provided a clear outline for questions that need to be

Table I summarizes the overall purpose of each of the primary questions and relevant sub-questions that should be asked of each constituent and the SoS as the whole. The process assists in gaining a more comprehensive understanding of the SoS dynamics and recognizing the many needs and beliefs of the involved stakeholders. In turn, this provides a more holistic and in depth approach to undertaking digital transformation to create effective eGovernment services.

V. CASE STUDY

The ATO was the first service provider to adopt digital first service provision with the introduction of myTax for individuals, business portals, and tax agent portals. The ATO requires all individuals who derive income within Australia to submit their tax return annually. Since the digital first transition, the majority of services are digital and require an understanding of both taxation and computer systems. Taxpaying population in Australia is over 16 million and of these, 84% are individuals [36]. While the ATO has high digital adoption rates of the MyTax platform, with 95% of individuals eligible to utilise the service [36], there are still gaps within the population that need to be explored and identified. Furthermore, the understanding of how the ATO has obtained such high digital adoption rates can help support ongoing policy and digital design of services across eGovernment sector. An example of the application of the SoS approach presented in Table II demonstrates the multitude various constituents that need to be considered with both the design of the digital services for the ATO as well as the ongoing maintenance. In this table, the two questions provide responses specific to each constituent system and the SoS. These responses presents examples of the elements that need to be considered when conducting a digital transformation, including the varying purpose and approaches needed to meet the needs of each constituent system. With this table it is also highlights the value of the SoS, indicating the interdependent and interrelated components of the constituent systems that form the complex and unified whole of the digital transformation.

TABLE II. SoS FRAMEWORK APPLIED TO ATO CASE STUDY

Questions	What is the purpose of the system?	What is the approach?
Cognitive	Outline the different abilities of individuals (e.g. tax knowledge), their attitudes towards taxation and digital services, and willingness to adopt the services provided by ATO.	Increase taxation education, foster an environment of willing participation, ensure transparent decision making in digital services. This includes providing assistance for tax related questions.
Social	Outline the different communities who are affected and their social and cultural norms (e.g. languages)	Increase information provision, through advertising the value of digital services, appeal to the cultural and linguistically diverse groups
Digital	Outline the appropriate interface (e.g. platform) and supports (e.g. platform support) provided to ensure they meet the different digital literacy levels.	Provide multiple avenues for support to provide available assistance (including call centres, online and in person). Provide a tested platform for the use by different stakeholders
Infrastructure	Identify different infrastructure required (at the lowest level) to ensure the digital transformation is accessible (e.g. bandwidth, ICT availability)	Ensure that the capacity of infrastructure is widely available to users, that these levels are not exceeded when providing and designing services.
Business	Outline the value for business to use and share digital services, ensure the provided services meet their needs.	Bring value to businesses by meeting their needs and expectations with iterations of service design.
Policy	Identify the changing legislation, responses to current government and encourage individuals to meet their legislative obligations (e.g. lodge their tax returns).	Outline the elements of the policy that need to be address, provide clarity to stakeholders, and implement policy that has minimal negative implications.
Whole system	Meet the needs of the stakeholders for each constituent system, ensure that there are appropriate supports and infrastructure in place to encourage the digital transformation and assist with tax related questions.	Create digital service interfaces that are inclusive and provides multiple avenues for access and support for the various users.

The ATO case study illustrates the importance of the approach by demonstrating how the SoS framework offers multiple views based on the individual system and the entire SoS. Designed to provide greater insights, the key questions lead to a more holistic understanding of the problem space, with an expanded vision of each constituent system, their perspectives within it, and of the SoS as a whole. Consequently, this broader awareness of the variety of constituents and their needs make it possible to manage constituent systems more effectively.

The presented approach was used to illustrate how a particular eGovernment organisation could use such an

framework and approach to more effectively manage their digital transformation. The same framework and approach can also be applied to other government organisations, as part of future research the authors of this are considering expanding this approach to other government organisations and industries.

VI. CONCLUSION

Through the combination of the individual systems and the SoS as whole provided by the SoS framework, this research shows the commonalities and differences across each constituent system and the shared purpose of the overall SoS. The SoS framework creates value for eGovernment through integrating multiple autonomous decentralised systems to bring about effective digital transformation. Many of the emergent properties that occur as the by-product of the constituent systems' interactions can be captured within the SoS through the SoS approach outlined above. The application of the framework allows digital service designers and policy makers to better understand and integrate multiple perspectives into a holistic presentation of the problem space. Furthermore, the approach helps draw out what each constituent system considers important and subsequently, which incentives will be most appropriate for each.

The SoS framework and approach offer organisations, digital service designers, and policy makers the ability to obtain more knowledge on how different systems affect digital transformation, allowing them to create more dynamic services and generate higher levels of productivity and preparedness in responding to unforeseen circumstances. In addition, the described framework and approach can serve as a platform for greater policy dialogue regarding ongoing system improvements (within the SoS and the individual systems), including discussions on situation modelling and risk mitigation.

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Chapter 3. Methodology

3.1 Introduction

This methodology chapter will outline the research process and the corresponding methods applied to each stage. The research design employed an exploratory, interpretative approach, underpinned by a triangulated systems approach which aimed to provide a holistic response to the problem space. Figure 21 outlines the research design for this research. The research focused on utilising a case study of a single government agency (ATO). The research design section also outlines the use of a case study and the application of triangulation.. The following section outlines the survey instrument design for the pilot study and extended study, as well as the focus groups for the validation of the emergent governance framework. The next stage of the method chapter outlines the qualitative data analysis tools, specifically the multidimensional stakeholder analysis and the application of the Gioia approach and thematic analysis. The quantitative data analysis tools are outlined next, including the research design applied to the extended study data, including the application on the quasi-randomised control trials, logistic and linear regression and K-means analysis. The final section of this chapter outlines the development of a governance framework for effective governance of digital transformation in eGovernment as well as the guidelines for its application.

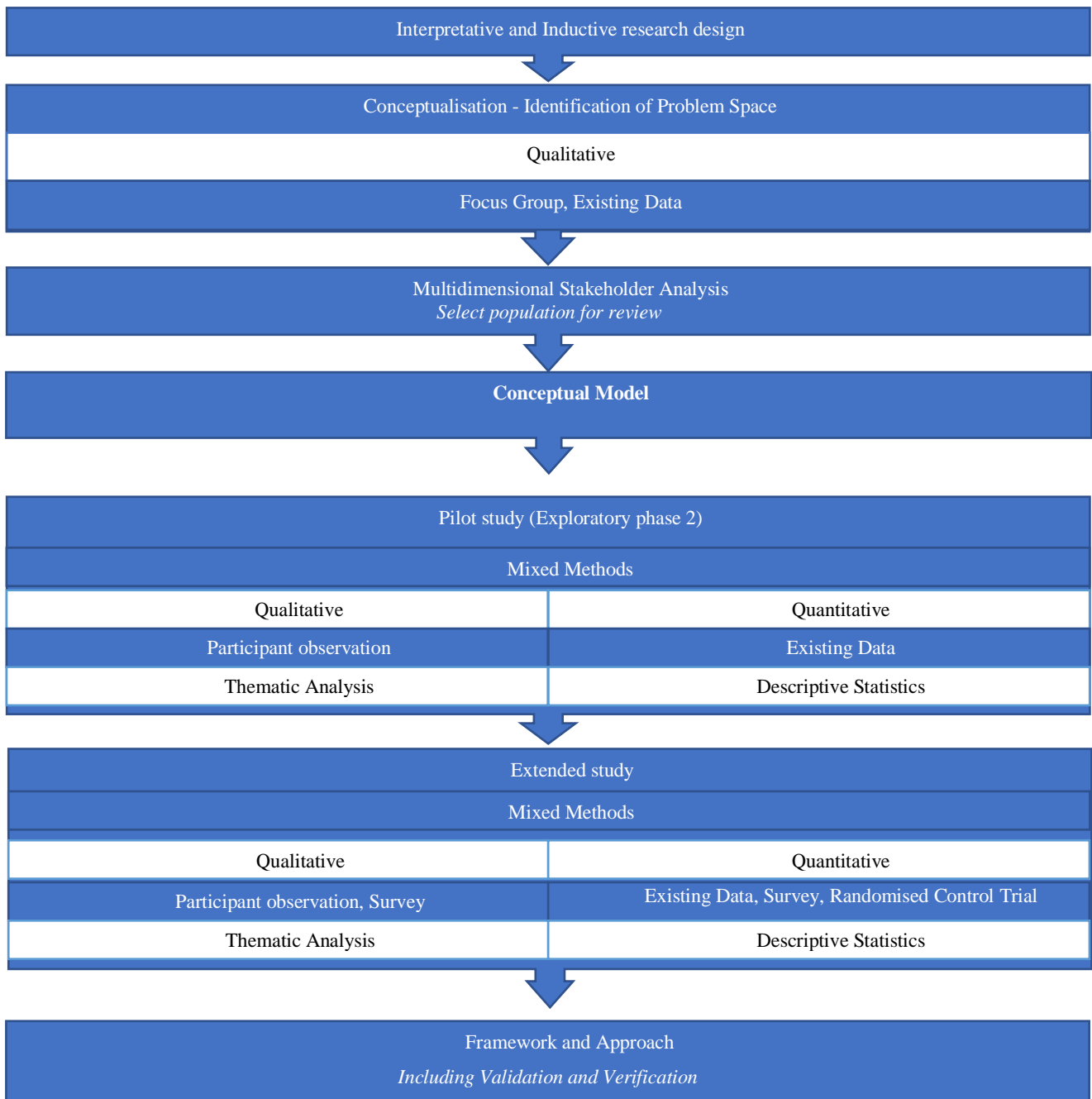


Figure 21. Research Design

3.2 Research Design

The literature review presented in Chapter 2 has formed the basis for the application of a combined methodological approach – both qualitative and quantitative. In addition, a triangulated systems approach was developed, which combined three different systems approaches (i.e., SSM, system of systems methods and EA) with the aim of increasing the

validity of the findings. Through the application of the multidimensional stakeholder analysis (explained in Chapter 3 Methodology, and Paper 1: Conceptual Paper) the research has identified the most relevant stakeholders to the case.

The research has adopted a case study approach, used to present the problem within the single organisational view, in order to identify the critical systems necessary for the development of an effective governance framework proposed within this research. The overarching aim was to build a model and/or a framework for a holistic stakeholder understanding, to map user behaviours and interactions to understand the digital service platforms, how they are used and the assistance-seeking behaviours.

Figure 22 outlines the links between the stages of research undertaken and how they relate to the previous and future stages.

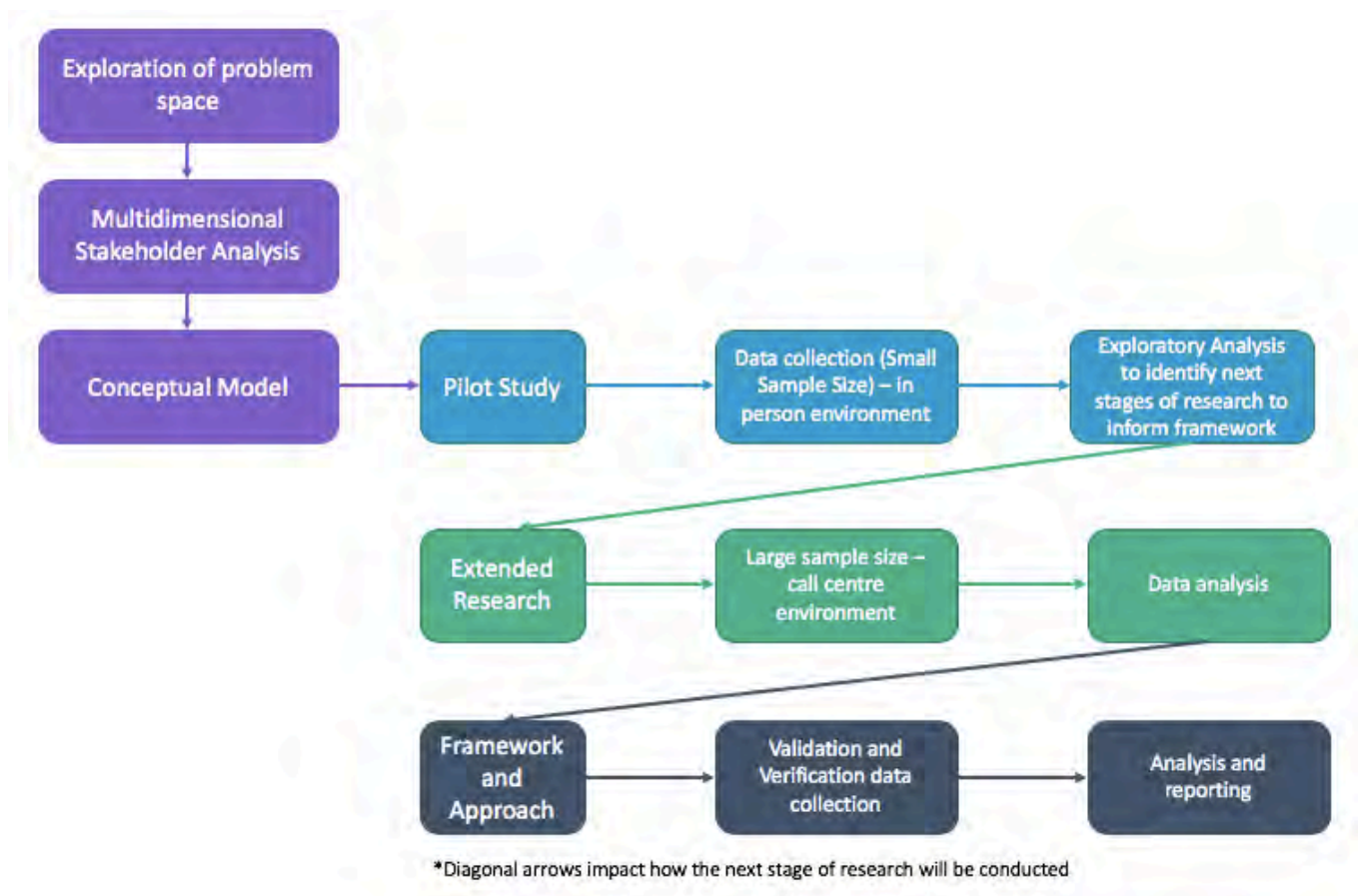


Figure 22. Steps of Research Design to Inform Development of Framework

3.2.1 Exploratory, Interpretive and Inductive approaches

This research applied an exploratory, interpretive and inductive approach to guide understanding of the problem space as it is messy, characterised as being complex and requiring significant judgment, and involving multiple stakeholders and conflicting goals. A messy/wicked problem involves the absence of a correct or easy to identify solution (Churchman, 1967, Wagner 1995).

The exploratory approach was adopted to assist with the conceptualisation of the problem space. The approach guided the research priorities and definitions of the key components, and improved overall research design by following the data. Exploratory research reveals the nature of the problem under review, instead of providing conclusive evidence (Saunders, Lewis and Thornhill 2012; Singh 2007). In order to conceptualise the problem, the three stages of exploratory research outlined in Figure 23 were applied. The first step involved the identification of the problem space, including completing a literature review and consulting experts to understand previous research and literature gaps. This guided stage two, which was to formulate a research question. The question is an open one, guided by the results of the data collection. The third stage involved continuing the study through to more detailed data collection and analysis, based on the findings of the initial stages of research.

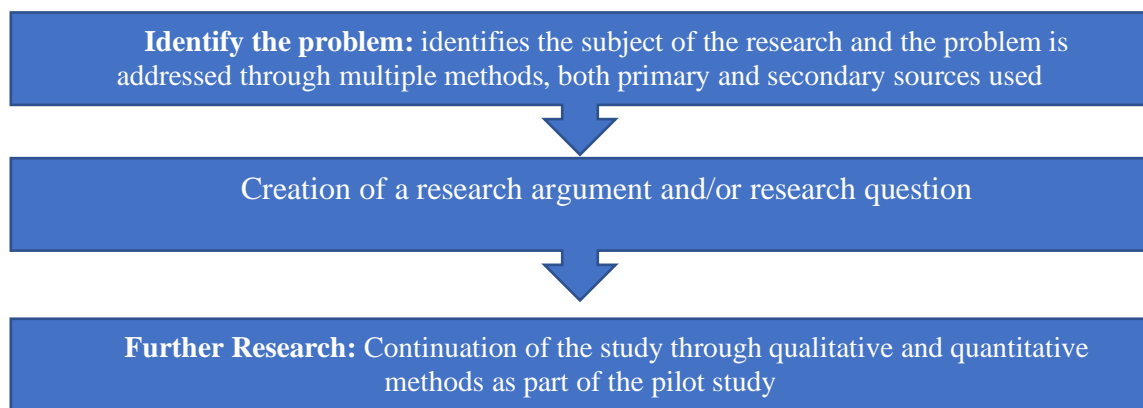


Figure 23. Exploratory Research Design Employed By This Research

In addition to the exploratory approach, the inductive research approach was applied. The inductive approach explores detailed observations of the problem space, to assist with developing abstract generalisations and ideas, and used to guide exploratory and interpretive research (Neuman 2003). The application of the inductive approach provides additional rigour

to the exploratory approach used to guide the research direction. This approach is bottom up, based on understanding the different dynamics within the population under exploration, including identifying emergence, robustness, resilience and focusing on individual behaviours while understanding links to collective behaviours (similarly defined in systems approaches) (Alexandiris 2006; Lodico, Spaulding and Voegtle 2010). Figure 24 outlines the inductive reasoning approach utilised within this research – an approach similar to that of the exploratory research approach outlined in Figure 23.

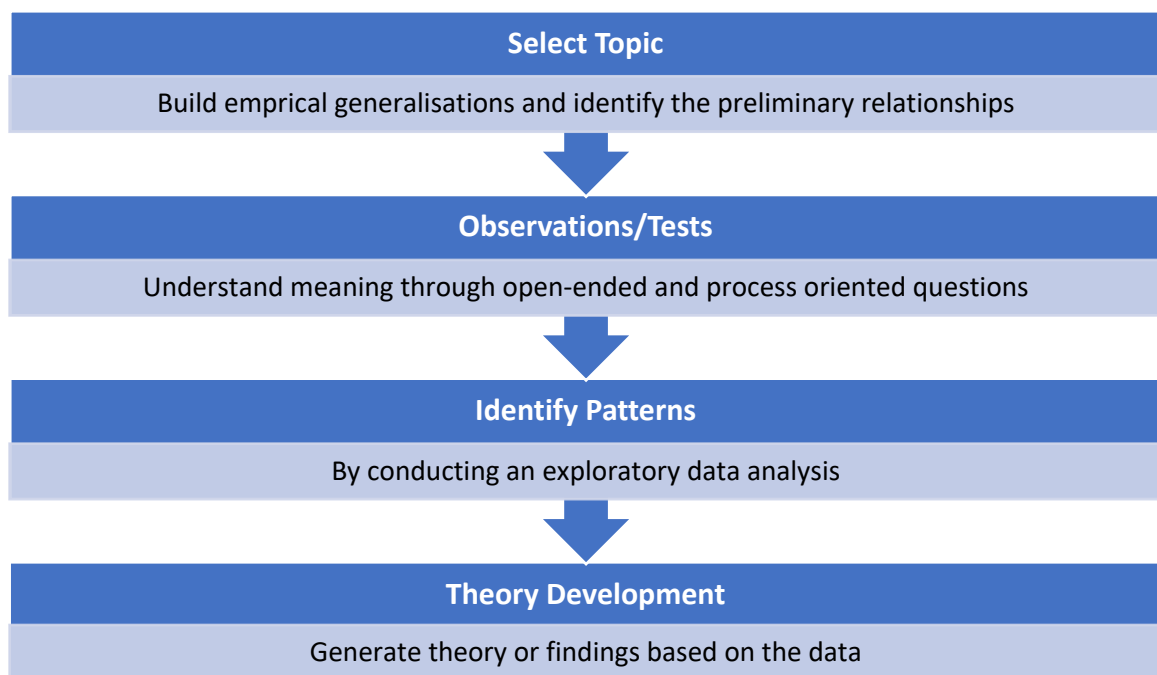


Figure 24. Inductive Reasoning Approach

To carry out inductive research, the researcher must develop a set of observations. These observations and this style of research links to both the exploratory and interpretive approaches.

The interpretative approach was then applied to support the exploratory and inductive approaches and in order to better understand the research problem. The interpretative approach focuses on the manner in which individuals make sense of their reality and how they attach meaning to it (Putnam and Banghart 2017; Elbardan, Othman and Kohleif 2017). Through the application of the interpretative approach, multiple subjective interpretations and behaviours of multiple individuals and systems can be reconciled, made possible through interpretation of

the reality utilising a sense-making process. The interpretative approach is based on four components (Andrade 2009; Klein and Myers 1999):

- (1) Use a theoretical sampling strategy, where the study positions, respondents or cases selected are based on theoretical considerations. This includes considering whether they fit within the phenomenon being studied and whether they possess certain characteristics that make them uniquely suited for the study.
- (2) The role of researcher is critical. Part of the consideration is the specific role and involvement that the researcher will play within the research process, which must be made clear during the data analysis. The researcher should remain neutral and unbiased throughout the data collection and analysis.
- (3) Interpretive analysis is holistic and contextual, focused on language, signs, readings and meanings from the participants' perspectives within the problem space under review. This approach recommends the use of systemic and transparent approaches for data collection and analysis rather than statistical benchmarks for construct validity or significant testing.
- (4) Data collection and analysis can proceed simultaneously or in stages. Researchers can correct potential flaws within the data collection protocol or adjust it to capture the phenomenon of interest. This includes potentially changing the original research question, and identifying whether the results of the data collection is likely to answer the question appropriately.

These steps have been applied to this research and relate to the ATO case study, as the starting point required understanding the various characteristics of the problem space, including how they relate to the direction of the research and data collection. Understanding the role of the researcher was important, this was considered by ensure additional verification was undertaken to validate the data collection and analysis process, including having other individuals conduct the collection and having the analysis validated externally. A triangulated, qualitative and quantitative data collection approach provided a holistic and contextual analysis. As the research was exploratory, the question and problem space adapted over the course of the research allowed a more holistic understanding of the larger area of interest – effective digital transformation.

3.2.2. Case Study

Throughout this research a case study was used to provide a consistent frame of reference for the research design and questions. To assist with creating a framework that relates to the public sector generally, a case study was employed to understand the relationship between the environments affecting the different cases. The case study allowed a detailed investigation which aimed to provide an analysis of the environment and processes in the area being studied (Johnston, Leach and Liu 1999). Through the application of a case study approach, insights and information within an organisation's behaviours can be identified and understood. This approach offers significant detail and analysis opportunities for behaviour and processes that influence context and processes and vice versa (Hartley 2004). The use of a case study approach provides a holistic single unit of analysis, building a meaningful analysis of a singular event or organisation (Ball 1996). Miles and Huberman (1994, 25) state that a case study is best applied to explore an event that occurs within a bounded context. Similarly, Yin (2003, pp .13) encourages the use of case studies to explore specific real-life research questions, to understand the environment, which is especially relevant when a research question has clear boundaries between an event and the environment.

The case study for this research is the ATO, as described in Chapter 1 Introduction, and Paper 1. This research was approved by the ATO as part of an academic partnership agreement. To obtain approval to conduct research and complete a case study, advice and guidance was obtained from the ATO research department. An ATO sponsor was sought and an ATO supervisor was brought on board. The data collection was conducted within both the ATO and University of Adelaide's data management requirements, the University's Human Research Ethics guidelines, and the security vetting requirements for the use of personal data within the ATO. As an employee of the ATO, the researcher was provided with conditional access to data, provided that results were shared internally with the ATO to ensure they obtained the benefits. The data is owned by the ATO and kept under the ATO Privacy Policy (Refer to: <https://www.ato.gov.au/about-ato/commitments-and-reporting/in-detail/privacy-and-information-gathering/privacy-policy/>). Data reporting throughout the case study was only shared in an anonymised format, at an aggregated level. No data was removed from the ATO systems, and all storage, collection and analysis was conducted on ATO servers to ensure anonymity of data.

3.2.3 Triangulation

This research was supported by the use of triangulation. The triangulation approach refers to the combined use of numerous research methods to study a single phenomenon (Bogdan and Biklen 2006). By applying multiple different observers (data collectors), theories, methods and data, the triangulation method assists in overcoming numerous weaknesses and intrinsic biases that can occur from singular methods (Bogdan and Biklen 2006). Triangulation is used in mixed methods approaches as it is appropriate for qualitative analysis and increases research credibility; it also provides additional criteria for reliability and validity (Rothbauer 2008). According to Cohen and Manion (2000), triangulation uses multiple research perspectives to assist in mapping out and explaining in more detail the richness and the complexities associated with human behaviour. Similarly, Altrichter, Feldman, Posch and Somekh (2008) state that the purpose of triangulation is to provide a more balanced and detailed picture of the situation under review. Therefore, triangulation can be seen as a method for cross-checking data from numerous sources, and identifying regularities in the data and research materials (O'Donoghue and Punch 2003). The triangulated approach was considered appropriate for this research, as the use of multiple complimentary approaches assists in providing validation and verification for the data collection and analysis processes.

There are four basic forms of triangulation according to Denzin (2006), all of which were used as a guide through much of this research:

- (1) Data triangulation: obtaining data from different timeframes, spaces and participants.
- (2) Theory triangulation: using numerous theoretical frameworks to guide the interpretation of the problem space.
- (3) Methodological triangulation: using numerous methods to collect data (including surveys, observation, focus groups and existing data).
- (4) Investigator triangulation: using more than one researcher to collect and analyse the data.

Triangulated Systems Approach

The extensive literature review in Chapter 2 outlines the various systems approaches, including their strengths and weaknesses. Within this research, the decision was made to

triangulate three systems approaches in order to increase validity of the research, overcome potential weaknesses in the use of a single approach and use complimentary approaches to support the research.

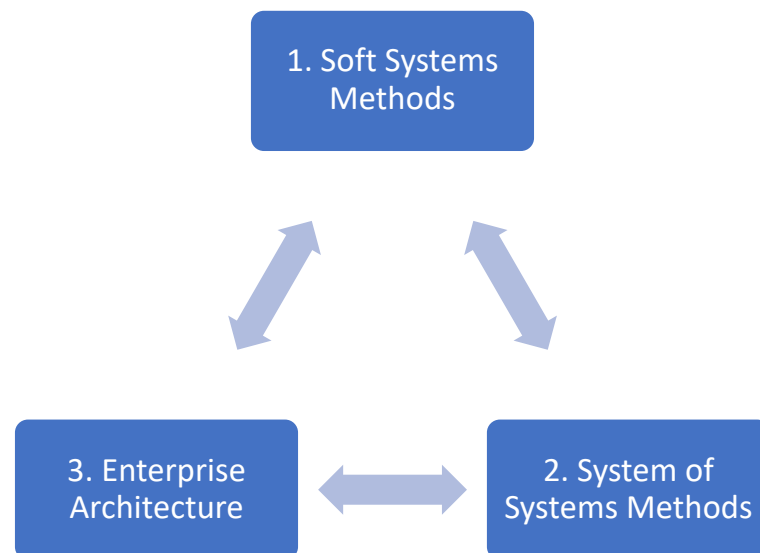


Figure 25. Triangulated Systems Approach

To fill an identified research gap and provide an effective governance framework for effective digital transformation, the triangulated systems approach was applied to assist in overcoming the complexities of the problem. Through the SSM, the unstructured problem space was understood in such a way as to provide structure through the use of rich pictures and root definitions. System of systems was used with the intention of integrating the constituent systems together to recognise the system of systems; specifically, it was used to provide a view of the different levels of obstruction and the ability to switch between them. Finally, EA was applied to understand each constituent system while also understanding the system of systems as a whole. The triangulated systems approach provides a more holistic picture of the problem space as well as how to best approach each of the complexities forming the system as a whole.

3.3 Survey Instrument

3.3.1 Pilot

A pilot study is defined as an exploratory small study for testing the research practices, data collection instruments, sample recruitment, strategies and research techniques (Waite 2002). The purpose of using a pilot study is to identify potential problems and deficiencies in the research instruments and protocols prior to full study implementation (Lancaster, Dodd and Williamson 2004; Kraemer, Mintz, Noda, Tinklenberg and Yesavage 2006). Conducting a pilot study prior to the main study increases the likelihood of success of the main study. The pilot study needs to be well designed with clear objectives, analysis plans and success criteria. The pilot study is a small-scale test of the methods and procedures of research to be used on a larger scale (Last 2001). A pilot study was considered appropriate in this research to test the feasibility of the research questions, methods and analysis to assist in understanding the possible effects and associations that were worth exploring further in the larger study (Everitt 2006).

The pilot study for this research was used to understand the most appropriate data collection method to address the research problem. The data collection for the pilot occurred in 14 days over a three-week period, at the Adelaide (South Australia) MyGov shopfront in July 2017. The MyGov shopfront is a bricks and mortar office that provides members of the general public with a place to come in and ask public sector employees for assistance with using different federal government digital services (including Taxation, Medicare and Centrelink). Two employees were responsible for the collection of data and documentation of methods employed. The pilot study focused on questions and assistance-seeking sought for taxation matters (using the MyTax digital service offered by the ATO). During this time more than 284 cases were collected; however, due to the scope of this research, deceased estates, hardship enquiries and non-digital service queries were removed. Therefore, a total of 248 validated cases were usable in this research. For qualitative research this is a large sample size. The size and content of this data provides rigor to guide further field research and it also promotes the direction of the quantitative research component for this research.

The data collection for the pilot study was observational, without a specific research question. The purpose was to explore the assistance-seeking requirements of individuals with eGovernment services. The primary questions used to prompt the data collection were:

- (1) Why people sought assistance.
- (2) Their demographics (age and gender).
- (3) If relevant, their emotional response.

Data was collected through a Microsoft Excel spreadsheet and documented after each interaction with clients. To ensure the privacy of the clients, the information stored within this spreadsheet contained no identifying information (no names or personal identification numbers, for example, their unique tax file number). The initial data collection was based on understanding assistance-seeking behaviours and requirements, and why people were not able to complete their mandatory interactions without assistance. The ATO has a number of available assistance options for individuals, including telephone, online, tax help and tax agents; however, the pilot focused mainly on in-person assistance. The specific focus of the pilot study was used to understand why people sought assistance in mandatory environments.

3.3.2 Extended Study

An extended study was conducted with a larger group of individuals Australia-wide, using a more focused data collection approach. With permission from the ATO, specifically the Service Delivery and the Human Resources Areas, 11 staff members were recruited nationwide. These staff members collected data in survey form after every call taken in their call centre rotation (as part of their graduate program), over a four week period in July 2018. As part of this process the staff were asked to not deviate from the script provided by the ATO and to provide as much detail as possible. The data was collected and entered at the end of each call into a Microsoft Access form and the data stored within Microsoft Excel spreadsheets, collated at the end of each day and saved to a protected drive. At the end of the four-week period 4,744 calls were taken, with 3,990 valid identifiers. Client identifiers were taken to obtain post-call data – after three months the researcher checked to see if they had either contacted the ATO again to seek additional assistance or resolved the issue successfully. All data was stored and analysed within the ATO buildings and on their networks, to maintain the highest possible data security.

A survey was developed to undertake a low impact examination of a representative sample of call centre taxpayers during July 2018 to identifying patterns and trends within the self-preparing individual taxpaying population. The survey was based on the experience and observed results from the pilot study; the pilot identified a number of patterns (outlined in Paper 2), particularly with regard to the broad range of taxpayers requiring assistance for different parts of the tax return process. Figure 26 provides a blank copy of the survey instrument filled in by call centre staff. An additional question was added later, which asked call centre staff to record the emotional response of the client; however, this was limited to only callers who stated an emotion (e.g., happy, unhappy, angry) at either the beginning or end of the call, or both if relevant. To ensure the call centre staff understood the purpose, their role and the importance of collecting the data properly, the researcher ran a training session. The managers of the staff were aware of the importance of allowing time to complete the survey instrument and the output was checked by an ATO data analyst (independent to the researcher) at the end of each day to ensure consistency across data collection.

Client No:	Age: U18 <input type="checkbox"/> 18-24 <input type="checkbox"/> 25-29 <input type="checkbox"/> 30-34 <input type="checkbox"/> 35-39 <input type="checkbox"/> 40-44 <input type="checkbox"/> 45-49 <input type="checkbox"/> 50-54 <input type="checkbox"/> 55-59 <input type="checkbox"/> 60-64 <input type="checkbox"/> 65+ <input type="checkbox"/>	Why did they call: Personal Details <input type="checkbox"/> How do I lodge? <input type="checkbox"/> Linking code? <input type="checkbox"/> Access lodgement page <input type="checkbox"/> What is income? <input type="checkbox"/> Deductions? <input type="checkbox"/> Prefill? <input type="checkbox"/> Medicare levy? <input type="checkbox"/> Offsets <input type="checkbox"/> Previous years returns <input type="checkbox"/> Years: _____	Tax position <input type="checkbox"/> How long till refund? <input type="checkbox"/> How do I pay debt? <input type="checkbox"/> Record Keeping? <input type="checkbox"/> TFN application <input type="checkbox"/> What's my TFN? <input type="checkbox"/> ABN application? <input type="checkbox"/> GST? <input type="checkbox"/> Other <input type="checkbox"/> _____ _____ _____
Gender: M <input type="checkbox"/> F <input type="checkbox"/>			
ESL Y <input type="checkbox"/> N <input type="checkbox"/>			
Comments:			Paper forms <input type="checkbox"/> Why did they want paper?

Figure 26. Survey Used by Call Centre Staff

During the data collection, the call centre staff also collected the client identifier of the caller. This was linked to the call details and client file, to obtain the demographic information

and post-call outcomes. Once the demographic data was linked, all Tax File Numbers (TFN) were removed from the survey response data. Demographic information collected included:

- Gender
- Age
- First year registered with the ATO
- Occupation based on ANZSIC code
- Salary and wages income range
- Location at the State and post code level
- If and how they lodged their tax return.
- Current and previous returns (2 years)
- Income range and type

This data was obtained from a data analyst outside of the research process, who developed unique ID numbers for each caller, removed all identifiers and provided an anonymised dataset. The data analyst linked the results from the survey instrument to the clients' details to provide a full picture. The researcher was not involved in the data collection or the de-identification process to ensure complete anonymity of callers and to minimise potential bias.

Additionally, data was obtained from all call centre operatives during this period; however, they were not subject to using the survey instrument. Therefore the data collected fit within a slightly different format, whereby the reason for the call and assistance-seeking was already categorised into themes, and the details of the call were outlined in notes which, through the use of text mining, yielded similar results and data as the survey instruments. This produced a total of 246,228 participants (or 242,238 additional participants). This process served to validate the consistency of the emergent themes characterising each individual's views and concerns.

3.3.3. Focus Group

The verification and validation of the governance framework proposed within this research was conducted in two parts, firstly through obtaining peer-reviewed feedback from the system of systems engineering conference, which triggered additional data collection. The feedback

from the peer review demonstrated positive responses in both aspects of the developed governance framework: the design and its application.

To conduct additional validation and verification, 4 focus groups were conducted, with a total of 42 active participants. The first focus group had 11 participants, the second had 12 participants, the third had 10 participants, and the fourth had 9. The 42 participants were individuals who had been part of a digital transformation process in the last 12 months and were in a position to explain the process they underwent. For validation purposes the focus groups were conducted two weeks apart. To fit within the Human Research Ethics requirements, all participants were employees of the Australian Public Sector, with the majority employed or contracted by the ATO. The validation and verification process focused on ensuring the value, validity and completeness of the governance framework and its guidelines for application. The focus groups were run online through Webex. Two forms of documentation were sought. Firstly, discussions with participants were recorded by an independent third party, secondly, participants completed a survey during the focus group, to ensure everyone was able to respond to the questions and provide feedback, both positive and negative.

The focus group started with the researcher explaining the purpose of the research in general, without mentioning a potential governance framework. After the opening questions, the governance framework and guidelines for application were outlined. The questions asked of participants are outlined in Table 24.

Whilst conducting the focus groups and concluding the research, the ATO was impacted by Covid-19. This shifted the focus of the organisation which had to move towards a help and support model, a process which included moving staff to areas of demand and which made it difficult to conduct further focus groups or administer surveys to obtain additional feedback. However, as focus groups are validated by a sample size of approximately 13 participants under the qualitative research approach umbrella, the total of 42 participants who contributed to this research is considered sufficient to evaluate the governance framework and its guidelines for application.

Table 24. Focus Group Questions for Validation and Verification of Governance Framework and Guidelines for Application

<p>Opening questions</p>	<ul style="list-style-type: none"> - Experience with digital transformation? - What industry do you work in? - In your organisation, is there a step-by-step decision-making guide that you utilise in your digital transformation endeavours? - Is it a formalised approach? <ul style="list-style-type: none"> o Is it based on intuition? - What are the limitations of your current approach? - Do you need an approach to support your digital transformation process? <ul style="list-style-type: none"> o Why/ why not? - In your opinion, will a standardised approach help you and your organisation be more effective in managing digital transformation?
<p>Framework and Approach questions</p>	<ul style="list-style-type: none"> - How strongly do you agree that this framework and approach is complete? - What would you add? - Are there any stakeholders not taken into consideration? - What questions would you add to the approach? - Is the framework set out clearly? - Do the questions within the approach cover the entire set of questions that are needed to completely understand each and every constituent system? - In your opinion, are the constituent systems outlined within the framework consistent with elements that should be considered when undergoing digital transformation?
<p>Closing questions</p>	<ul style="list-style-type: none"> - In your opinion, can you see that the approach and framework suggested within this research will be useful? Please explain your response. - This final question is open, please include any additional comments or thoughts you may have on the digital transformation process and digital transformation generally.

The results of the focus group were analysed through a thematic analysis for the qualitative results component of the session, and the quantitative data was analysed through summary statistics (i.e., yes and no questions). The thematic analysis was conducted using the methods outlined above. Appendix 4 outlines the questions asked in the focus groups. The results of the validation are reported in Chapter 4.

3.4 Qualitative Analysis

3.4.1 Conceptualisation – Identification of the Problem Space

As a result of an extensive literature review, numerous key elements of the environment surrounding the users and designers of mandatory digital services were identified in Chapter 2. These elements related to the use of these services and factors specific to the individuals and environment. This literature review included identifying and understanding research on different system research, including digital (Wu and Chang 2007), business (Peltoniemi and Vuori 2004; Heikkila and Kuivaniemi 2012), technology (Wareham, Fox and Giner 2014), and innovation systems (Nambisan and Baron 2012; Autio and Thomas 2014). The different systems were analysed and broken into their constituent parts to understand the various systems within the system, and then to understand their broader structure. This process included identifying numerous internal and external components, within and outside the control of different organisations; the analysis was then related and applied back to the public sector environment case study: the ATO.

Additionally, a focus group was conducted with six Australian Public Sector Staff (ATO) in leadership roles. In this session the participants were shown a copy of the figure and asked to outline whether or not they believed all of the factors within the system were relevant, and to identify if there were any key points missing. The focus group ran for sixty minutes and the participants were not compensated for their time. Information was recorded in writing only (i.e., no visual or audio recording), at the request of some of the participants. Two separate scribes documented key words and phrases and only two questions were posed to the group: question 1 was used to determine whether or not factors outlined within the system were relevant, and question 2 sought to identify if there were any specific points missing. The transcripts were analysed through a simple thematic analysis, coding for key words and phrases used consistently. These codes were then aggregated into themes which were used to guide the ongoing creation of the conceptual model.

The triangulated systems approach was applied to understand the themes emerging from the focus groups and their relationship to the literature review. Systems approach was deemed appropriate as it is often used to improve the quality of the perceptions and functions of the

whole system, the parts and the interactions between and within the various levels (Von Bertalanffy 1959). This approach involved the application of the SSM to understand the different components and interactions, as earlier described in the chapter. Specifically, how they could be mapped in a rich picture diagram, while highlighting the various links between the different elements and systems. A rich picture diagram is used to draw a situation which highlights the key elements and relationships that need to be considered in the various interventions or to inform the direction of the research (Avison, Golder and Shah 1992; Berg and Pooley 2013; Checkland 2000; Lewis 1992). The rich picture is used to understand and learn about poorly defined problems; in this research it was used to record the different elements of the given situation (Avison et al 1992).

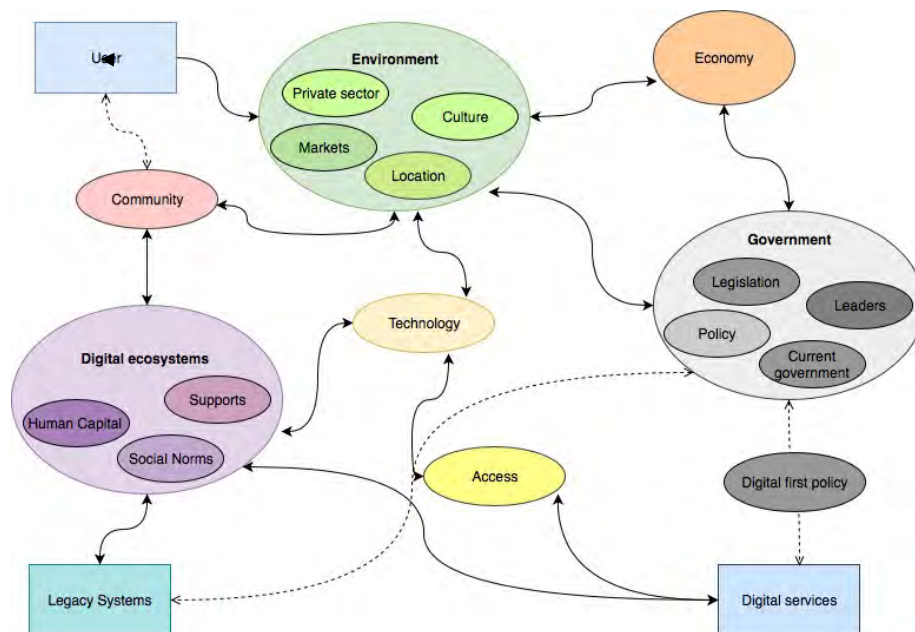


Figure 27. Rich Picture of the Systems Impacting the Use of Mandatory Digital Services

Figure 27 outlines the factors which impact the adoption of mandatory digital services. The creation of the rich picture was used to guide understanding of the problem space. This was useful in building the conceptual model to identify the systems considered critical for digital service designers and policymakers, and can be used to ensure the creation of inclusive and effective digital services. This also guided the steps required to build a multidimensional stakeholder analysis technique.

The use of solid lines within the rich picture were used to demonstrate a strong association to the existing literature and responses from focus groups, indicating clear and direct reporting or association between the systems/themes. Whereas the dashed lines were used to indicate relationships between systems/themes that were briefly touched on but which were more fluid or unclear. The dashed lines indicated an uncertain relationship. All of the lines (dashed and solid) have a two-way arrow to demonstrate how the systems/themes interact with one another. These relationships are not unidirectional, the arrows only capture at a high level the connections between the systems. Through the conceptualisation phase the problem space became clear, specifically that without a governance framework outlining the constituent systems impacting digital transformations, it is difficult for those transformations to be effective.

3.4.2 Multidimensional Stakeholder Analysis

The multidimensional stakeholder analysis technique was developed to assist in understanding the multiple stakeholders who could be affected or impacted by the implementation of public sector digital services from different angles. The multidimensional stakeholder analysis was developed as a result of the extensive literature review on stakeholder theory and analysis. The purpose of a multidimensional analysis is to outline the complexities within and across stakeholder groups, which can be achieved by applying numerous stakeholder analysis techniques in parallel to compare the specific stakeholder characteristics. This provides the researcher with a multidimensional lens through which they can view their stakeholders more holistically. This is particularly useful in a complex operating environment such as the ATO. The proposed multidimensional stakeholder analysis was shown in Paper 1.

Table 25 outlines the key questions that stakeholder identification and analysis should answer to provide a clear understanding of the different stakeholders, their role and impact on both the organisation and the project. The results are outlined in Figure 28.

Table 25. Multidimensional Stakeholder Analysis Questions

Questions	
What is their role/s in the system?	
Do they have multiple roles? <i>*if yes conduct the analysis based on both roles</i>	Y / N
Power/Influence Model	High/Medium/Low
Do they have power? Do they have interest?	
RACI model	Yes/No
Are they Responsible? Are they Accountable? Should they be consulted? Should they be informed?	
Stakeholder Salience Model	Yes/No
Are they discretionary stakeholders?	
Are they dormant stakeholders?	
Are they demanding stakeholders?	
Are they dominant stakeholders?	
Are they dangerous stakeholders?	
Are they dependent stakeholders?	
Are they definitive stakeholders?	

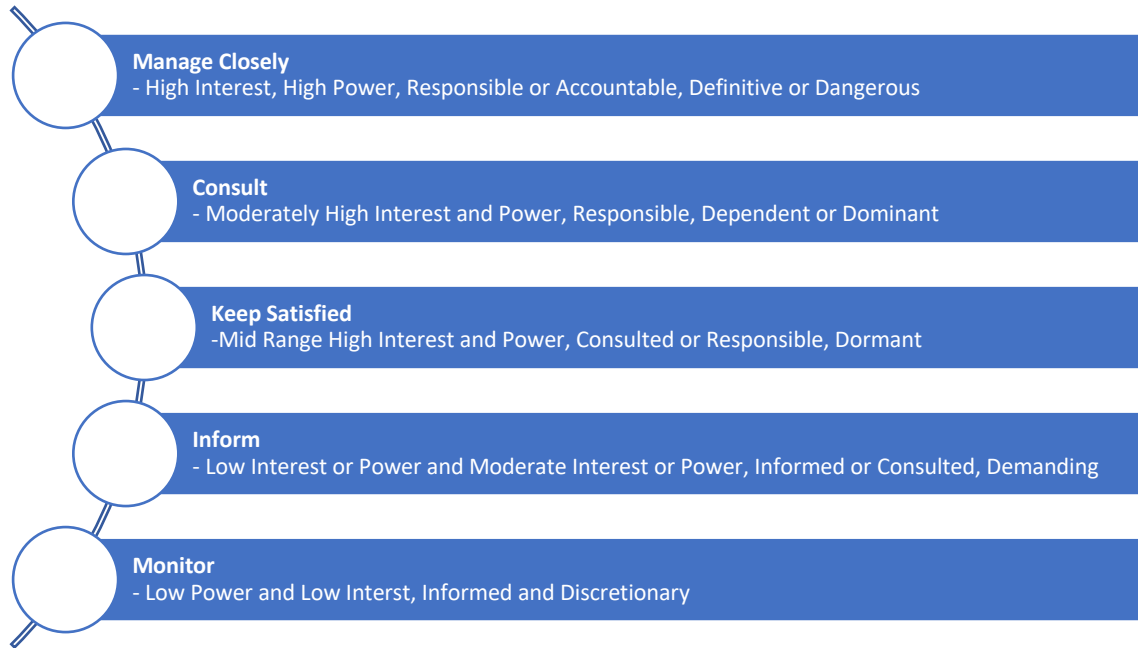


Figure 28. Multidimensional Stakeholder Analysis Outcomes

The multidimensional stakeholder analysis formed a supportive role in this research, used to guide the identification of the various systems impacting the digital transformation system of systems. Specifically relating to the creation of the framework, the multidimensional stakeholder analysis assisted in the identification of the views, roles, goals, concepts, concerns and other factors important to the systems under review and was able to support the understanding of how they relate to the broader digital transformation process (also referred to as system of systems). Furthermore, the structure of the questions posed in the multidimensional stakeholder analysis assisted in identifying the critical systems that are seen to be required in order to develop an effective governance framework for digital transformation in eGovernment.

3.4.3. Gioia Analysis

Gioia’s method for qualitative rigour enables finding structure in unstructured qualitative forms, as it provides an organised approach. Firstly, the Gioia method requires the researcher to step back, categorise the accounts into three different phases (First, Second and Third order). The first order, “Concepts” are the “voice of the user” (also known as “voice of the customer”) (Gioia, Corley and Hamilton 2012; Gioia and Chittipeddi 1991; Gioia 1999). The second order,

“concerns and statements”, takes specific sentences from “participants” and then groups them together to discover the themes and patterns in events and accounts (Gioia, Corley and Hamilton 2012; Gioia and Chittipeddi 1991). These second order “Themes”, that are more generalised underlying explanatory dimensions, test consistency and patterns (Gioia et al 2012; Gioia and Chittipeddi 1991). Finally, the third order, “aggregate dimensions”, reveals the more generic theme encompassing all of the second and first order (Gioia 2012; Gioia and Chittipeddi 1991). Significance was measured through counting occurrences of first, second and third order elements to identify themes and patterns throughout the different accounts. The patterns in the text were then linked by connections, highlighting key features and emergent concepts or themes that require further analysis. The Gioia method in the pilot study was done manually; however, in the main study, text mining and content analysis techniques were applied.

Figure 29 shows the Gioia Analysis results for the pilot study, the results of which have been reported in Paper 2. This paper demonstrates how use of a Gioia analysis was deemed the most appropriate for this pilot study as it provided the avenue for a systemic approach and exploratory analysis assisting the emergent concepts. The Gioia analysis ensured qualitative rigour and transparency in the research process. This included understanding how the first order concepts were used to derive the themes, through clear presentation and ensuring that the process matches the research design.

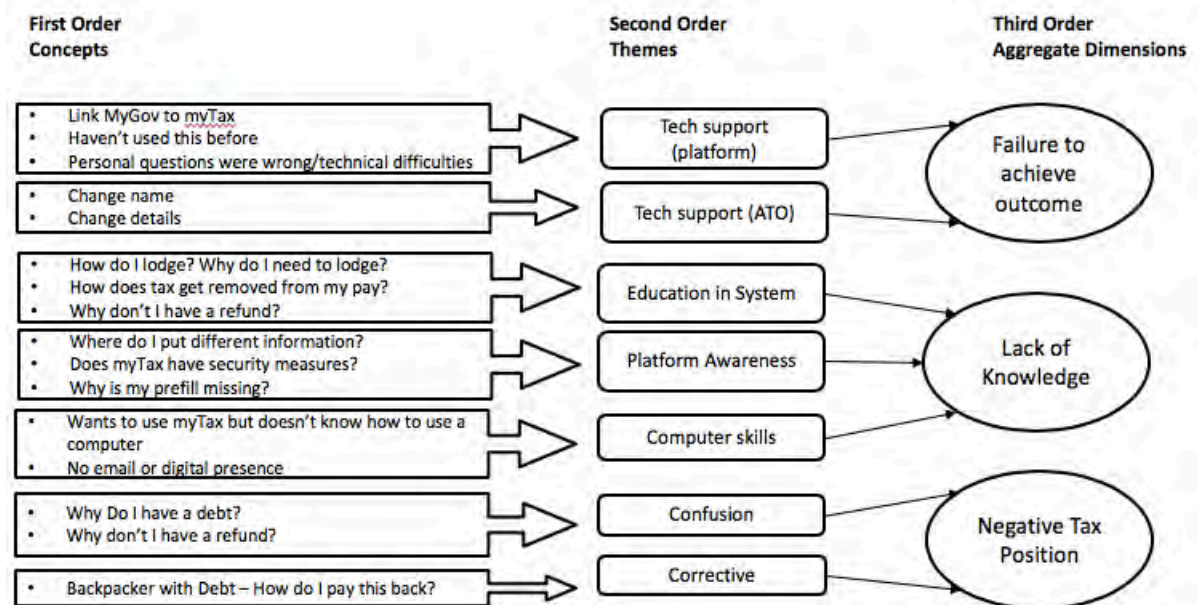


Figure 29. Gioia Analysis Results from the Pilot Study

The themes within this data were obtained through the inductive approach, which allowed the data to determine the most relevant and common themes. This involved using both a semantic approach, which included analysis of the explicit content within the data and following the voice of the user, whilst also incorporating the latent approach, which involves including the subtext and assumptions which are underlying in the data. The first step involved identifying the key phrases (or voice of the user) used frequently across the different clients. The second step involved identifying the themes, which are broader statements than the codes or user voices, where patterns have emerged among the various statements. These themes were then categorised into overarching statements which encapsulated numerous themes and statements from users. The Gioia analysis was undertaken by two separate researchers who conducted the analysis independent of one another. This process was undertaken to ensure that similar results were obtained by two researchers, to provide both credibility and validity. The results of the Gioia analysis was used to guide the development of the survey used in the extended study to identify important constituent systems for digital transformation.

3.4.4 Thematic analysis

For the extended study, the Gioia analysis was conducted through thematic analysis or topic modelling using software. Python statistical software was used to conduct the analysis

and the Natural Language Toolkit (NLTK) package for natural language processing. This toolkit assisted in the analysis and identification of the different themes or topics, which were then grouped together to develop broader categories (Bird, Klein and Loper 2009). Thematic analysis was used as an extension of the Gioia approach used previously, as a manner to validate the process utilising statistical software. When conducting the Gioia method for qualitative rigour (Gioia et al 2012; Gioia and Chittipeddi 1991), the researcher usually categorises the accounts into three separate phases (first, second and third order); however, in this research these steps were conducted out of order.

Using Latent Semantic Analysis (LSA), the third order or “aggregate dimensions”, generic themes and topics were identified by word frequency. LSA is based on the use of a distributional hypothesis, whereby words and expressions occurring within similar parts of text have similar meanings (Landauer, Foltz and Laham 1998). The significance of each of these themes were tested in the following stages of analysis, whereby occurrences were counted to identify themes and patterns throughout the different accounts. The second order, which seeks “concerns and statements”, was completed next. This process identified key sentences or phrases through the use of Latent Dirichlet Allocation (LDA) to understand themes and patterns within the accounts. LDA utilises mathematical probabilities to help define the unknown words that represent a known topic, by mapping the known elements to the unknown elements in a way that provides a probability of a word belonging to a particular topic (Blei, Ng and Jordan 2010). These were used to develop themes which are generalised underlying explanatory dimensions, and which also demonstrate consistencies and patterns within the data (Gioia et al 2012; Gioia and Chittipeddi 1991). Finally, the first order “concepts”, or “voice of the user” were identified, through Jaccards Text Similarity Metrics. Jaccard’s similarity metric calculated the similarity between two sentences by determining the size of the intersection by the size of the union of two sets, thus identifying the number of common words between sentences and providing a numeric output (Ritter, Etzioni and Etzioni 2010). This identification process was simplified by applying the information obtained in the LSA and LDA processes. The patterns in the text were linked together by hand to identify connections, highlight key features and the emergent concepts or themes not picked up by the analysis. The results of the thematic analysis in the extended study were reported in Paper 4, and outlined here in Figure 30.

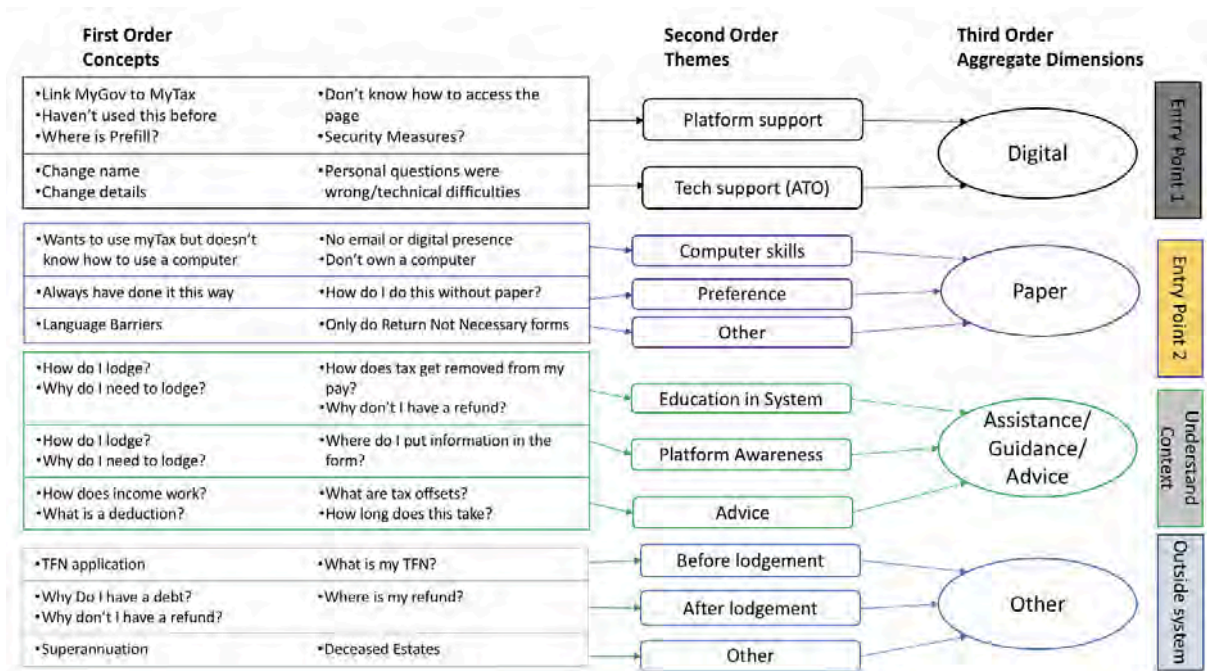


Figure 30. Results of Thematic Analysis for Extended Study

The results of the thematic analysis, combined with the summary and descriptive statistics, provided the baseline for creating a governance framework and guidelines for application for managing effective digital transformation, specifically as it relates to ensuring digital adoption. Through the text mining and Gioia techniques for thematic analysis, the data demonstrates some key systems requiring consideration within the digital transformation space, especially regarding its effective use. These techniques were used in the exploratory approach applied to this research, to guide the identification of the important constituent systems affecting the digital transformation and system as a whole.

3.5 Quantitative Analysis

The quantitative data analysis was conducted as part of the case study, in response to an ATO request. A rigorous analysis was undertaken on the extended study dataset to address the other quadrants of the conceptual model (outlined in Paper 1), and to address both the identified research gaps and the research argument discussed previously. The primary focus of the

extended study analysis was to understand within the case study what type of individual sought assistance when lodging their annual income tax returns as outlined in Figure 31.

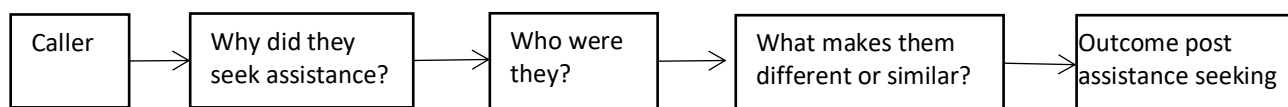


Figure 31. Primary Research Questions

3.5.1 Descriptive Statistics

The first stage of the data analysis involved profiling who the call centre clients were in the study. This involved exploring the data with R statistical software and Microsoft Excel to build profiles of the different segments of the population and to determine which groups individuals fit within, and the characteristics between them including:

- (1) Who are current digital service users,
- (2) Who are those who have shifted from non-digital service users to digital,
- (3) Who are the non-digital service users.

Descriptive statistics was used to understand the different relationships between variables within the population. Upon completion the call centre population profiling, an additional analysis on the general taxpaying population was conducted to determine (using linear regression) if there were generalised characteristics specific to each group. The quantitative approach was used to explore the demographic information and provide summary statistics to better understand the different factors impacting the different age groups and genders. The summary statistics were completed in Microsoft Excel, using percentages, means and medians to provide a picture of the different age groups. Age groups were defined as per the ATO standard age groups. The descriptive statistics were used to understand the population under review and determine the potential generalisability of the results.

The results of the descriptive statistics were outlined in Paper 3.

3.5.2 Quasi-Randomised Control Trial

In addition to the collection of the assistance-seeking data, a quasi-randomised control trial (QRCT) was conducted. Within a QRCT, participants are allocated to different arms of the trial (either treatment or control groups), through an allocation method that is not truly random. The QRCT differs from a regular RCT, as the sample sizes are not predefined prior to conducting the trial and the individuals who are involved in the trial are allocated randomly to the control and treatment groups (Gribbons and Herman 1997). Due to random allocation in both groups, this trial is deemed to be equivalent to an RCT, however due to the lack of control of sample sizes it is being labelled as a QRCT (Gribbons and Herman 1997). For this trial, individuals were allocated to the treatment group if their call was answered by the 11 staff fielding calls as part of their call centre rotation, and all other callers were allocated to the control group. The two groups were then followed up to see if there were differences or similarities between the outcomes for the treatment and control groups. The results of the QRCT were tested to assess the effectiveness of the intervention, specifically seeking to understand whether the treatment was providing benefits or not to both the organisation and the clients. The QRCT was run in an experimental environment; however, it was not as controlled as a pure RCT study normally would be.

Figure 32 outlines the setup of the QRCT in this case. The results of the QRCT were outlined in Paper 4.

The trial was conducted over the same four-week period in July 2018. The trial sought to provide non-digital lodgers with information about the availability of digital services and compare the behaviours to non-digital lodgers who were not informed of the digital services. Within this trial, the treatment group were comprised of callers who sought paper tax return forms and had lodged the three previous tax returns via paper. They were informed of the digital lodgement offering, provided guidance and support to obtain and complete their lodgement digitally, and offered additional support (through tax help volunteers if needed). The control group was comprised of callers who met the same characteristics; however, the call centre operatives were asked not to talk clients through the digital service offering. The purpose of conducting the QRCT was initially in response to an ATO request to understand the role of behavioural messaging in changing the behaviour of non-digital service users. However,

the study provided some insights into the broader picture, including solidifying the researcher's understanding with regard to the role of assistance-seeking and how assistance is provided, the importance of addressing the potential skills gap, and how important maintaining legacy systems are to some users.

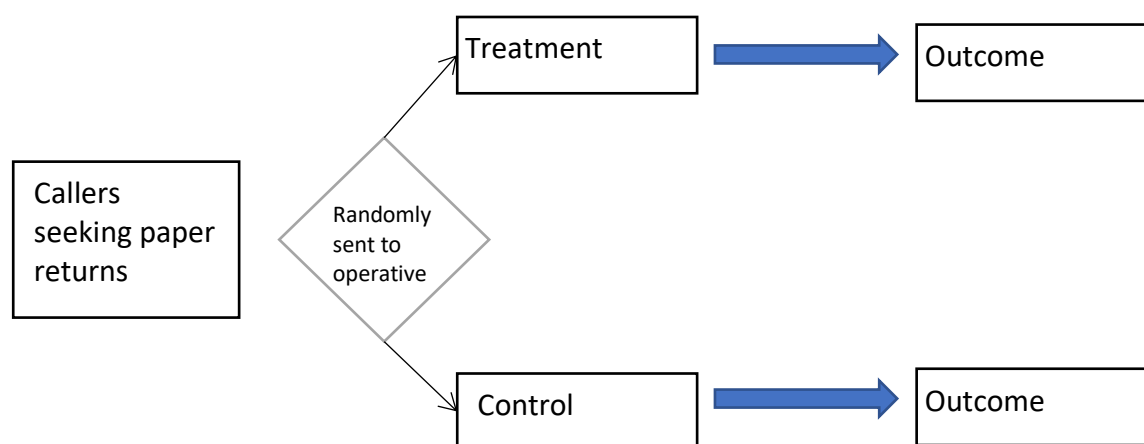


Figure 32. Quasi-Randomised Control Trial Set-Up

The QRCT was used to understand various behavioural drivers in the ATO, and the results were used to understand the role of assistance provision in changing behaviours and how that impacts cognitive systems.

3.5.3. Logistic and Linear Regression

A linear regression determines whether there is a correlation between the independent and dependent variables through a linear relationship. Linear regression uses a continuous dependent variable and independent variables which can be either continuous or discrete (Yan 2009). Applying the line of best fit demonstrates if there is a straight-line linear regression relationship between the dependent variable and one or more independent variables. This is used to demonstrate if a linear relationship exists between the independent and dependent variables. The results of the regression were shown in Paper 5.

To run the linear regression, the Stats library in R was used. A graphic analysis was conducted using the different graphs to visualise the potential relationships between variables in the dataset. Firstly, a scatter plot (scatter.smooth function) helped visualise the linear

relationships between the dependent and independent variables. Secondly, a boxplot (boxplot function) was built to identify potential outliers which can affect the direction and slope of the line of best fit. Thirdly, a density plot helped visualise the distribution of the independent variable, with the ideal state being a bell-shaped curve or normal distribution. After building the graphical analysis, the correlation was measured to identify the level of linear dependence between the two variables under observation. A linear model was built, based on the results of the correlation, with a score close to 0 indicating a weak relationship, close to 1 indicating a positive strong relationship, and close to -1 a negative strong relationship. Using the `lm` function, the linear model was developed. The p value was calculated to check for statistical significance.

The results of the randomised control trial were assessed using binomial and multinomial logistic regression to determine if the behaviours could be predicted based on specific characteristics of the two groups. A logistic regression uses a dependent variable which is represented in binary form (0 or 1, yes or no), indicating that the outcome can be either one or the other (this is a binomial logistic regression) (Wiesberg 2005). A multinomial regression has more than two discrete outcomes. Logistic regression is used to model and predict the probabilities of different outcomes of the dependent variable based on independent variables (Wiesberg 2005). The logistic regression was used to test the predictability of the QRCT results, specifically the outcomes were 1 = shifted to digital services, 0 = did not shift. Whereas a multinomial logistic regression was used to see if the reasons why an individual sought assistance could be predicted based on their characteristics, the outcomes were 1 = digital, 2 = publication and 3 = advice generally.

The first stage of conducting the logistic regression process was cleaning the data, which required identifying and accounting for missing or corrupted data. To check for missing data the `SAPPLY` function was used on every column in the data set. Using the `Amelia` library, a `missmap` was developed to visualise the missing versus observed values. The columns with the missing values were identified, and manual checking and addition of data was completed. The second stage required changing the format of the data to factors (e.g., male or female, age groups). The third stage involved splitting the data into a training set and testing set which was 75% and 25%. Using the `glm` function (for the binomial) and the `ml` function (for multinomial), the model was built and tested through iterations. The model was assessed by the results of an

Anova (using the anova function) and odds ratios (odds.ratio function). When an appropriate model was denied, the model's accuracy was tested using the test set and the predict function, this output the level of accuracy.

The use of logistic and linear regressions formed part of the results requested from the ATO to understand the results of the QRCT. As mentioned above, these had an impact on the researcher's understanding of the results more broadly.

3.5.4 K Means Clustering

K means clustering is an unsupervised learning algorithm which is used to cluster data based on levels of similarity (Forgy 1965; Hartigan and Wong 1979). Unsupervised learning is used when there is no outcome for prediction; instead, the task is to find patterns within the data (Hammerly and Drake 2015). K means clustering requires identifying the number of clusters that the data should be grouped into, with the algorithm randomly assigning each individual observation to a cluster to find the centroid of a cluster, with iterations occurring to reassign data to the cluster most suited and to calculate the new centroid of a cluster (Forgy 1965; Hartigan and Wong 1979). The K means clustering was used to understand the different clusters of the non-digital service user population to identify if there were specific characteristics of the population and into which groups they could be categorised. K means was also used to identify the groups between the total assistance-seeking population to understand if individuals seeking specific types of assistance could be grouped into clusters (this was unsuccessful at yielding useable results).

The first stage of K means clustering was to use the ggplot2 library to build a scatterplot of the different characteristics and identify similar groupings. The second stage involved modelling, specifying the nstart value (20 was selected). This tells the algorithm to try 20 different random starting assignments and select the one with the lowest cluster variation (this was done using the kmeans function). The model was also told to select three clusters (as the exploratory analysis demonstrated three distinct groups). The third stage included plotting the clusters into a scatterplot to visualise them and compare back to the first scatter plot. The use and results of the K-means were requested by the ATO, to understand the non-digital service users. A report was built specifically outlining the results (see Appendix 1).

3.6 Governance Framework for Effective Digital Transformation and Guidelines for Application – Development and Application

Through the data collection and analysis supported by the triangulated systems approach, the governance framework and guidelines for application were developed. A shortened version explaining the process was outlined in Paper 6. The starting point was the use of SSM to expand the CATWOE analysis and root definition. After the results of the previous research stages were known, the root definition changed to address the gap identified within the research, specifically that there was no framework or guidelines to support digital transformation. The new root definition is:

A decision-making framework build for policymakers, digital service designers and engineers to increase the effectiveness of public sector digital transformation to guide design, planning and building mandatory digital services that account for the different multidimensional levels of integrated and autonomous constituents within the complex system.

As a result, the CATWOE analysis was also updated in Table 26 to highlight how the research aims had adapted over time to specifically look at the outcomes of the digital transformation process, instead of the individual services provided.

Table 26. CATWOE Analysis

Customers	Public Sector Service Users The interest is in the provision of tailored services, as current services do not take all of the systems influencing their use of services into consideration.
	Public Sector Service Providers The increased use of digital services is the objective, as well as providing more effective digital services.
Actors	Support persons, avenues for participation (digital vs non digital services).
Transformation (purpose)	Digitalisation/digital services.
Worldview	The shift from legacy to digital services in mandatory spaces needs to incorporate all levels of obstruction influencing service users. Taking into account the multiple layers of obstruction/various systems affecting service users will benefit service designers, policymakers and engineers.

Owner	Australian public sector.	
Environmental constraints (3 E's)	Government, legislation, regulation and parliament.	
	Efficacy	Centralisation.
	Efficiency	Minimising customer time and cost. How easy is it for the user to use and access?
	Effectiveness	Training/degree of engagement or information sharing. How much support do the users require to use the system? Do the users understand the system?
Purpose (P)	Provide a framework for digital services designers in mandatory space that are informed by understanding all levels of obstruction influencing users. Increase digital service adoption by providing more effective services	
How (Q)	Provide a framework that outlines all of the levels of obstruction impacting users in a clear manner.	
Why (W)	To ensure that all users are understood, what influences them is considered and the most effective and efficient services are provided in the mandatory service space. Legislation (Digital Continuity Policy 2020). Requiring public sector to shift to a digital platform and requiring public sector service users to use digital systems (mandatory system).	

3.6.1 Governance Framework for Effective Digital Transformation of eGovernment

In order to address the CATWOE and root definition, system of systems methods were applied to provide tools for building structure into the constituent systems within the digital transformation system of systems. Vertical integration and holarchy principles were adopted to provide structure. In identifying the various consistent systems through an exploratory approach, a framework emerged. This framework was further developed as a result of the pilot and extended qualitative and quantitative results, exploring the various reasons individuals used digital services assistance or support. This includes the results from the ongoing literature review. The primary constituent systems are outlined in Figure 33. Digital Service Provision Systems of Systems as Identified from Research Results

The results of the thematic and Gioia analysis were used to identify the constituent systems used within the governance framework. Further data analysis was conducted on top of the original thematic analysis, by searching for keywords and counting occurrences which were grouped together in the constituent systems literature and found common within the results. Counts of the themes were outlined after Paper 5. The results of the thematic analysis identified four key constituent systems (cognitive, business, infrastructure and digital). Two other systems were identified separately. Firstly, the social system was identified based on ATO and industry research. The social system was not directly reflected in the thematic analysis, social norms and community perceptions emerged in the data however were not clearly stated. Secondly, the policy system was deemed vital to include outside of the results of the analysis, as policy and legislation forms the basis for the transformation of government services from legacy to digital.

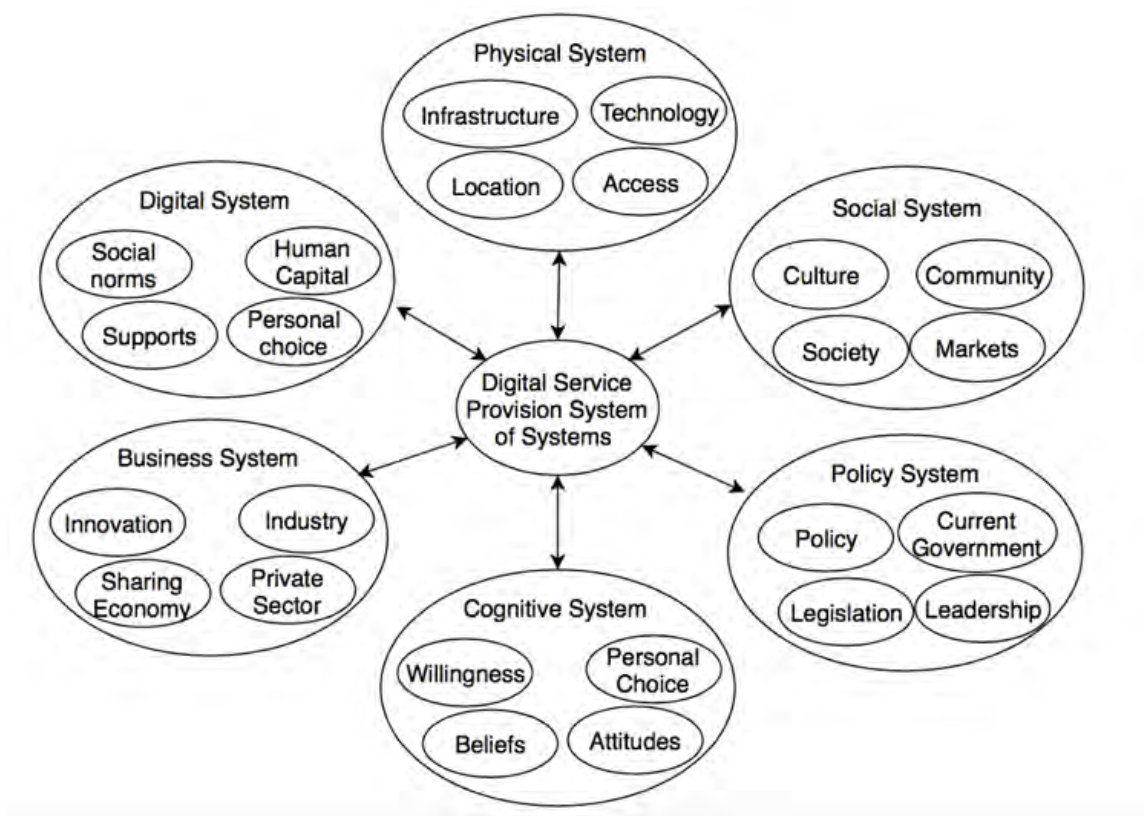


Figure 33. Digital Service Provision Systems of Systems as Identified from Research Results

Figure 33 outlines the most influential constituent systems impacting digital service provision in the public sector. These were identified through a number of forums. Firstly, the

role of the physical, digital and cognitive systems was outlined within the results of this research, with the majority of individuals seeking assistance for one of the components within the constituent systems. The implications of the social system are well documented within the public sector, as outlined in the literature review, especially the impacts of culture and community of individuals' behaviour or behavioural change. The primary driver of the digital transformation process in public sector digital services (or shift to eGovernment) has been due to policy and legislation changes, highlighting the importance of understanding the policy system in digital transformations in the public sector. Finally, businesses of all shapes and sizes form a large component of the economy, not only for commercial products and services but also as employers. The multiple roles of individuals participating in the digital service provision in the public sector space is an important factor to consider when addressing the influential systems. The identified systems are the most important to this research, however additional external factors could be explored or be influential in different cases.

By understanding the various constituent systems and the system of system as a whole, a systemic and more holistic picture of the systems affecting digital transformation and the resulting digital adoption emerges. For this research, a system is defined as a collection of interrelated elements, including relationships and interactions which are often the result of emergence (Backlund 2000; Baldwin and Sauser 2009; Fisher 2006). Furthermore, the definition of emergence in this research is the result of the cumulative actions and interactions of the multiple constituent systems within the system of systems, involving both understanding and supervising emergent behaviour affecting the success of the system of system (Fisher 2006). The use of constituent systems allows for emergent properties to appear which is more representative of the problem space. For this research, a system of systems is defined as a set of systems which contribute to each process in which they interact, creating a system that none of the constituent systems can achieve on its own (Baldwin and Sauser 2009). The identified systems are not all inclusive, there are a number of external factors which should be considered as having an impact on the efficiency and efficacy of digital transformation in the public sector.

The next stage was to build an easy to understand and adopt representation of the constituent systems which influence digital transformation processes in the public sector in a vertical and layered approach provides a separate view of each system. Vertical integration is an arrangement often of a supply chain, within a company which is owned by that specific

company (Kathryn 1986; Grossman and Hart 1986). Within vertical integration, each member of the supply chain is responsible for producing different elements or components of a product or service, and the combination of the elements are used to satisfy a common goal or need (Kathryn 1986; Grossman and Hart 1986). Vertical integration represents the systems interacting vertically with arrows pointing in the direction in which the system or component has impact on the broader system (Kathryn 1986). However, with balanced vertical integration, the arrows move in both directions and are able to skip levels, and the interactions can go in any direction (Rothaermel, Hitt and Jobe 2006). The balanced vertical integration approach was applied to the presentation of this framework, as it provides a vertical visualisation and does not limit the interactions between constituent systems in either direction. Similar to vertical integration, the constituent systems are independent and autonomous. Also, similar to vertical integration, when a constituent system chooses to be part of the system of system, they give up a portion of their autonomy to join and move towards a common goal or purpose.

Digital transformation is most effective when there are adequate incentives for each constituent system to join the system of systems. It should be noted that the whole system of system is greater than the sum of its parts as a result of integration of system interactions within and between one another. This is a paradox as, through the participation in the system of systems, the constituent systems are both collaborating and competing with one another in order to develop and work together for a unified system of system direction. Therefore, the autonomous constituent systems with separate goals and purposes integrate as part of a system of systems to achieve the common goal. Therefore, the representation of the framework shown in Figure 34, demonstrates how each constituent system changes how the entire system of system operates. The representation also demonstrates how they remain independent simultaneously, achieving the shared goal of bringing about effective digital transformation.

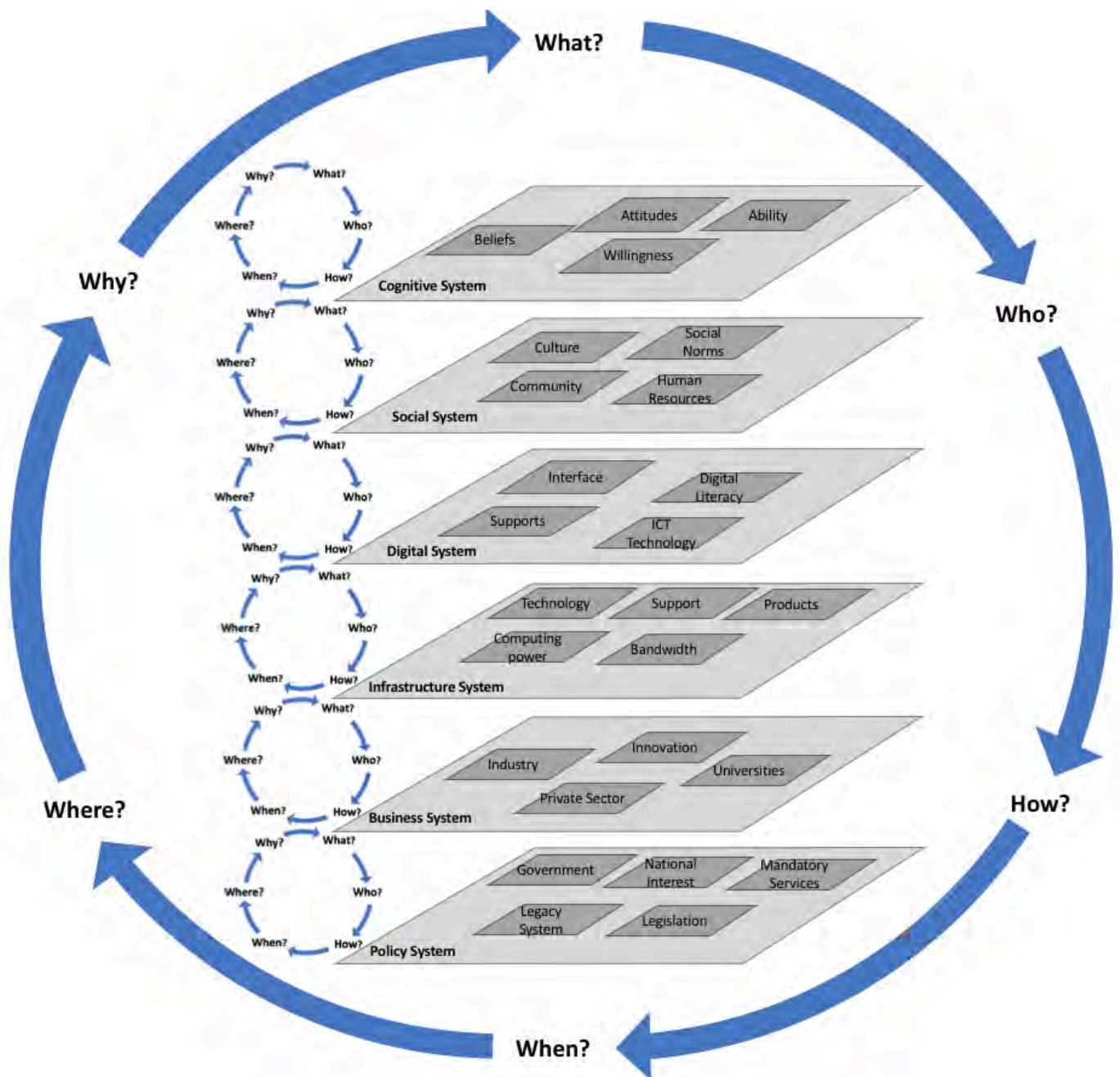


Figure 34. Governance Framework for Effective Digital Transformation

3.6.2. Guidelines for the Application of the Governance Framework for Effective Digital Transformation

As outlined in Table 27, the Guidelines for the Application of the Framework for Effective Digital Transformation (hereby referred to as guidelines for application), is comprised of six key questions used to guide the identification of the key components within the constituent system and system of systems. These six questions are based on Zachman's EA Framework

and the five Ws and H of systems theory (as discussed in Chapter 2). The questions outlined in Table 27 summarise the purpose of each of the primary questions within the guidelines for application, providing guidance on the purpose of each of the sub-questions within the constituent systems and system of systems. The process of answering these questions assists in gaining a more comprehensive understanding of the dynamics within the system of systems, thus recognising the multiple needs and beliefs of the involved stakeholders.

Table 27. Description of Key Questions of the Guidelines for Application

Questions	Purpose
What?	These questions highlight the approach and purpose of each constituent system and how they relate to different measures of success, specifically related to the constituent systems and the system of systems under review.
Who?	These questions outline the various actors involved, specifically the decision-makers, users and service designers and how they relate to the constituent system and the system of systems under review.
How?	These questions summarise by what means the performance will be measured and actors will be identified and engaged in each constituent system and the System of Systems under review.
When?	These questions highlight at what time performance reviews will occur and how feedback provisions will improve the approach, and how they relate to the constituent system and the system of systems under review.
Where?	These questions determine the boundaries of the constituent system and system of systems under review and where the approach will be located, and how that relates to the specific constituent system and the system of systems under review.
Why?	These questions outline the motivation behind the approach being applied and how it relates to the specific constituent system and the system of systems under review.

Figure 35 outlines the guidelines for applying the governance framework. Each question guides the service designer and policymakers' consideration of the diverse views and stakeholders who are relevant to the transformation in their various ways. The simplicity of Zachman's framework was used to guide the development of guidelines to respond to the system of system framework. The remainder of the questions were derived from the thematic analysis. The questions are linked to how assistance-seeking issues were discussed. This provides a holistic view linked to the system of systems and the constituent systems. The

research has provided a clear outline for questions that need to be addressed as part of evaluation of the systems impacting the digital transformation. The application of the Governance Framework for Effective Digital Transformation in eGovernment is shown in Chapter 4.

What?	How?	When?	Who?	Where?	Why?
What is the purpose of the system?	How external factors might affect the system?	When do reviews occur?	Who are the stakeholders in this system?	Where in the system is the feedback coming from?	Why is this approach meaningful to stakeholders?
What are the areas in the system that need development?	How well can the approach perform in this system?	When is feedback provided?	Who are the decision makers in the system?	Where are the boundaries of the system?	Why this approach was chosen?
What is the approach?	How is feedback provided?	When is feedback received?	Who is responsible for providing support?	Where are the constituent systems within their respective lifecycles?	
What are the known constraints/risks?	How are the needs being met?	When is change documented?	Who manages risks in this system?	Where are the interfaces between systems?	
What's the role of people?	How management constraints are taken into consideration?	When is system intervention most effective?	Who will use the system?		
What's the role of technology?	How do constituent systems interact with each other?	When interactions between constituent systems occur?	Who defines success measures in this system?		
What are the characteristics of an acceptable solution?	How is emergent behavior documented and observed?	When are legacy components considered?			
What are the measures of success in the system?	How are risks addressed within this system?				
What are the incentives for the constituent systems to belong to the SoS?					

Figure 35. Guidelines for the Application of the Governance Framework for Effective Digital Transformation in eGovernment

3.7 Summary

The application of the combined qualitative and quantitative methods provided an in-depth analysis of the complexities of the problem, which was then used to develop the basis of the framework. The application of the triangulated systems approach assisted with identifying the constituent systems considered critical to the development of the effective governance framework, which is required for stakeholders' engagement in digital transformation in the eGovernment field. Paper 6 described the development process as well as the application of the governance framework. A comprehensive application of the governance framework applied to the case study will be outlined in Chapter 4. The methodology, the research design and the application of the various approaches were used to develop a holistic view of the relevant systems affecting digital transformation. The application of the various results was critical for developing the proposed governance framework to identify the relevant systems, including an assessment of their roles and interactions relating to effective digital transformation.

Chapter 4. Results

4.1 Application of Governance Framework for Effective Digital Transformation in eGovernment through Guidelines

The application of the framework outlines ATO responses to the questions within the governance framework, responding for each constituent system (level) as well as the system of system. The focus is on the impacts of digital transformation relating to the creation of digital services in response to tax legislation (primarily the lodgement of tax returns). Although primarily focused on the individuals within the system, businesses are also taken into consideration as they are also taxpayers. Table 28 outlines the summary of the responses for the 6 primary questions highlighting the response at an overarching level. The application of the governance framework in the ATO case study is outlined in Table 29.

Table 28. Summary responses to the Six Key Questions in the Guidelines for Application

	Responses related to Digital Services
What?	The creation of digital services to meet the expectations of the users, make transactions easier and quicker for the users and the government agencies. Transformation of legacy services to digital, moving taxation forms (individual and business) to online platforms. This is the result of legislative changes requiring digital first service provision for all government agencies. Also, a need to ensure legacy systems are maintained, to ensure inclusiveness of services.
Who?	The ‘who’ discussed within this section includes the decision-makers within the organisation and across the constituent systems. The users are those who are the primary stakeholders in the digital services provided by government, specifically who the information is provided to, whose expectations are to be met and the actual users of the services. Also, the service designers who are those that are deemed responsible for developing the services and undertaking much of the digital transformation process.
How?	The process of how various elements within the process are undertaken in the current state and should be moving forward. Firstly, within the system how can the approach perform for each constituent system and how does that relate to the constituent systems, e.g., the optimal performance of digital services is long-term adoption (more than one use) of 95% of the population. Meeting the needs of the constituent systems through understanding the various stakeholders, views and goals; however, understanding how these can be linked together is poorly documented within the digital transformation process.

When?	The timing of the interactions between the various constituent systems and the system of systems. Namely understanding how feedback occurs, specifically when the users have a negative or positive experience, at what time do the stakeholders provide feedback and how. When the data is obtained or provided directly to the organisation, when is the data actually used and applied to future changes in the services or assistance provided. For the ATO digital service use occurs annually as tax returns are required.
Where?	The boundaries of the constituent systems, and how they relate to the digital services and digital transformation in the government space. The majority of transactions and boundaries occur digitally, with the exception of the need for assistance or providing feedback. For much of this system of system, geographic location is important as it relates to access of infrastructure and digital technology.
Why?	Why the digital transformation has been conducted, specifically how in this circumstance digitalisation occurs as a result of legislation. Furthermore, how government organisations (for the ATO) the improvements made to shift digital, can be used to support and assist users with easier to access services Furthermore, how the creation of digital services are more cost effective for government agencies than legacy services.

	Cognitive	Social	Digital	Infrastructure	Business	Policy	Whole System
What?							
What is the purpose of the system?	The different levels of ability in individual users could hinder their capacity, attitudes towards and willingness to adopt digital services provided by government.	The different community members could have cultural and social norms which impacts on the adoption of the digital services.	The interface and supports provided may not meet the different digital literacy skills and available ICT Technology available to potential users.	The various infrastructure components need to be of a standard that makes undergoing the digital transformation possible and the services accessible by users.	Creating value for business to use and share the digital service and understanding their needs to provide better services.	Meeting the changes to legislation, while encouraging users to meet their legislative obligations and maintaining legacy systems.	Meeting the needs of the users, the businesses, policymakers and ensuring there are appropriate supports and infrastructure in place to encourage the transformation.
What are the areas in the system that need development?	Increased levels of education related to the specific legislation of taxation and eGovernment services generally. Increasing awareness of the availability of services and assistance to use services.	Relationships with community leaders to assist in sharing the messages of digitalisation, messaging associated with available services and information on assistance within local communities.	Development is needed to improve the interfaces, to be more user friendly. Programs to support and increase digital literacy, improved access to technology (either through public access ICT or otherwise).	Standardised internet bandwidth speeds to ensure digital platforms work across all locations, standardised access to infrastructure (e.g., electricity, water, gas).	Businesses adoption of digitalisation or eGovernment services, the use of assistance provided (either within the community or through intermediaries) and informing the ATO of issues associated with services provided.	Transparency of changes and decision-making, ongoing support for organisations implementing changing policies and additional support for the users affected.	The process needs to be based on the users and their needs and expectations, additional research and exploration needs to go into understanding what these are and how they can be implemented.

<p>What is the approach?</p>	<p>Provide opportunities to educate on how to use the services, their value and foster an environment of willing participation in digital services through transparent decision-making (providing all information they require to make the decision).</p>	<p>Provide information and advertisement material that appeals to the expectations and requirements of the various cultural and social needs (e.g., consult with cultural and linguistically diverse experts).</p>	<p>Have multiple different avenues of support available to provide assistance where and when needed (e.g., telephone, online, in person). Provide an interface that is tested on multiple platforms, on different stakeholders and meets minimum requirements for the majority of stakeholders.</p>	<p>Ensure that the capacity of the infrastructure widely available to users and government is not exceeded when services are designed and created.</p>	<p>Understand what the value of going digital is for business and meet those needs/expectations.</p>	<p>Outline the points of the policy that need to be met, provide clarity to the users as to what affect changes will have on them and implement the policy in a manner that has minimal impact on the users.</p>	<p>Create a digital service interface that is inclusive and provides multiple avenues for access and support for the various users.</p>
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<p>What are the known constraints/risks?</p>	<p>Lack of willingness to interact with government agencies (specifically with taxation), not reporting issues with systems as they arise, lower levels of skills and understanding in specific geographic areas.</p>	<p>Sharing poor experiences with the community through social media or other social forums.</p>	<p>Digital literacy, changes to ICT interfaces, access to technology.</p>	<p>Cost of systems, service blackspots, time taken for repairing or implementing change.</p>	<p>Businesses economic capacity (cashflow), willingness to adopt changes in the economy.</p>	<p>Transparency of why legislative changes occur and when.</p>	<p>Digital Adoption, Digital Literacy and understanding of the systems.</p>
<p>What's the role of people?</p>	<p>All of the individuals who need to participate in the system fit within this category (taxpayers, assistance providers, employees of organisations). They are primary in this area.</p>	<p>Community is comprised of people who develop social norms and communicate experiences across groups.</p>	<p>Training how to use digital technology, installing technology and repairing technology.</p>	<p>Repairs and upgrades occur through people.</p>	<p>Businesses are run and managed by people.</p>	<p>Parliament is comprised of people.</p>	<p>Need people to build, use and manage the digital transformation and services.</p>

What's the role of technology?	Supports the lodgement of tax returns, facilitates assistance, provides information.	Keeps communities in touch.	Forms the entire system.	Technology makes infrastructure possible.	Businesses adopt technology to document transactions, complete lodgement obligations and sell products and services.	Sharing of information, to simplify access to services and support, improve quality of services.	Need technology to undergo transformation and have digital services.
What are the characteristics of an acceptable solution?	All individuals at various levels of skill and expertise in the area are able to interact, have access to assistance when necessary, understand their obligations and provide feedback as needed.	Easily accessible support mechanisms, positive stories shared throughout the community and changes in social norms to adopt the digital services and interact with the ATO.	Increased access to technology and levels of digital literacy	Taking into consideration the levels of access, the capability of the infrastructure and how that impacts the individual users.	Easy to access, simple, information provided in plain English.	Increased use of digital services, decreased costs associated with service provision, improved and more streamlined assistance provision.	High use of digital services, low levels of complaints, streamlined assistance and a clear issue reporting platform.

<p>What are the measures of success in the system?</p>	<p>Majority (more than 95%) of individuals are utilising digital platforms for their tax lodgements, support is obtained as needed and the individuals obtain the support needed first time, the process is seamless (quick and easy to follow from start to finish).</p>	<p>Community members use the services, seeking minimal support, inexpensive to use and maintain.</p>	<p>Collaboration between technology companies and software developers to assist in between cross agency collaboration.</p>	<p>Appropriate use of infrastructure, not overusing or straining.</p>	<p>Information is safe, easy to use, works and instantaneous, getting the process right the first time.</p>	<p>Information can be shared across agencies, data is secure.</p>	<p>Well used and liked services, easy to use and able to get the process right the first time.</p>
<p>What are the incentives for the constituent systems to belong to the broader system?</p>	<p>Easier to access services at any time of the day, increased access to information, multiple support mechanisms.</p>	<p>Making life easier, sharing information across organisations.</p>	<p>Support for government, through improved software and technology.</p>	<p>Support improvements to infrastructure and seek funding.</p>	<p>Saving time having to seek assistance or support, saving money by not having to utilise an intermediary or accountant.</p>	<p>Better services, shared data across agencies, cheaper service provisions and happier clients.</p>	<p>Better services, shared data across agencies, cheaper service provisions and happier clients.</p>

How?							
How might external factors affect the system?	Various changes in personal circumstances may change someone's willingness to use the services (e.g., loss of income, bad experience using the services, global pandemic).	Shifts in social norms, community members change in circumstances.	Lack of access to technology or skills to use it will hinder use, significant changes to the ICT will impact digital literacy skills.	Lack or high cost of infrastructure will prevent use, breakdown in supply.	Financial capacity, management and employee changes.	Changes in international legislation, expectations change.	Social changes, changes in personal circumstances, digital access.
How are management constraints taken into consideration?	Documentation of when they occur, mitigation or treatment strategies to overcome (e.g., long term non lodgement results in financial penalisation).	Controls in place, seek support from community members.	Logs of issues, documenting downtime or outages.	Document, logs or maps of geolocation outages.	Documenting constraints as they arrive and mitigate as needed.	Transparent documentation, transcripts of parliament and research.	Documents and logs.

How is feedback provided?	Over the phone, through an intermediary or online.	Social forums, engagement with forums or assistance seeking.	Directly to the technology and software companies to ensure that they understand the issues.	Directly to the providers to ensure they are aware of the issues.	Over the phone, through an intermediary or online. Through small business support organisations.	Election changes of government, protests and complaints.	Mediums most appropriate to services for organisations and users.
How are the needs being met?	Providing an easy to use platform, while maintaining legacy systems.	Provide education opportunities.	Providing support to those who need it in multiple formats.	Leverage off of the available infrastructure, provide services that do not exceed the capacity.	Encouraging partnership and input to ensure ongoing iterations are improving the services and value.	Ensuring all policy and legislative requirements are met within both digital and legacy systems.	Meetings the needs and expectations of the users, providing avenues for support and training, encouraging feedback to include new ideas and provide forum for complaints.

How well can the approach perform in this system?	At this stage 97% success rate – taking into consideration all of the potential issues within constituent systems.	With support from community and volunteers (aim for 90% community coverage).	With support services provided by software developers and technology companies aim for 40% of these companies working in collaboration with us.	Black zones which affect the population to decrease to less than 10% of population, increase the use of mobile devices to compensate.	70% of businesses to shift to digital services (recent changes to online).	Aim for 95% digital service use, this will increase over time.	Aim for 95% ongoing adoption, multiple and ongoing using not one time.
How do constituent systems interact with each other?	In person, through technology, social groups or social clubs.	In person, through technology, social clubs and charity groups (e.g., RSL groups).	Through technology and software produced and put online/shared.	Through customers and providers, repairers and suppliers.	In person, through technology, economic transactions.	In person, through technology, elections.	In person, online and over the phone.

How is emergent behaviour documented and observed?	Through research, research into behaviours are documented by the ATO annually or quarterly depending on the topic, assistance sought.	Changes in social norms, social media posts and reporting.	Changes to software and technology, changes and improvement overtime documented and assistance sought.	Improvements to provide new technology, reported as they emerge.	Business newsroom and behavioural research which occurs quarterly.	Transcripts of parliament, legislation, media releases.	Research, social media, complaints and assistance.
How are risks addressed within this system?	As they arise, or as legislation requires, changes be made to deal with “problem behaviours”. Planning needed to address risks.	Reactive at the local level, privacy ensured, community responses at the geographic level.	Pre-emptive, long-term privacy and based on the provision of support.	Reactive.	Reactive, slow response based on money.	Privacy, governance, information security.	Planning and reactive.

When?							
When do reviews occur?	When large numbers of complaints occur, if not annually pre-tax time (before June 30).	When a geographic area shows negative taxation behaviours.	As software changes occur from technology companies.	When the system breaks or when upgrades are necessary.	When large numbers of complaints occur, if not quarterly (January/April/July/October).	Change in elected government or as a committee is raised to assess the success of something implemented by government.	Annually or as complaints arise.
When is feedback provided?	Instantaneously, through various mediums (e.g., over the phone, in person or online).	When asked for information, through research and surveys. Through social media platforms.	As needed – logs of issues, logs of lag or time outs.	As needed – complaints are made to infrastructure providers.	When businesses are unhappy, complaints through complaints mediums, social media.	Parliament, budgetary discussions.	As issues or complaints arise.
When is feedback received?	When sought, through searches.	When research results are made available, social media scans to explore research.	In real time.	Quarterly, data is compiled and shared.	Monthly, data is compiled and reported.	As needed.	As wanted and sourced by agencies.

When is change documented?	As it occurs.	As research is conducted into social norms or community perception on the performance on the ATO is completed.	As more research is conducted in levels of access or digital literacy, this can be annually or biannually.	As the changes occur in the systems.	As businesses change how they interact with the community.	As discussions occur in parliament bringing up potential changes in the systems, as well as when changes are implemented.	As it occurs, often pre-emptive.
When is system intervention most effective?	Right after poor behaviour is identified or complaints are received.	During tax time (30 June to 31 st October) each year.	Directly after the software changes occur.	As system upgrades occur.	Directly before or after the due date of taxation obligations.	As legislation changes occur.	Right before tax time and due dates, right after poor behaviour.
When do interactions between constituent systems occur?	Seeking assistance (from infrastructure providers, digital support services, ATO, community members).	When they are seeking access to digital services they use digital systems, infrastructure when they are seeking electricity.	Software developers assist in creating services and distributing across the community.	Infrastructure clients, government regulations, changes and new technology businesses.	New products, changes in social expectations.	After parliament sits and legislation is changed, also in times of crisis.	Use of services or changes in expectations.

When are legacy systems considered?	When individuals are not willing to shift to digital platforms, when digital services go offline.	Through the manner in which information is shared across the community (e.g., through the use of newspapers or letters/mail).	Each stage of software or technology improvements considers the legacy systems preceding it.	When infrastructure falls behind expectations it is often comprised of legacy components – e.g., poor internet bandwidth.	When businesses do not adopt new technologies or services.	When legislative change is proposed or considered.	Non digital services and as updates are needed.
Who?							
Who are the stakeholders in this system?	Users, potential users and non-users.	Community leaders, educators, social groups/clubs (e.g., sports).	Support staff, service providers employees, software companies,	Providers (e.g., internet, computers), technology companies.	Financial institutions (e.g., banking and insurance), industry leaders, universities.	Government employees, government members, service providers, law enforcement.	Users.
Who are the decision-makers in this system?	Digital service designers, users of the system.	Community members.	Assistance providers, intermediaries.	Owners of infrastructure companies providing access.	Business owners and accountants responsible for deciding on how to interact with the ATO.	Policymakers and current government.	Digital service designers (decide how the system will look), users (whether or not to use it) and government (where it will live).

Who is responsible for providing support?	Online support channels, family members, ATO Tax Officers.	Members of the community through voluntary programs (e.g., tax help).	Intermediaries or educators.	Contact centres of infrastructure firms.	Business support organisations.	Current government, cabinet and parliament.	Intermediaries and tax officers (from the ATO or voluntary programs).
Who manages risks in this system?	Users and digital service designers.	Community leaders.	Technology companies.	Providers.	Business owners.	Government.	ATO.
Who will use the system?	Individuals who under law are required to interact with the ATO to lodge their taxation obligations.	Community groups, social clubs, charity groups.	Software developers.	Infrastructure providers/companies.	Businesses who have chosen to use the digital lodgement channel as their lodgement pathway.	Politicians, government agencies, government employees.	Individuals or businesses who need to lodge their tax obligations, taxation officers who need to obtain information on tax lodgements.
Who defines success measures in the system?	Users – whether they use it or not. ATO – user perceptions, number of users, number of complaints and types of complaints.	Community members – based on what they discuss through various social platforms (sharing good and bad experiences).	Technology companies and intermediaries who provide support, determining how easy the digital services are to access and use.	Providers, who are able to increase the capacity of the infrastructure or accurately report blackspots that require attention.	Business leaders through community discussions, social media posts and use of the services.	Parliament or government who outline the percentage they expect to use the system.	Users determine whether it is accessible, ATO and government determine what percentage they expect to use the services provided.

Where?							
Where in the system is the feedback coming from?	Users, ATO, Employees.	Social behaviours that become “social norms” that are exhibited by members of communities, additionally research.	Online channels or other service providers.	Companies responsible for the distribution and repairs.	Business owners or directors.	Government, parliament or cabinet.	From users, government employees and feedback channels.
Where are the constituent systems within their respective lifecycles?	Depends – some will be first time users and new to the system, some will be long time users of the system and some will be last time.	Social ties and community groups have long standing roles within societies – developed.	ICT and digital services are established.	Within Australia infrastructure is established.	Three respective stages: New to business (first 2 years), Establishing (2 to 5 years), Established (more than 5 years).	As new government or members are sworn in a new cycle begins.	Has been in operation digitally for approximately 6 years.
Where are the boundaries of the system?	Only individuals.	Social groups, family groups, community groups.	Online – digital technologies (ICT).	Internet, power, water, healthcare.	Registered as a business (e.g., has an Australian Business Number of an Australian Company Number).	Legislated by government.	Digital services supplied as the result of legislation for the lodgement of taxation obligations.

<p>Where are the interfaces between systems?</p>	<p>Communication between individuals (e.g., socially or through assistance seeking).</p>	<p>Interactions between individuals and community members (e.g., employees at work) when they use technology.</p>	<p>Use of digital technology by individuals, businesses and government.</p>	<p>Supply of the infrastructure to the community.</p>	<p>Businesses are economic beings, interactions occur when seeking specific services or products supplied by business.</p>	<p>Elected officials interact with the community, through digital means or in person.</p>	<p>Lodgement of taxation obligations.</p>
Why?							
<p>Why is this approach meaningful to stakeholders?</p>	<p>Those who need to by legislation interact with the service are impacted by any changes made by digital transformation which affects their ability to comply with their legislative obligations.</p>	<p>As those who influence and shape the social environment of the potential users, they provide the avenues for both support and encouragement to use the service.</p>	<p>These are often client/user facing staff who deal with the issues faced by trying to use the service and understand the issues with the integration between various platforms.</p>	<p>They provide the infrastructure for which the platforms are able to run and be used (make the transformation possible).</p>	<p>They have the influence on the markets, employment, and if complying with legislation is too difficult they will leave.</p>	<p>Provides the necessity to transition to the digital platform and provide performance metrics to ensure basic needs are being met.</p>	<p>They are the people who will be expected to use the service, the digital transformation needs to ensure that their needs are understood.</p>

<p>Why was this approach chosen?</p>	<p>Cost effective, quick to interact with, easy to use, fast to obtain results from ATO, Information and assistance readily available.</p>	<p>Information can be shared across the community and social groups quickly, easily and cheaply.</p>	<p>Majority of individuals have digital literacy skills, providing additional support to those who do not or choose to use different means is more cost and time effective.</p>	<p>The infrastructure can be prepared for, e.g., knowing the bandwidth can assist in knowing how a digital service will run, knowing gaps in the access allows for additional support and assistance to be provided to those areas.</p>	<p>Businesses can obtain more support, submit returns quicker and report obligations as needed.</p>	<p>Legislative obligations required the shift to digital.</p>	<p>Meet legislative requirements, while ensuring that all individuals can interact with government services (taxation) as needed, obtaining relevant support through multiple provided channels.</p>
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Table 29. Application of the Governance Framework for Effective Digital Transformation in the ATO Case

The needs and requirements of the organisation informs how the information provided by the responses to the questions in the guidelines for application is used. For the ATO, these responses were used to validate how the previous digital transformation process was conducted and how the processes can be improved going forward. In this case the responses demonstrated that feedback needs to be obtained and used more frequently, and assistance-seeking behaviour has not been documented previously – by understanding this data the process of digital transformation could be more effective, and how the digital services interact with other constituent systems could be understood more clearly. This includes, conducting holistic analysis to understand how the interactions between these constituent systems impact tax lodgement, both digital and through legacy services. The framework provided validation for the previous process undertaken, however demonstrated the gaps that need to be filled going forward.

4.2 Verification and Validation of Governance Framework and Guidelines for Application

To validate the proposed governance framework and guidelines for application, and measure its perceived completeness and value-add, focus groups were conducted. These had 42 respondents, split across four groups. The respondents were both public and private sector employees, all with experience in at least one digital transformation project/process. The roles of the respondents are outlined in Figure 36, while the industries of respondents are outlined in Figure 37. As outlined in Figure 38, more than 66% of respondents have more than 3 years' experience with digital transformation projects, and of those more than 40% have greater than 5 years' experience. The many years' experience in digital transformation projects demonstrates their knowledge of the process within their organisation.

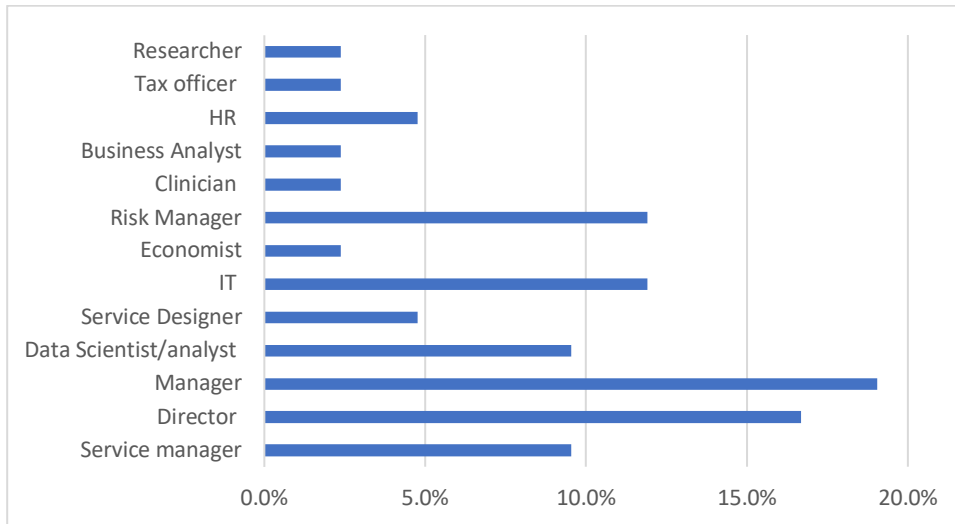


Figure 36. Roles of Respondents

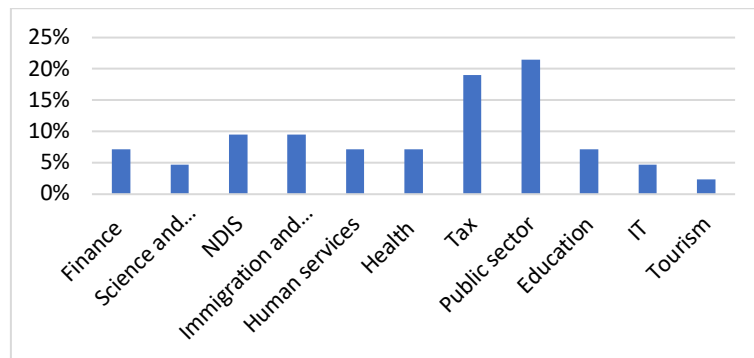


Figure 37. Industry of Employment of Respondents

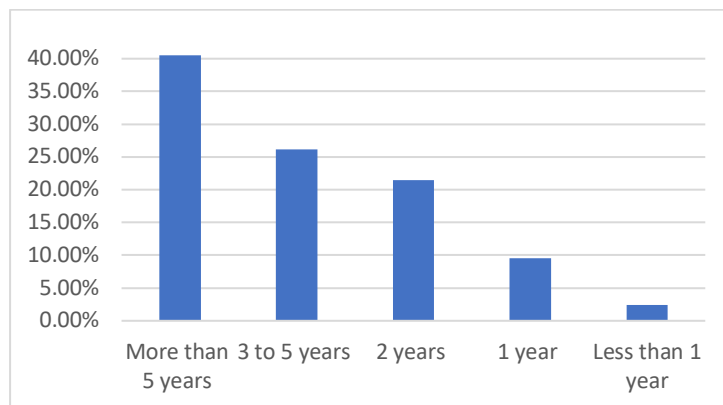


Figure 38. Experience with Digital Transformation

Figure 39 outlines the responses to whether or not the respondent's organisations have a step-by-step guide for their digital transformation projects. Of the respondents, 48% stated that

they do not have a step-by-step guideline. Additionally 94.75% of respondents stated that they needed a framework to guide their digital transformation process. Of the 26.19% who stated they had a step-by-step guide, 77.14% of these respondents stated that they did not have a formalised process and 83.3% indicated that this informal process was based predominately on intuition and experience. Finally, 97.62% of all respondents stated that they saw value in having a formalised process to guide their digital transformation project. Finally, 100% of respondents indicated that a step-by-step guide would help an organisation be more effective in managing digital transformation. This demonstrates the value and need for the creation of a framework and approach.

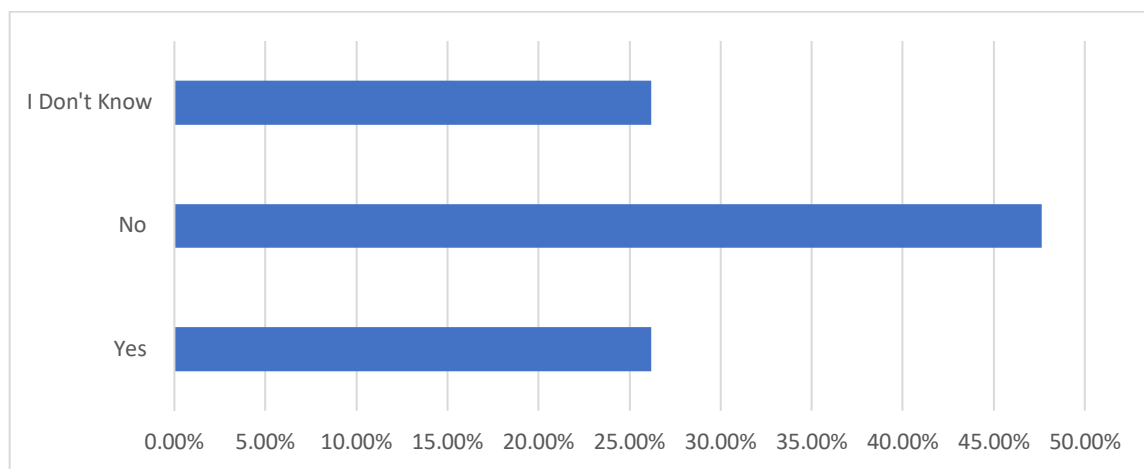


Figure 39. Does your Organisation Have a Step-By-Step Guide for Digital Transformation?

When respondents were asked about the framework and guidelines for applications completeness, 81% indicated that they were complete; 97.56% of the respondents stated that all of the constituent systems outlined within the framework and questions within the guidelines for application had been considered; and 95.25% of the respondents stated that the framework is set out clearly, requiring no further detail. Additional details were obtained, of the framework respondents through a checklist providing practical examples, how external factors can be included, competitors applications to identify their risk mitigation strategies and some examples of successful applications. Of the respondents 87.8% stated that both guidelines for application and framework are flexible enough to be adapted to other environments. The results of the focus groups demonstrate that the respondents agreed that the governance framework and guidelines for application proposed by this research are both complete and valuable.

Chapter 5. Findings and Implications, Future Research and Limitations

5.1 Theoretical Contribution

The theoretical contribution of this research includes the development of a governance framework that is a practical tool for guiding organizations through effective digital transformations. This research supports a more holistic understanding of the constituent systems of the whole digital transformation system and help with creating effective digital services in the public sector. Through qualitative and quantitative data analysis, the research was able to identify relevant systems affecting digital service adoption or non-adoption in the public sector. This research contributes to the body of knowledge through the creation of a practical framework for effective digital transformation, as it helps to identify and evaluate the relevant systems and their roles and interactions in the process, and which can be applied in the private and public sector.

5.2 Summary of Key Findings

This research has contributed to the body of knowledge by developing a governance framework that can be used to guide organisations through effective digital transformations. The results demonstrate that there is a need for more holistic understanding of the relevant constituent systems impacting digital adoption of eGovernment services and the preceding digital transformation processes. Analysis of quantitative and qualitative data assisted in identifying relevant constituent systems from which the governance framework was developed. The following sections will discuss the practical implications of the governance framework, the research limitations, and recommendations for future research.

In summary, the overall contribution to knowledge from this research is the creation of a practical governance framework for effective digital transformation. This tool assists with identifying and assessing the relevant systems and their roles and interactions in the digital transformation process. Using a research design that was exploratory in nature, the research developed in response to the results of the data collection. The application of both qualitative

and quantitative research methods (including data collection and analysis) provided the research with a degree of reliability, validity and credibility. Through the final stages of research, the opportunity to conduct four large focus groups ensured that feedback was obtained from a diverse range of respondents, and many of them indicated that they saw value, completeness and validity in the governance framework. In conclusion, the research has demonstrated not only the need for the development of a governance framework, but also the usefulness and value of the governance framework for effective digital transformation proposed in this research.

The ATO has deemed this research to be useful, as they are now better able to identify the strengths within their current digital transformation practices and identify opportunities for ongoing effective digital transformations. Discussions are currently underway for future research to be undertaken with the ATO and the application of the governance framework.

5.3 Practical Implications

There are a number of practical implications of this research. The primary implication of this research is that, through the application of the framework, the effective governance of digital transformation can occur. Effective management can include the appropriate reactions to change, ensuring that the systems provide responses that are quick and effectual in the long term. Therefore, change management can be more responsive, including ensuring that managers are able to support the new processes, policies and practices that occur (either planned or unplanned). This includes providing more proactive management of change, as well as effective reactive management, made possible through the systemic understanding of the various systems affecting the digital transformation process prior to undertaking it, as well as identifying the interrelationships that occur within the system of systems. By outlining and understanding these factors ahead of time, management can govern and approach these challenges and opportunities earlier, build risk mitigation strategies, and put in contingencies to manage any potential changes or issues either before or as they arise.

The system of systems view provided in the governance framework assists in clarifying the specific requirements of the constituent systems within the digital transformation, outlining how each interaction occurs and how the organisation should interact with them. By responding to each of the questions within the approach for each constituent systems, the organisation can

diagnose and correct practices employed for the governance of these systems. This means that organisations are able to create a best practice, outlining principles for achieving business outcomes while ensuring that the constituent systems are accounted for. The responses from the application of the governance framework and guidelines for application are documented, not only encouraging easy deployment, but also maintenance and increased reproducibility. This also reduces potential repetition of documentation and of employee's workload. Documentation provides organisations accountability for the roles and responsibilities of employees, while also demonstrating that the various constituent systems are considered.

By applying the framework and approach, organisations can implement consistent practices across their planning and implementation of digital transformation, including providing good governance practices and building evidence-based decision-making into the planning of the digital transformation projects within the office. This can only be achieved by understanding all of the systems affected by the process or having an effect and asking the right questions to obtain the appropriate responses, thus providing a processes approach, including flexibility and an organisation based on continuous improvement, reinforcement of decision-making and inbuilt measures of effectiveness. These effectiveness measures are based on responses to questions posed within the guidelines for application, and they ensure organisations consider the various systems, their goals and views and how they relate to definitions of effectiveness. Furthermore, each individual constituent systems definitions will differ from that of the system of systems, thus requiring consideration of how to best combine these into a consistent and holistic effectiveness measure.

Similar to the application of policy, through the application of the governance framework, the underlying principles and values of the constituent systems and system of systems can be documented. By analysing the constituent systems, the various goals and objectives of their choice to belong in the system of systems can be documented, and this can be related back to the digital transformation process. This information can assist organisations to determine the best strategies to interact with and influence the constituent systems to achieve the organisational objectives. Although the framework does not outline the specific actions to be taken by employees, it does provide guidelines to achieving the desired outcomes, while also providing information on how the digital transformation system of systems should be reviewed, documented and understood. With additional research, this level of understanding could be

related to both a cost and time saving for an organisation, reducing the amount of time spent on additional iterations of the process to meet the needs of the constituent systems not included in the first round, while reducing costs associated with additional iterations.

The guidelines for application provide an avenue for the organisation to ask and answer the appropriate questions to achieve an effective and inclusive digital transformation. As the guidelines for application and framework provide a systemic and holistic view of the constituent systems, stakeholders and views requiring consideration, better communication and facilitation of information can occur between the organisation and its customers (or in this case government and citizens). This can assist in improving access to online services, by creating a more inclusive platform taking into account the potential barriers and challenges effecting the different constituent systems, including the individuals within them. For example, understanding how access to infrastructure can hinder the use of digital services or a specific bandwidth requirement can impact certain user's access. By understanding this from the onset, designers of the services can create platforms with low bandwidth requirements, for example, to meet these needs. By understanding the constituent systems and the people within them, increased organisational (or government) engagement is possible, decreasing the level of associated difficulty of accessing the services and thus increasing willingness to adopt or use eGovernment services. The ability to obtain a holistic view of the constituent systems and the system of systems as a whole, provides a view which is more than just the sum of its parts and therefore builds more inclusive services and digital transformation processes.

5.4 Future Research and Limitations

There are some limitations in this study. The first is the generalisability, as the research focused on a single case study (the ATO) only and within the Australian context. Additional research was conducted in the digital health space to counter this limitation, as outlined in Appendix 1 and 2. Future research is recommended, applying the framework and approach to other areas and industries and countries or regions, in order to explore how they can be applied, to provide examples, and identify any potential gaps or external factors not observed within the validation and verification provided by the focus groups in this research. This further research could assist in demonstrating the generalisability of the framework and guidelines for

application to other industries (both public and private sector) and other public sector organisations/agencies (including digital health and digital social services).

The second limitation concerns the potential of researcher bias, as the research was conducted as part of an industry partnership between the University and the ATO. Although steps were taken to minimise bias, including having impartial individuals collect the data, employing an external data scientist to analyse the data, and drawing up a formal agreement with the ATO to report findings in a neutral manner (whether they reflect positively or negatively), nonetheless, this still equates to a potential limitation.

The third limitation relates to the sample size for the validation and verification of the framework and guidelines for application. Although the data collection occurred as part of focus groups, additional data collection should be undertaken to explore in greater depth the value, completeness and validity of the framework and guidelines for application. This limitation was primarily the result of the COVID-19 situation, which changed the focus of the ATO to help and support their clients, and resulted in significant staff reallocation. The researcher proposes future research to continue the validation and verification of the framework and approach, obtaining responses from individuals in different industries, countries and agencies. This would provide additional support for the framework and approach beyond that provided in the current research.

Future research could contribute to information systems literature through exploring mandatory digital service adoption. This research could include exploring in more detail through the system of systems perspective, including exploring the roles of multiple stakeholders.

Additional research should also be undertaken to validate the framework, through the application of an action-oriented research process. This would help address some of the questions related to overcoming some of the criticisms of Zachman's framework.

In conclusion, future research is recommended by the author to explore the generalisability of the framework and guidelines for application. This includes exploring the applicability of the research to different industries, public sector organisations and countries.

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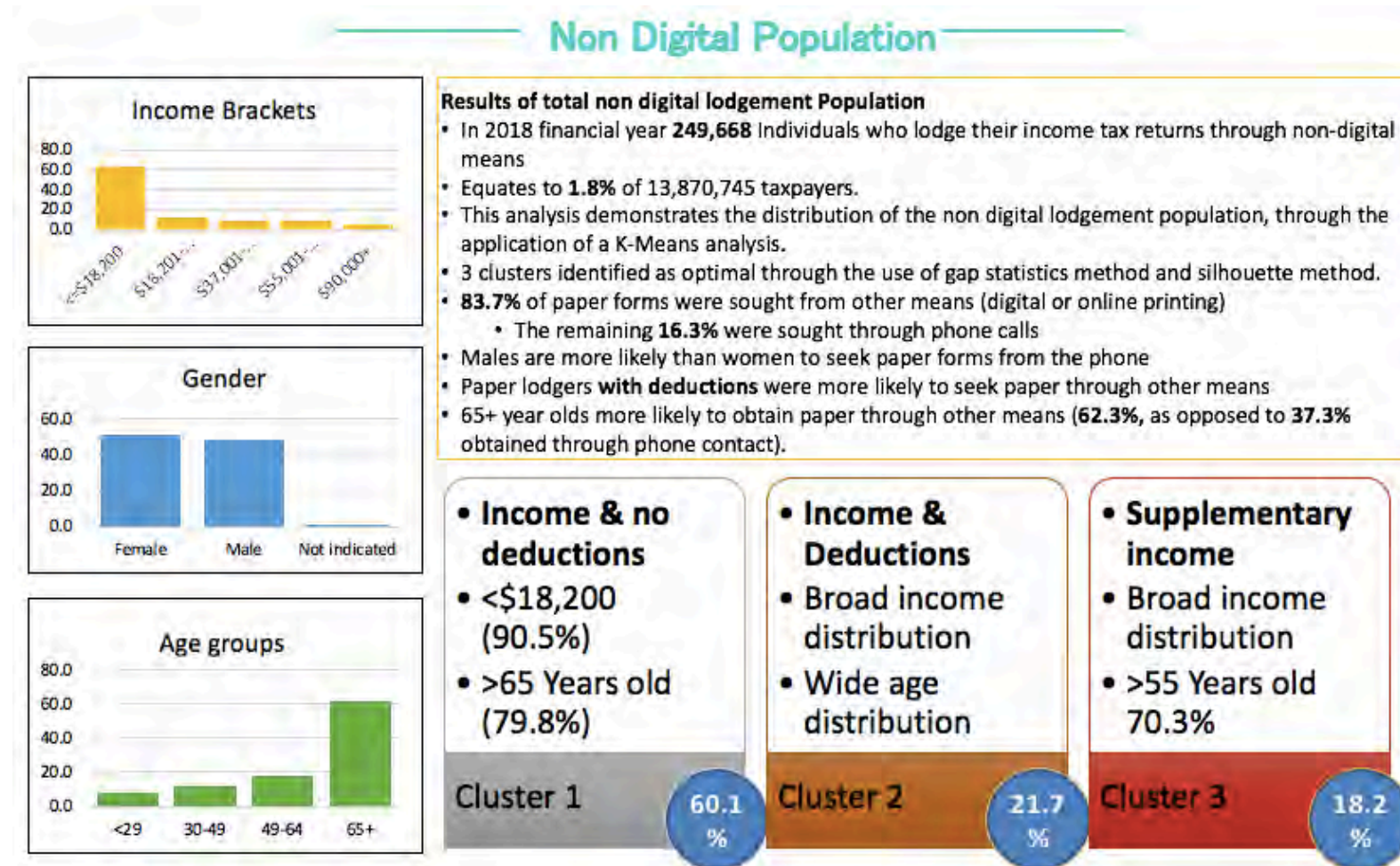
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Appendices

Appendix 1: Snapshot of the non-digital lodgement population



Appendix 2: Paper 7: A Digital Systems Approach Across eGovernment Services: The Australian Taxation Office and The Health Environment

Reference: Papavasiliou S and Reaiche C, 2020. 'A Digital Systems Approach Across eGovernment Services: The Australian Taxation Office and the Health Environment', *The Fourteenth International Conference on Digital Society*, pp. 60-65. ISBN: 978-1-61208-760-3

This paper was awarded a best paper award and invited to complete an extended paper to be published as a journal article as part of the conference issue of the International Journal on Advances in Information Technology (not yet completed).

This paper was developed to demonstrate applicability and comparability of governance agencies assistance seeking requirements. Highlight how the research findings were identifying consistent relevant systems and how they impact the system as a whole, regardless of the government organisation under review.



Statement of Authorship

Title of Paper	A Digital Systems Approach Across eGovernment Services: The Australian Taxation Office and The Health Environment
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Principal Author

Name of Principal Author (Candidate)	Samantha Papavasiliou		
Contribution to the Paper	Designed and Conducted the study undertaken. Applied the findings to the Conceptual 'User Centred Model' used for testing. Completed the data analysis		
Overall percentage (%)	70%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	14/05/2020

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Carmen Reaiche		
Contribution to the Paper	(30%) Supported the data analysis, assisted with the validation of the results and guided theoretical underpinnings		
Signature		Date	1/6/20

A Digital Systems Approach Across eGovernment Services: The Australian Taxation Office and The Health Environment

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Abstract— The public sectors shift to digital first service provision has had a considerable impact on how individuals interact with public sector entities. This research highlights the similar assistance requirements and concerns with different public sector digital services. Evidence for this research is presented through a case study on the Australian Taxation Office and two digital health platforms, MyAgedCare and My Health Record. By understanding the different issues and assistance seeking requirements across the public sector digital services, digital service designers and policy makers can better create services that meet the needs and expectations of users. A primary finding of this research highlights the expectations of users that human interfaces for assistance-seeking are maintained, in order to maximise an individual's capacity to interact with the system successfully.

Keywords- *Digital Health; Assistance Seeking; Digital Inclusiveness; Digital Ecosystem; Public Sector.*

I. INTRODUCTION

As public sector services adopt new technologies and start to identify the considerable benefits associated with utilising digital services, the availability and use of legacy systems will decrease [1]. Public sector services are fundamental in a modern society and service availability is crucial. However, with the use of digital services in lieu of legacy systems, especially in the mandatory service space, users are becoming more and more limited in their choices [1]. Therefore, this paper argues that for governments to be truly inclusive, legacy systems must remain in place, to enable and provide access to all who require them.

This paper explores the application of findings from an Australian Taxation Office (ATO) case study, used to understand the barriers and opportunities affecting digital service provision in the public sector. The findings are used to start the discussion on the digital health environment, including the most common Australian digital health platforms known as My Health Record and MyAgedCare [2], both services which are displayed with similar digital formats. This paper does not argue against the use of digital approaches for service provision, however it questions the inclusiveness of providing digital first services in mandatory service space (e.g., tax lodgement or aged care referrals).

The purpose of transitioning public sector services to digital platforms is clear, to provide easy access to

government services, and to promote the transformation and delivery of modern and future proof digital services to those who need them [1] [3]. There are millions of Australians who utilise online government services through the central platform "myGov", as well as numerous state government online services [1]. The large numbers utilising the services demonstrate how Australian public sector digital services are well adopted within the community. However, there are still pockets of the community who are struggling to access necessary services [1].

All Australian Public Sector Organisations were impacted by the introduction of the Australian Digital Continuity Policy 2020, mandating the use of digital first channels for every public sector service provided [4]. This policy put considerable pressure on both public sector organisations and service users. Through exploration of previous literature, a considerable gap was identified between what is known about digital service users and non-users, and those individuals who are required to use them. Therefore, the impact of shifting mandatory public sector services to a digital first platform is still largely unknown. As digital first service provision is the way forward for all public sector organisations (especially in Australia), a holistic view of users is needed. Research needs to support and assist users, improve services and inform policy to increase long-term voluntary compliance obligations in a mandatory service space. To support this view, this research is exploring the relevance of previous research based on a case study on the ATO, and comparing them to different services provided by the Australian Department of Health.

This paper will explore the barriers to digital adoption in the public sector space, specifically comparing mandatory and voluntary spaces. These comparisons will be based on understanding that ATO and MyAgedCare services are mandatory and My Health Record being voluntary. This research explores the common reported themes among digital barriers and proposes additional research to be undertaken to address the gaps. The themes will be derived from an ATO case study (conducted previously) and comparing to a pilot study undertaken on MyAgedCare. Additional research has explored the identified barriers to the use of My Health Record (a voluntary service), to understand the similarities across digital health and digital taxation, as well as mandatory and voluntary. Through the

use of thematic analysis outlining the barriers to digital adoption, links between the ATO case study and the digital health platforms are introduced to demonstrate the similar issues across the different eGovernment services. By exploring the various barriers and their links to the User Centred Model (Figure 1) the analysis provides lessons learned applicable to both policy makers and digital services designers.

The structure of this paper is divided into six sections. Section one contains the introduction, section two outlines the literature reviewed, section three discusses the ATO, My Health Record and MyAgedCare, the fourth section outlines the methods, the fifth section highlights the results of the study and the final section is the conclusion.

II. LITERATURE REVIEW

A. Digital inclusion

Inclusion is complex as it incorporates numerous concepts including; awareness, acceptance, respect and understanding, to provide equal participation opportunities [5][6]. An inclusive environment encourages people with different characteristics, backgrounds and ways of thinking, to work together to fulfil their potentials [5][6]. These environments require considering both internal and external stakeholder perspectives, and placing equal value on all perspectives regardless of where they originated [7]. Digital inclusiveness is also increasingly complex, as it involves multiple components within the specific digital ecosystem of an individual. Therefore, digital inclusion identifies the importance of access to information and communications technology and the resulting social and economic benefits for users [8]. An individual's level of digital inclusion is impacted by digital skills, connectivity and accessibility. Digital skills include the capacity to use technology to connect with the services (internet and computer), connectivity involves having internet access (the infrastructure) and accessibility is the user friendly digital services that assist in accessing the service [9]. Thus raising the question, does digital health have potential negative implications on levels of digital inclusiveness?

B. Digital divide

One of the most significant issues towards the use of digital public sector services is the digital divide, whereby in Australia more than 2.5 million individuals are still not online [9] and the digital divide is largest in those older than 65 [9]. The digital divide is defined as the gap between individuals or groups with limited access to digital information and services, compared to those who have effective access [9]. With the shift of government services to online delivery methods, there is considerable potential for older Australian's to be disadvantaged from the greater use of emergent and dominant communication technologies [13], as digital services tend to leave older Australian's out [10]. An aging population is vulnerable and in some cases

reluctant to use digital technology, raising concerns about ability to use technology, scams, privacy, self-diagnosis resulting from misunderstanding of information and the desire for face-to-face explanations [11]. Thus raising the question, how do digital health platforms affect service use?

The digital divide is an issue that effects lower income earners, individuals with poor access to the internet and/or those individuals who lack the skills to use technology, making it harder to access. Furthermore, lower levels of digital inclusion are associated with individuals who only access internet through mobile devices. Digital exclusion often exacerbates other forms of social exclusion; this includes unemployment, low education and poverty [12]. Therefore, the importance of digital inclusion is undeniable; all Australians require access to both technology and skills to ensure they can take part in every aspect of social and economic life. There are practical concerns for achieving equitable levels of access between different social groups and public services, as society is not homogenous, providing basic accesses to the community is not sufficient. Services provided to citizens by government need to align their design and application to the needs of the community, to encourage digital inclusiveness and begin to breakdown the digital divide.

C. Barriers to eGovernment

Previous research has explored the specific barriers to digital adoption within the eGovernment space. The European Commission, defines a barrier to eGovernment as the, characteristics within the contexts of legal, social, technological, or institutional which negatively impact the development of eGovernment [11, P.3]. This can be caused by users' lack of demand and the obstacles preventing engagement with services, or disincentives for the government to supply the eGovernment services or prevalence of obstacles preventing its supply [12]. This research identified barriers and compiled them into seven key categories; leadership failures, financial inhibitors, digital divide and choice, poor coordination, workplace and organisational inflexibility, lack of trust and poor technical design [12]. However, research suggests that regardless of the platform, the impact of stakeholders (internal and external) can negatively influence its use [13]. Therefore, successful eGovernment platforms depend on understanding the environments in which they operate [14]. These elements including stakeholder inclusiveness should be considered more in-depth, with their relationship to the multiple barriers preventing eGovernment/digital service adoption and their applicability across disciplines.

III. EGOVERNMENT SERVICES: ATO AND HEALTH

For this research, mandatory environments are classified as "Public Sector Organisations who must by legislation provide Digital Platforms for their services" [15][16]. Whereas mandatory interactions are defined as "Users who meet certain characteristics and must by legislation interact

with the public sector service provider to meet these obligations” [15][16]. Therefore, users must engage with providers, but under the digital first mandate expectations around how they do so has changed. In contrast voluntary public sector services are similar to those provided by the private sector, in that an individual can decide whether they want to utilise the service or not.

A. ATO

The ATO was the first service provider to adopt digital first service provision, with the introduction of myTax for individuals, business portals, and tax agent portals. The ATO requires all individuals to interact annually with them to submit their tax return, all individuals who derive income within Australia. Since the digital first transition, the majority of services are digital and require an understanding of both taxation and computer systems. Taxpaying population in Australia is over 16 million; of these 84% are individuals [16]. The ATO has high digital adoption rates of the MyTax platform, with 95% of individuals eligible to utilise the service [16], however there are still gaps within the population that need to be explored and understood.

Progressively the myTax platform became more inclusive, through annual and ongoing adaptations, and the progressive changes in the manner in which digital adoption and service provision has occurred [17] [18]. Each iteration incorporates the feedback from users to ensure ongoing viability of the platform, while also ensuring ongoing success [24]. The iterative approach of ongoing improvements has been a key component outlining the success of the myTax platform, which makes the platform a good case study on the creation of inclusive government services. This is not to say that the platform is 100% inclusive, there are still issues with accessibility, understanding and willingness to change that impact its use [19].

B. Digital Health

Healthcare systems are becoming significantly more complex, with more professionals becoming involved in each individual patients care, and ever-changing healthcare needs of the population [20]. Healthcare is the product of a complex adaptive system, comprised of people, equipment, processes and institutions which all work together [21]. Healthcare systems operate at their best, by undertaking ongoing improvements. However, when the system fails to improve it negatively impacts the system [22]. Therefore, the research argues that through the application of a systems thinking lens, the complexity of the different interacting internal and external environments within organisations, health systems and society for example, can be better identified and understood. The systems complexity highlights both problems and opportunities and requires responsive organisations and systems capable of adjusting to changes. The ability of the system or components of the

system to respond to changes, all depends on one’s ability to understand influences [23]. Systems thinking can provide a holistic view and assist in identifying areas requiring revisiting [24].

C. My Health Record

My Health Record is an online platform containing a summary of an individual key medical and health information (including histories). The site provides information for individuals and health practitioners who opted into the service to view medical histories, previous tests, medication (history and current) and diagnosis. The My Health Record platform was piloted in 2016 [25]. The aim of the platform was to provide a single location for all medical details of a patient that is readily available for health practitioners and users. The service is voluntary, there was an opt-out process between 2018 and 2019, where eligible Australians indicated whether or not they wanted the service [25]. To be eligible an individual must be registered with Medicare. Although there are a number of benefits from the provision of the online health record, more than 2.5 million Australians opted out of the platform [26]. The primary reason was privacy concerns, specifically because not only doctors can view the records (any registered health provider can); data can be used for research; once created the record cannot be deleted and there is fear of hacking data [27].

D. MyAgedCare

MyAgedCare is an online platform for individuals aged 65 or older which is the starting point on an individual’s aged care journey [28]. The site provides information for government-funded services available at home to enable individuals to continue living independently. The MyAgedCare platform has undergone numerous changes since its launch in 2013, aiming to provide a consistent, streamlined and holistic assessment of clients. However a study published in 2018 demonstrates service demand significantly outweighs supply. With 127,748 on waitlists or not receiving adequate levels of assistance based on their needs [29], and the waitlist growing by 20,000 every six months [30]. Furthermore, 96,000 people waiting since 2013 have found nursing home placements faster than their preferred option of home care, and more than 16,000 people died waiting for services [30]. Numbers are impacted by geographical location, types of services, financial outlay and availability of qualified staff. Although this backlog in services is important to note, it is not the key issue raised in this paper, this study focuses on the implications of MyAgedCare as a digital platform and how this, in turn, affects patient centred care.

Both digital health eGovernment platforms under analysis are relatively new, having not undergone as many iterations as the ATO myTax platform. However, these platforms have a considerable impact on end users and the Australian population, as they are both critical for providing

information and links to information that outline individuals health profiles, where and how to access services and has the capacity to act as a facilitator of medical services in Australia. This research intends to highlight the key lessons learned from the ATO digital experience, to help inform digital health service designers, to provide avenues for designers and policy makers to obtain guidance on how to develop more inclusive digital services in this space. Simultaneously, other eGovernment platforms can take advantage of the key learnings from the ATO digital experience, as this is transferable to eGovernment.

IV. METHODS

A qualitative approach was applied to this research. An integration of both interpretative and exploratory approach to obtain an in-depth understanding of the key barriers to digital adoption and how they were overcome was considered appropriate to the ATO, MyAgedCare and My Health Record cases. This approach provides evidence to describe the eGovernment environment and provide insights to promote ongoing service adoption.

This research has two components, the first component was the analysis of the ATO digital experience. The ATO study component for this research used primary data collected during a 4-week period over July 2018. A survey form was provided to 11 call centre operatives who populated numerous fields outlining reasons for call and demographics of callers; to understand why people were seeking assistance. Once collected the data (N = 3,990) was anonymised through aggregation techniques to group like individuals into similar groups to understand the population. As this research was designed to be exploratory in nature, the focus was to understand the different issues facing users, a thematic analysis was completed on the qualitative data obtained.

The second component incorporates the Digital Health sector platforms, My Health Record and MyAgedCare. For the MyAgedCare component of this research, data has been collected from concerns, interpretations and perceptions of various stakeholders engaged with the MyAgedCare platform. Data analysed underpinned the actor’s perception on “What do they think of the MyAgedCare platform?”. The same method was utilised to explore the My Health Record platform which works on similar digital integration system approach. The main focus of the discussions was to understand what different actor’s perceptions are on “What do they think of the My Health Record Platform?”. The data was consolidated and anonymised when analysed to identify common themes and trends within the responses. The data collected for this component has been treated as a pilot and comparative form to the ATO digital environment and therefore was only based on answering a singular question. The additional analysis conducted was on existing data provided outlining environmental components.

V. UNDERPINNING FINDINGS: USER CENTRED MODEL

The research adopted an interpretive lens to guide analysis with a systems view. Through the analysis of the 11 call centre operatives’ surveys, a conceptual model is proposed for the complete integration of key stakeholders influencing end user digital adoption: User Centred Model (see Figure 1). The key factors and element of this model emerged by observation and interpretation of all the stakeholders and interactive elements within the system and all the parts of the broader environment. The purpose of adopting a systems lens to build this model was to provide a user-centred research approach which can guide policy making as well as provide better support and understanding of the various needs of the different users. This conceptual model contributes to knowledge by initially identifying a number of factors within a user’s environment and their degree of impact on willingness or capacity to adopt mandatory digital services.

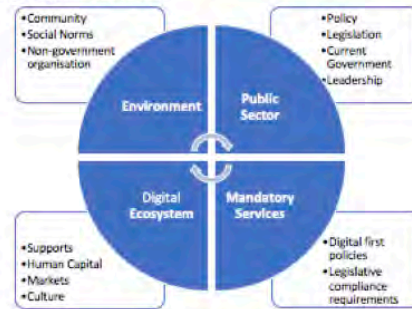


Figure 1. User Centred Model

TABLE I. ATO BARRIERS TO DIGITAL ADOPTION

Theme	Users comments
Platform support and technical support	<ul style="list-style-type: none"> - Do not know how to access the page - What are the security measures in place? - How do I link between the MyGov and MyTax platforms? - I have not used this before - where is my prefilled data ? - How do I change my details/or name? - The identification questions were incorrect - I am having technical difficulties
Lacks computer skills, preference to use non digital	<ul style="list-style-type: none"> - I want to use myTax by I don't know how to use a computer - I have no email address or digital presence - Do not own a computer - How do I do this digitally? - I always do my taxes this way - Language barriers prevents the use of digital - Only completes old non digitalised forms
Requires education in the system, platform awareness	<ul style="list-style-type: none"> - How do I lodge? - Why do I need to? - How does tax work? - Why do I have to pay money? - How does income work? - Where do I put information on the form? - What are tax offsets? - How long does this take? - What is a deduction?

Table 1 outlines the thematic analysis conducted within the ATO, this table demonstrates the different barriers individuals face when interacting with the myTax platform and creates a basis for the analysis of the digital health platforms. The thematic analysis demonstrates that individuals seek assistance and advice on both tax technical components and general platform and technical support. Both of these scenarios are relevant for the digital health space, as language used in services and information provided can have a considerable impact on end users.

When comparing the themes outlined within Table 1, all themes influence an individual capability and willingness to utilise digital services. There are links within each section to legislation, mandatory services and the environmental impacts. From this, the research can infer that there is a lack of understanding of mandatory services, specifically what the legislation is requiring the shift to digital. Therefore, to address this, users need to be informed of the changes and the provision of transparent policies are required, these policies need to be easily interpreted by all users. Furthermore, by understanding how different policies interact with the mandatory services users can be more informed as to the security and safety of their data, without this understanding it is unclear how end users will feel confident and comfortable using the services.

When comparing the findings within Table 1 to the preliminary findings within Tables 2-4, lessons can be learned in relation to the potential inclusiveness of digital services, especially when looking beyond mandatory systems and simply exploring the various policies and involvement of stakeholders. For example, in both mandatory and voluntary systems, an important issue for end users is the security concerns related to their private data, how they access the digital services and their level of digital literacy. The users for these services also differ considerably, which demonstrates interesting findings when it comes to across the board generalisability of barriers to digital inclusiveness.

TABLE II. RESPONSES TO "WHY ARE YOU NOT USING DIGITAL SERVICES?"

Theme	Users comments
Scams/Fraud /Security	<ul style="list-style-type: none"> - Fear of scams - Not sure which is the real website and which is fraudulent - Computer/cyber security concerns
No computer/ Internet access	<ul style="list-style-type: none"> - Have no experience utilising a computer or accessing the internet - Unclear on what a digital health service is - Have no access to the internet of computer

The results within Tables 1, 3 and 4, highlight how regardless of platform, the assistance required relates to end-user concerns about terminology, accuracy of information and representation. Furthermore, there is a clear and direct relationship between digital awareness of the operations of online platforms (eGovernment) and the types of questions asked within the digital space (e.g., digital literacy questions, obtaining the correct information).

TABLE III. RESPONSES TO "WHAT DO YOU THINK OF MYAGEDCARE?"

Theme	Users comments
Phoneline	<ul style="list-style-type: none"> - Rude staff - Staff demanding to speak to client directly despite acknowledgement of advocate availability - Hearing impairment impacting communication - Language barriers
Confusing	<ul style="list-style-type: none"> - Terminology used by staff - Questions deemed by clients as intrusive and unnecessary - Inaccurate information provided on website - Clients unable to understand the different services and costs involved – written information only with a lack of visual representation - Sometimes inaccurate representation of available services - Availability of services for under 65 years
Difficultly accessing	<ul style="list-style-type: none"> - Vision impairment - A lack of comprehension - Unreliable or no internet in the home (particularly rural and remote) - Mobility impairment - unable to leave home to use public access computer - Inability to express urgency

TABLE IV. RESPONSES TO "WHAT DO YOU THINK OF MY HEALTH RECORD?"

Theme	Users comments
Privacy	<ul style="list-style-type: none"> - Confidentiality and privacy concerns - Concerns for the ongoing privacy for their data stored online - Unhappy that it cannot be deleted once created - Unclear who can access my records and why? - Allied health services can access my records - What if my medical history is shared an
Confusing	<ul style="list-style-type: none"> - Terminology used online - Accuracy of information provided on online - Not every doctors client and hospital is represented
Difficultly accessing	<ul style="list-style-type: none"> - Vision impairment - Do not understand how to use the portal - Low levels of digital literacy - Unreliable or no internet in the home - Mobility impairment - unable to leave home to use public access computer

VI. CONCLUSION

The preliminary findings from the digital health space in comparison to the ATO case study demonstrates significant similarities between the digital/online platforms and the issues associated with digital awareness, acceptance, assistance seeking, accessibility and support. As demonstrated within the results of the ATO case study, the value of face-to-face or human interaction based assistance is still a necessary component of the success of eGovernment service inclusiveness. Digital health too quickly removed the face-to-face component of assistance in regard to both My Health Record and My Aged care, decreasing the inclusiveness and making it difficult for individuals who preferred face-to-face support. Human interaction support is available in this space, however does not provide the same emotional support often expected within the delicate situations evident in healthcare.

My Health Record and MyAgedCare have a considerable amount to learn from the ATO, who have maintained high adoption and satisfaction ratings within their digital service. Furthermore, through multiple iterations, ongoing improvements were made possible,

while ensuring that different avenues for obtaining support and assistance were available to suit the user's needs (e.g., in person, over the phone and through intermediaries). What this research has indicated is that the digital health services have moved too quickly in their transition from legacy to digital services. The ATO learned within their transition to digital first services, specifically what legacy systems they could do without and which ones they need to maintain and improve.

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Appendix 3: Paper 8: Digital Health and Patient Centred Care: A Digital Systems View

Reference: Papavasiliou, S., Reaiche, C., & Papavasiliou, S. 2020. 'Digital Health and Patient-Centred Care: a Digital Systems View', *Systems Research and Behavioural Science*, pp. 1-15. DOI: 10.1002/sres.2726.

This paper was developed to demonstrate the across government applicability of the research findings, identifying the consistency of the relevant identified systems and how they impact the system as a whole.

Statement of Authorship

Title of Paper	Digital Health and Patient-Centred Care: a Digital Systems View
Publication Status	<input type="checkbox"/> Published. X <input checked="" type="checkbox"/> Accepted for Publication <input type="checkbox"/> Submitted for Publication. □ Unpublished and unsubmitted work written in manuscript style
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Principal Author

Name of Principal Author (Candidate)	Samantha Papavasiliou		
Contribution to the Paper	Designed and Conducted the study undertaken. Applied the findings to the Conceptual 'User Centred Model' used for testing. Completed the data analysis		
Overall percentage (%)	60%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	14/05/2020

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Carmen Reaiche		
Contribution to the Paper	20% - Supported the data analysis, assisted with the validation of the results and guided theoretical underpinnings		
Signature		Date	14/06/20

Name of Co-Author	Shirley Papavasiliou		
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Contribution to the Paper	20% - Guided data collection and assisted with the application of findings and patient centred care to the conceptual model (including explaining the technical medical terminology)		
Signature		Date	01/06/2020

Please cut and paste additional co-author panels wherever required.



Digital health and patient-centred care: A digital systems view

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Abstract

The public sectors' shift to digital first service provision has had a considerable impact on how individuals interact with public sector entities. This research highlights the similar assistance requirements and concerns with different public sector digital services. Evidence for this research is presented through a case study on the Australian digital healthcare platform, MyAgedCare. By understanding the different issues and assistance seeking requirements across the public sector digital services, digital service designers and policymakers can better create services that meet the needs and expectations of users. A primary finding of this research highlights the expectation of users that the human interface for assistance is maintained, in order to maximize an individual's capacity to interact with the system successfully.

KEYWORDS

digital health, digital inclusiveness, digital systems, patient-centred care

1 | INTRODUCTION

Australia's government and public services have been impacted by considerable policy shift, moving from face-to-face and call centre to digital first. There has been growing discussion on the impacts of this shift, especially when looking at mandatory service use. In Australia, for example, previous research has identified the implications of digital first service provision on annual taxation lodgement, demonstrating shifts in assistance-seeking behaviours and change in demands for user-centred design. However, the shift of healthcare services and healthcare referrals to digital first services has yet to be explored in depth. Digital first does not remove access to traditional services; however, access to nondigital services are more difficult—in most cases, it appears to lead to longer wait times and are often perceived to provide less detailed information, thus raising the question, what is the impact of shifting services to digital first?

This research utilizes a case study to start to explore the different perspectives of digital health services,

including key stakeholders such as professionals and clients in Australia. As digital service provision is complex, this research argues for the application of a user-centred model and a multidimensional stakeholder analysis to assist in providing a more systematic view. In particular, a systems lens is adopted as it will provide a holistic view to underpin the analysis of this research. Results of this research will provide recommendations in the area of digital health services and patient-centred care. Future research is suggested to further evaluate factors aligned with barriers and impacts on the digital system discussed in this research. Therefore, the research starts to explore the impacts of digital healthcare services on patient-centred care. Evidence will be provided from a case study on the digitalization of aged care referrals in Australia, which demonstrates the potential adverse implications to promoting the use of online services to those least likely to understand their use. This research specifically focuses on the MyAgedCare platform, which is currently the only Australian government digital first healthcare service system for the Australians aged over 65.

The primary focus of this research is to determine the impact of digital first service provision on patient-centred care—an issue that is especially problematic for individuals seeking aged care services in Australia, where changes in the system require seeking services through digital means. All patients and carers seeking home support or residential care from the Australian government need to access MyAgedCare as a starting point. The MyAgedCare platform requires a comprehensive understanding of information and communications technology (ICT), as well as access to both the internet and a device that is compatible with the platform. This research seeks to understand the implications of transitioning to digital first service provision on patient-centred care, focusing on the aged care sector in Australia. The paper is divided into six sections. Section 1 contains the introduction, Section 2 presents the literature review, Section 3 presents the methods and Section 4 outlines the research findings, Section 5 discusses the findings of the research and Section 6 concludes the paper.

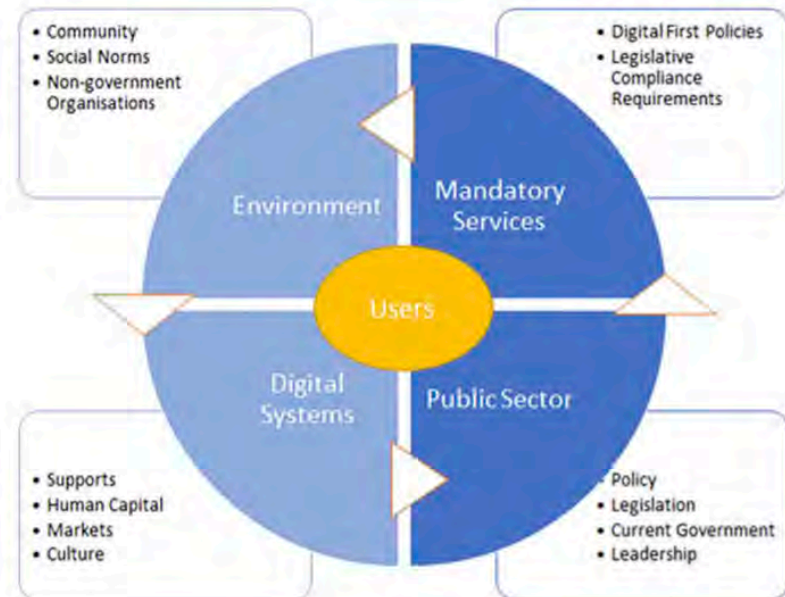
MyAgedCare is an online platform for individuals aged 65 or older, which is promoted as the starting point on an individual's aged care journey. The site provides information for government-funded services available in the home to enable individuals to continue living independently and details about what can be expected in aged care facilities. MyAgedCare is focused on providing information and services to individuals over the age of 65 and seeking services and support, including palliative care. Palliative care is an approach based on the improvement of the quality of life of patients and families, for those individuals diagnosed with a terminal illness (inclusive but not limited to end of life care) (Zhukovsky, 2019). The MyAgedCare platform has undergone numerous changes since its launch in 2013, aiming to provide consistent, streamlined and holistic client assessment. However, a study published in 2018 demonstrates that the demand for services significantly outweighs the supply. There are 127,748 people on waitlists or not receiving adequate levels of assistance based on their needs (Department of Health, 2019), and the waitlist grows by 20,000 every 6 months (Lauder & Milton, 2019). Furthermore, 96,000 of those waiting since 2013 have been forced to find nursing home placements rather than receive care at home as first requested, and more than 16,000 people have died waiting for services (Lauder & Milton, 2019). These numbers are impacted by geographical location, types of services, financial outlay and availability of qualified staff. Although this service backlog is important to note, it is not the key issue raised in this paper. This study focuses on the implications of MyAgedCare as a digital platform and how this, in turn, affects patient-centred care.

Healthcare systems are becoming significantly more complex with the ever-changing healthcare needs of the population (Leyshon & McAdam, 2015) and more professionals becoming involved in each individual patient's care. Healthcare is the product of a complex adaptive system, composed of people, equipment, processes and institutions, which all work together (Clarkson, Dean, Ward, Komashie, & Bashford, 2018). When healthcare systems operate at their best, there are ongoing overall improvements in the system's function. However, failing to meet needs within any part of the system impacts negatively on the remaining components (Braithwaite, 2018). Therefore, the research argues that by applying a systems thinking lens, the complexity of the different interacting internal and external environments within organizations, health systems and society for example, can be better identified and understood. The systems complexity highlights both problems and opportunities and requires responsive organizations and systems capable of adjusting to changes. The ability of the system or components of the system to respond to changes all depends on one's ability to understand influences (Lebeir, 2006). Systems thinking can provide a holistic view, as well as an understanding of the different components that build the system, and assist in identifying areas requiring revisiting (Gorod, Hallo, & Nguyen, 2018).

1.1 | User-centred model: A systems view

This research tests a user-centred model developed in earlier research. Previous research has tested the viability of a user-centred model for understanding the various systems impacting the potential users of public sector services, especially as they shift to digital (Papavasiliou, Reaiche, & Ricci, 2019a,b). As shown in Figure 1, this model outlines four key systems that have an impact on users of public sector services. The model was created using a systems thinking lens, in order to determine the most important factors. The model is based on an analysis of digital, business, technology and innovation systems. The analysis determined four primary systems impacting the user's willingness and ability to adopt a digital service within a mandatory space. This research defines mandatory environments as 'Public Sector Organisations who must by legislation provide Digital Platforms for their services' (Papavasiliou et al., 2019a,b). This definition has been expanded to include those individuals who are affected by the change, for example, those who are seeking aged care services from MyAgedCare, who must use the digital platform to obtain assistance.

FIGURE 1 User-centred model with the user as the centre focus (Papavasiliou et al., 2019a,b) [Colour figure can be viewed at wileyonlinelibrary.com]



The key factors and elements of this model emerged by observation and interpretation of all the stakeholders and interactive elements within the system and all the parts of the broader system. The purpose of adopting a systems lens to build this model is to provide a user-centred research approach, which can guide policymaking as well as provide better support and understanding of the various needs of the different users. Previous research does not focus on factors that impact a user's ability to adopt and participate within a mandatory digital system. The existing research provides minimal discussion on how digital adoption can differ in mandatory and voluntary environments. Through a thorough literature review, a number of factors within a user's environment were identified as having considerable impact on willingness or capacity to adopt mandatory digital services. Therefore, this research seeks to explore elements of support, human capital, social norms and community and how they link back to policy. The results of this study are focused on the digital system quadrant of the model.

Figure 1 outlines four key systems that emerged from an environmental analysis of the impact on mandatory digital service users and how they, in turn, influence the system, forming the background of this research. The first quadrant is the environment (e.g., interactions with other people), which includes culture and social norms as they outline perceptions of the environment (Herrera et al., 2016; Hall & Khan, 2002). To be truly inclusive, public sector entities must understand the environment and the effect on the users. The environment also

includes access to technologies, services and communications infrastructure, as well as education level and socioeconomic and employment status.

The second quadrant is digital systems (e.g., how digital products are accessed), which includes human capital that impacts a user's capacity to interact with the system (Buchanan et al., 2016). The digital systems quadrant is defined as a distributed, adaptive, open socio-technical system with properties of self-organization, scalability and sustainability inspired from natural systems. This is composed of four elements. Firstly, support (and assistance) involves the provision of help to users, often used to provide guidance on how to best use the services provided. Secondly, human capital is defined as the skills, experience and knowledge held by an individual, group or population and is viewed by value and costs to the country or organization. Thirdly, the markets are based on supply and demand of the various securities, goods and services within a single nation as well as between multiple nations. Fourth, culture is the particular people or societal group, encompassing their basic ideas, customs and social behaviour.

The third quadrant is the public sector, which requires understanding the responsibility of government and their agencies to implement and regulate policies enforcing mandatory services (Bach et al., 2012). The public sector is composed of elements of the economy, which are controlled by the state (or government) and are composed of services and enterprises that are public. Within the public sector, policy is defined as actions adopted or proposed by organizations to achieve specific

outcomes based on procedure or protocol. Legislation is the law enacted by the governing body and is based on the legislative priorities of the government. This is largely impacted by the current government—the federal executive government—led by the Australian Prime Minister and elected through a federal appointment. Legislation is also impacted by leadership, which is the action of a group of people or an organization (including the state and public entities) who lead change to assist in enacting the legislation or policies. These policies dictate how the office manages the provision of services, what is included within the MyAgedCare jurisdiction and so forth and are therefore of interest to this research.

Finally, the fourth quadrant considers mandatory services (which differ markedly from voluntary) and the role public policy and sector entities play in enforcing such services (White & Heckenberg, 2012; Yildiz, 2007). This interaction has been impacted by the implementation of digital first policies. These policies are complex and difficult to understand and alter. These elements should be considered, explored and understood in order to gain a holistic view of the users and their barriers to long-term adoption of mandatory digital services.

2 | LITERATURE REVIEW

2.1 | Patient-centred care

Patient-centred or person-centred care is a critical component of medical care worldwide. According to the American Institute of Medicine, patient-centred care is defined as being respectful of and responsive to individual patient preferences, needs and values and ensuring that patient values guide all clinical decisions (Institute of Medicine, 2001). It ensures that all patients and their families (and carers) are cared for in ways that are meaningful and valuable to each individual patient (Vimalachandran et al., 2017). Patient-centred care strategies include promoting relationship-based care by providing caring, healing environments and removing barriers that impact care. These strategies should increase the patient's ability to reach healthy goals, whilst being alert and present and promoting patient involvement in health and treatment plan discussions (Carman & Workman, 2017; Cheng, Karimi, & Leggat, 2016; Roberts, 2016). Research suggests that patient-centred care is defined as the way forward to overcome the rapidly escalating dehumanization of medical care (Miles & Mezzich, 2011a,b). The application of patient-centred care principles is becoming more complex with the shift to digital first service provision worldwide—a phenomenon becoming more prevalent in healthcare practices.

However, with the increased application of patient-centred care, the perceptions of how care is provided becomes directly linked to how the transition to digital health platforms occurs.

MyAgedCare is a digital health platform designed to provide a 'one-stop shop' for older Australians accessing aged care services. The aim is to promote an environment that is inclusive to the aged care needs of all Australians and to tailor and coordinate integrated care plans to best suit the holistic needs of the individual. Discrepancies will exist between the health professionals' and clients' perspectives relating to what is considered appropriate and necessary healthcare needs and services and the associated timeframe for implementing services. There is a myriad of factors that will impact an individual's perception of the care they receive. The aim of an inclusive aged care system is to promote an environment, which removes barriers and facilitates an affordable and equitable system of accessing services. However, the adoption and implementation of a digital health system have the potential to negatively affect an individual's inclusion (Atkinson, 1998). Issues such as the digital divide, security concerns and lack of knowledge of available services (online or offline) can lead to exclusion, and this is of great concern. It is important to understand not only the role of MyAgedCare and the effect the platform has on individuals but also the possible implications of providing services to older Australians in this format.

2.2 | Digital inclusiveness

Inclusion incorporates numerous concepts such as awareness, acceptance, respect and understanding and equal participation opportunities (Thompson, 2017; Wallace & Pillans, 2016). Inclusiveness requires an environment encouraging people with different characteristics, backgrounds and ways of thinking, to work together to fulfil their potential (Thompson, 2017; Wallace & Pillans, 2016). This requires considering both internal and external stakeholder perspectives, placing value on all perspectives (OECD, 2015). Social inclusion and exclusion are processes, not a singular outcome, and understanding the causes of exclusion and inclusion are important (Atkinson, 1998; Saunders, 2003). Social exclusion occurs when inclusion is either not achieved or not possible. Social exclusion is not limited to individuals—it is possible for groups to be affected (Atkinson, 1998). Saunders (2003) states that social exclusion and inclusion are multidimensional in nature, as they reflect combinations of multiple interrelated factors. This indicates the need for research into the different users to be

multidimensional in nature, to meet the needs and issues associated with social inclusion as well as digital inclusiveness.

Looking specifically at services in the public sector, it is clear that creating completely inclusive services is a complex process, especially with the transition towards digitalization of key services. Digital inclusiveness involves many components of the digital system—an aspect discussed later in the paper. Digital inclusion considers access to ICT and the resulting social and economic benefits for users (Thomas et al., 2018). Digital inclusion is impacted by digital skills, connectivity and accessibility. Digital skills include the capacity to use technology to connect with the services (internet and computer), connectivity is having access to the internet (the infrastructure) and accessibility is having user-friendly digital services that assist in accessing the service (UK Government, 2014). This raises the question—does digital health have potential negative implications on levels of digital inclusiveness?

2.3 | Digital health

The purpose of creating and utilizing digital health platforms in society is to positively influence and support patient-centred care (Ovretveit, 2017). Digital health systems are becoming a worldwide phenomenon (World Health Organisation, 2015). The focus is on retaining strong patient-centred care, utilizing technologies to improve how effectively patients manage their health, providing better ways to monitor healthcare and providing more streamlined platforms for the delivery and management of healthcare (World Health Organisation, 2018). It is evident that the role of digital technology in healthcare is to inform, support and build capacity to empower individuals seeking better healthcare or managing chronic illness (World Health Organisation, 2018). However, the difference between digital technologies and digital health must be acknowledged: Digital health is the provision of tools that help educate, empower, inform and motivate individuals and their families to navigate the healthcare system (World Health Organisation, 2018).

As outlined in the Australian National Digital Health Strategy, shifting healthcare provision to incorporate digital services and strategies increases ease of access and flexibility, improving how and when individuals seek healthcare (Manovel, 2017). Therefore, digital health solutions should be based on teaching and empowering everyone to improve their own healthcare. A successful move to digital healthcare platforms requires that all patients have the capability to understand and access all

provided information and indeed the desire to utilize digital means (Giedrojc, 2016).

This raises the question of whether there is too much reliance on digital healthcare and whether we are meeting the needs of patients who need support the most. Research highlights that digital health is not a one-size-fits-all solution. The application must be flexible, allowing users to mix and match how they obtain their healthcare—from different technologies to traditional approaches (PCCRC, 2018). Furthermore, services need to adapt to different types of patients; for example, digital services for older patients should be increased; however, not all groups should be expected to welcome them (Manovel, 2017). For digital services to be successful, they need to exist in parallel to traditional services, not simply replace them (Manovel, 2017). Generally speaking, policymakers and regulators are struggling to keep up with technological developments, especially in healthcare, thus raising questions about universal healthcare access, ongoing inequalities in society and exclusion of patients and healthcare professions from technological developments including digital healthcare strategies (Giedrojc, 2016). Therefore, it becomes imperative that the Australian Public Healthcare System needs to acknowledge the limitations of the current one-size-fits-all mentality and embrace a more patient-centred culture, enabling a more manageable, realistic and effective system (Manovel, 2017), especially when it comes to digital health services. Digital health services, in particular for those older than 65, can result in digital divide; therefore, this research is particularly focused on further exploring and understanding the impacts of the shift to digital health on patient-centred care.

2.4 | Digital divide

One of the most significant issues impacting the use of digital healthcare services is the digital divide, whereby in Australia, more than 2.5 million individuals are still not online (Donaldson, 2018), and the digital divide is largest in those older than 65. The digital divide is defined as the gap between individuals or groups with limited access to digital information and services, compared with those who have effective access (Thomas et al., 2018). Research suggests that the digital divide is the result and cause of digital services and information not being completely inclusive. With the shift of government services to online delivery methods, there is considerable potential for older Australians to be disadvantaged from the greater use of emergent and dominate communication technologies (COTA, 2019), as digital services tend to leave older Australians out (AgedCareGuide, 2017). The

aged population is inherently vulnerable, and many individuals are reluctant to take up digital technology because of, for example, concerns around their own ability to use the technology effectively and fear about potential scams and breaches of privacy. Misuse of technology can also lead to erroneous self-diagnoses and consequently an urgent need to seek face-to-face explanation and assistance (Page, 2017). This raises the question—how do digital health platforms impact service use?

In Australia, only 15% of individuals older than 65 years indicated that they have accessed government or health services online, and 54% of people aged 65+ stated that they were somewhat or very dissatisfied with the concept of interacting with government by digital means (COTA, 2019). By not taking these statistics into account, 85% of older individuals may be missing out on vital healthcare services, which are provided online, especially aged care support, facilities and assistance (AgedCareGuide, 2017). Ironically, there is more information about aged care services available online compared with other mediums (e.g., face-to-face and printed materials), but those who would benefit the most from this information are missing out because they are not accessing it. Therefore, digital interventions could negatively affect practices, user experience and outcomes (Shaw, Hines, & Kielly-Carroll, 2018).

There are practical concerns about how to achieve equitable levels of access between different social groups and public services, and much of the current research does not take into consideration enough environmental factors to overcome the digital divide. As society is not homogenous, providing basic and uniform access to the general community is not sufficient. Government services need to align their design and application to the needs of the community, to encourage digital inclusiveness and begin to breakdown the digital divide.

3 | METHOD

This research uses a qualitative, rational and interpretive lens and employs a systems view to interpret, define and explore various stakeholders' perspectives of the problem under scrutiny. Data have been collected from concerns, interpretations and perceptions of various stakeholders engaged with the MyAgedCare platform; however, the main focus of investigation has been a case study. The case study further underpins the actor's perception on 'What do they think of the MyAgedCare platform?' The data were consolidated and anonymized before being analysed to identify common themes and trends within the responses. The data collected were based on a single question, but further research is underway with

additional questions. The additional analysis conducted was on existing data provided outlining environmental components.

The case study approach was applied to assist in creating a detailed investigation, providing an in-depth analysis of the environment and processes within this particular case: MyAgeCare (Johnston, Leach, & Liu, 1999). The purpose of utilizing a case study is to obtain insights and information very specific to the area being explored, including offering significant detail and analysis opportunities for behaviour and processes that influence context and processes and vice versa (Hartley, 2004). The use of a case study approach provides a holistic single unit analysis, used to build a meaningful analysis of a singular event or organization (Ball, 1996). Miles and Huberman (1994, p. 25) state that a case study is best applied to explore an event that occurs within a bounded context. Yin (2003, p. 13) also encourages the use of case studies to explore specific real-life research questions and to understand the environment, which is especially relevant when a research question has clear boundaries between an event and the environment.

3.1 | Multidimensional stakeholder analysis

Through the application of a multidimensional stakeholder analysis, various stakeholders who were impacted by the need to obtain access to healthcare services (specifically aged care) through MyAgedCare were identified. As stakeholders can be a broad subset of the population, within this research, it was important to identify who could provide the most relevant responses. Stakeholders are defined as 'any group or individual who can affect or is affected by the achievement of the organisation's objectives' and 'those groups or individuals who are vital to the survival and success of the organisation' (Freeman, 1984, p. 46; Freeman, Wicks, & Parmar, 2004, p. 32). Within this definition, employees, users of products and services, members of the community and government and non-government organizations are included (Freeman et al., 2004). Through understanding the different stakeholders, an organization or system can understand a problem in the variety of different ways stakeholders view it; however, this increases ambiguity, self-interest and politics (Gorod et al., 2018). Through the use of a multidimensional stakeholder analysis (based on systems thinking principles), complexities and stakeholders within the system can be understood (Preiser, 2019). This approach can improve meaning-making obtained through the analysis of stakeholder

perspectives, build greater relationships with diverse stakeholder groups, increase collaboration, support communication and connectivity, utilize evidence-based data sources to encouraging knowledge creation and adapt organizational strategic planning to incorporate stakeholders (Preiser, 2019).

Once the attributes of specific stakeholder interest groups have been determined, applying a multidimensional lens highlights the complexities within the stakeholder group (Kivits, 2013). This can be achieved through applying numerous techniques in parallel with comparing stakeholders' specific characteristics. A multidimensional stakeholder analysis identifies all stakeholders and their role within the system (Mok & Shen, 2016). Both primary and secondary sources are required to identify, understand and acknowledge all stakeholders. The proposed process involves identifying the stakeholders and determining where they fit in the questions outlined in Figure 2.

This research utilizes a multidimensional stakeholder analysis to build a holistic representation of the views of stakeholders who form the systems. The critical approach utilized emphasizes the elements within the system outlined in the conceptual model outlined in Figure 2. The model assists in understanding broader public sector systems, creating a consultancy approach. The application of the multidimensional stakeholder analysis was able to assist in identifying key stakeholder groups within the population, specifically those who require consultation and are significantly affected by the use of digital platforms to obtain aged care services.

As a result of the multidimensional stakeholder analysis, three primary stakeholder groups were identified as requiring consultation. These include healthcare providers (e.g., agencies), allied health practitioners (e.g., nurses, doctors and social workers) and patients and carers. Consultation in this instance required seeking

feedback and perceptions of using the MyAgedCare platform from all three stakeholder groups.

3.2 | Systems thinking: Soft system methodology as a useful means for structuring MyAgedCare complexities

A systems thinking lens was applied to this research. Systems thinking is defined as, 'Where the whole is more than the sum of its parts' (Kim & Kollak, 2006). Therefore, a person's interaction with their environment comprises a whole-person system; this includes inputs, throughputs and outputs. Ackoff defines a system as a set of interrelated elements, with each element connected to every other element directly or indirectly (Ackoff, 1999). Therefore, systems *thinking* is a perspective, a set of tools and methods and a language or vocabulary that assists in providing a holistic view (TAPPC, 2014), and the systems view is composed of many units operating independently, each focussed on its own performance. Both the systems thinking and view come together to build a broader system (Reid, Compton, Grossman, & Fanjiang, 2005). Within the healthcare space, this includes the patient, healthcare practitioners, the organizations and the political and economic environment. All of these are independent of one another, however link together to build a broader system, which requires understanding (Reid et al., 2005).

Adopting a systems perspective as a method enables the identification of the different patterns of distributed risks, challenges and opportunities, rather than fragments or individual episodes (De Savigny & Adam, 2009). Through this systems view, we can gain a deeper understanding of the distribution, linkages and relationships among the processes that characterize an entire system and encourage proactive solutions (De Savigny & Adam, 2009). Systems thinking is used as a way to explore how the different components interact, in a diagnostic manner (TAPPC, 2014). By understanding the different components within the system, innovative changes can be made to meet the changing needs and expectations of the stakeholders (Adhikari, 2018). Therefore, conducting assessments of the system at a single point in time does not appropriately capture the dynamics of system population or the interactions that shape health outcomes (Leslie et al., 2018). The application of a systems lens within this research, combined with the multidimensional stakeholder analysis, is providing a holistic view of the elements impacting digital health adoption.

Soft systems methodology (SSM) is described as systemic, as opposed to a systematic approach used to

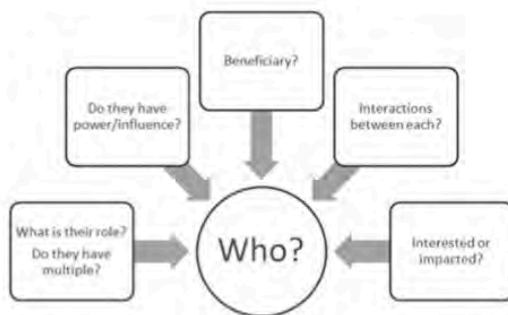


FIGURE 2 Stakeholder identification questions (Jacka & Keller, 2009; Mendelow, 1991; Mitchell, Agle, & Wood, 1997)

manage soft systems problems (Emes and Grifaeths 2018). SSM utilizes an interpretive perspective of social setting, whereby a social setting and reality is an ever-changing environment of the social process in which human beings continuously negotiate and renegotiate with others their perceptions and interpretations of the world outside themselves (Checkland, 1981). Therefore, reality from this perspective is complex and cannot in itself be assumed to be composed of systemic properties (Checkland, 1985). The purpose of SSM is to improve real-world situations and problems, through the coordination of changes within the cyclic learning process (Bergvall-Kåreborn, 2001). SSM provides a view of human activity, as it cannot be easily structured, specifically with regard to appreciation, norms, relationships and emotions (Vickers, 1968). Thus, SSM guides the exploration of a problem situation that occurs by repeatedly confronting the conceptual-systemic constructs within the real problem situation (Lane & Olivia, 1998).

The general agreement amongst researchers is that SSM can be applied to complex management problems as the process provides a rich inquiry process, a problem structuring process, a goal formulation process, or sense-making device (Galliers, 1995; Mingers, 1995; Nuseibeh & Easterbrook, 2000; Ormerod, 1995), with the overarching aim to deal with fuzzy or soft problem situations, especially where there are multiple stakeholders and diverse interactions (Checkland, 1981; Rosenhead, 1989). SSM looks at the different relationships within a project and unravel them, to enable better decision-making (Jackson, 2003).

Within this research, the two stages of general problem solving in SSM were applied: (1) the definition and analysis of the problem and (2) the decision-making. Stage 1 included the identification of issues and the context of the analysis, understanding the problem situation and apprehending the problem from the perspectives of the different stakeholders (Brown, Cooper, & Pidd, 2006; Shalhoub & Qasimi, 2005; Hanafizadeh & Mehrabioun, 2017). The second stage of problem solving in SSM is to improve the decision-making and policymaking and develop a framework and scope for decision-making (Hanafizadeh & Valizadeh, 2014; Luckett & Grossenbacher, 2003). To achieve this, rich pictures were used to visualize the problem space. A rich picture is a mechanism for understanding complex problems by drawing a detailed representation. The rich picture is based on numerous elements, containing all of the information deemed necessary for understanding the problem space, whereby the picture captures different components or stages of the problem (Avison, Golder, & Shah, 1992).

4 | FOCUS GROUPS AND INTERVIEWS

The focus groups covered two of the identified stakeholder groups, and the interviews covered the third. Two focus groups were undertaken to understand the impact of creating digital services as the primary access point for obtaining aged care services. Each focus group contained seven participants representing each of the different stakeholder groups and sought responses and reactions to MyAgedCare. The focus groups sought responses from allied health practitioners and healthcare providers. The purpose of utilizing a focus group was to capture the views of a small and demographically diverse group of people but potentially representative of the broader population (Calder, 1977; Morgan, 1996). Focus groups generate data collection through interactive discussions with the participants, providing the opportunity for all participants to discuss their experiences and identify differences and similarities (Morgan, 1996).

The responses were documented by an independent third party who was not part of the research and was unaware of the purpose of the research. Ensuring that the scribe was independent of the research and unaware of the research questions and purpose provided additional validity to the documentation of the responses and minimized potential biases. Upon the completion of the focus groups, a number of the participants provided additional views through email, which included elements that they were unsure of sharing with the broader group ideas that came to them later that day and experiences they had after the focus group.

Outside of the focus groups, patients and carers were given the opportunity to provide their feedback through a short interview asking the same questions. This was due to many of the patients and carers wishing to discuss their experience, however not within focus groups. Interviews were offered based on the emotive nature of the topic of aged care and end of life care; as a result, 10 interviews were conducted. The interviews were semi-structured, intended to be informal and flow like conversations, with some loosely structured questions (Edwards & Holland, 2013). This allowed the participants to guide the direction of the interviews and provide their views and perceptions of the MyAgedCare platform.

The primary questions asked of the participants included

1. Do you (or your patients) use digital services?
2. Why are you (or your patients) not using digital services?
 - a. What factors are preventing your (or your patients use)?

3. Have you used the MyAgedCare Platform?
 - a. When you used the platform, were you using it as a patient, carer or healthcare provider/practitioner?
4. What do you think of MyAgedCare?

Interestingly, the responses to Questions 2 and 3 yielded the same results. Therefore, only one has been outlined.

5 | DATA ANALYSIS

The Gioia method for qualitative research was used to explore the data. The Gioia method requires the researcher to step back and then categorize the accounts into three different phases (first, second and third order). The first order, 'Concepts,' is the 'voice of the user' (also known as 'voice of the customer') (Gioia, Corley, & Hamilton, 2012; Gioia & Chittipeddi, 1991). The second order, 'Concerns and Statements,' takes specific sentences from participants and then groups them together to discover the themes and patterns in events and accounts (Gioia et al., 2012; Gioia & Chittipeddi, 1991). These create second order, 'Themes,' that are more generalized underlying explanatory dimensions, to test consistency and patterns (Gioia et al., 2012; Gioia & Chittipeddi, 1991). Finally, the third order, 'aggregate dimensions,' creates more generic themes that encompass all of the second and first orders' themes (Gioia et al., 2012; Gioia & Chittipeddi, 1991). Significance was measured through counting occurrences of first-, second- and third-order elements to identify themes and patterns throughout the different accounts. The patterns in the text were then linked by connections, highlighting key features and emergent concepts or themes that require further analysis. The Gioia method in the case study was completed manually; however, in future research, text mining and content analysis techniques will be applied.

The themes within these data were obtained through the inductive approach, which allowed the data to determine the most relevant and common themes. This involved utilizing both a semantic approach, which included analysis of the explicit content within the data, and following the voice of the user; all this whilst also incorporating the latent approach that involves including the subtext and assumptions, which are underlying in the data. The first step involved identifying the key phrases (or voice of the user) used frequently across the different clients. The second step involved identifying themes, which are broader statements than codes or voice of the users, where patterns have emerged among the various statements. These themes were then categorized into

overarching statements, which encapsulated numerous themes and statements from users. The Gioia analysis was undertaken by two separate researchers who conducted the analysis independent of one another, providing both credibility and validity of results.

6 | FINDINGS

Figure 3 outlines a refined form of a rich picture, which highlights the complexity of the process of accessing aged care services through the MyAgedCare platform. This rich picture also identifies three primary stakeholders who are valuable within this research: the patients, the allied health practitioners and the health providers.

- The patients are those who are influenced by changes made in it; they are beneficiaries of the system and are impacted by the manner in which the services are provided.
- The allied health practitioners include those individuals who are interacting with the patient to provide care (e.g., nurses and carers); they are impacted by changes made to the manner in which services are provided and the amount of time they can spend with each individual patient.
- The healthcare providers are the firms who are responsible for implementing the plan created for each patient; they provide the various allied health practitioners and are capable of influencing the various policies and how they are implemented within their firms.

Only 10% of patients indicated that they were currently using any digital services. The majority of individuals stated that they were primarily using digital services for banking and online shopping. This is similar to the published statistic, which stated that only 15% of all those aged 65+ used digital services (COTA, 2019). Both of these results indicate that there is a potential issue around ongoing aged care service being exclusively digital. Although patients can and do ask an allied health practitioner or doctor to seek an aged care referral on their behalf, this does not seem to be the reason they are not accessing digital platforms themselves.

Through an analysis of responses to the environment quadrant of the user-centred model, this research identified responses for social norms and the community to understand the different perceived barriers outside of the digital system. There are a number of social norms within the community in Australia: Table 1 outlines the responses to the question, 'why are you not using digital health services?' The two primary themes were lack of clarity of what digital services are or being completely

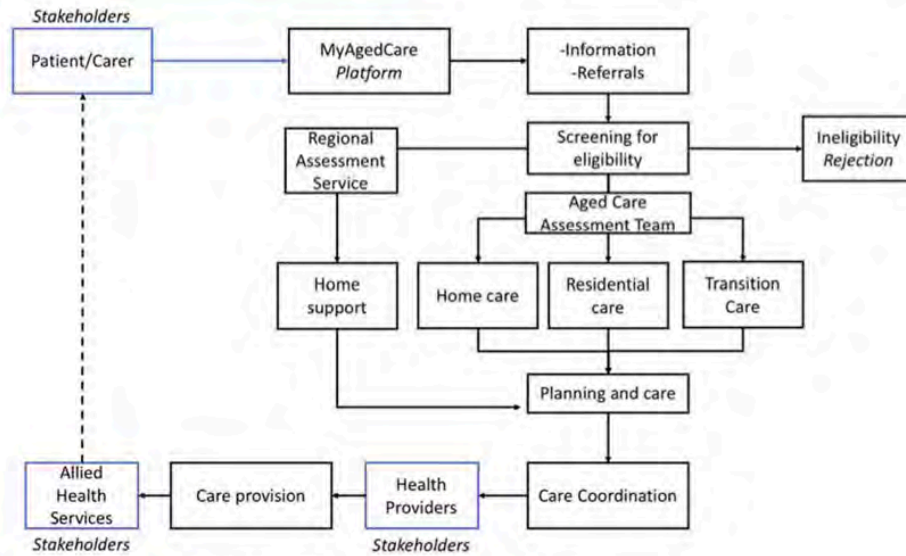


FIGURE 3 MyAgedCare access system: aged care services

TABLE 1 Responses to ‘Why are you not using digital services?’

Aggregate dimensions	Themes	Voice of the users
Complexity of digital services	Security concerns	-Fear of scams -Not sure which is the real website and which is fraudulent -Computer/cyber security concerns
	Digital literacy and access	-Have no experience utilizing a computer or accessing the internet -Unclear on what a digital health service is -Have no access to the internet of computer
Lack of personal connection	Face-to-face	-Why can I not speak to someone in person? -Digital health means that I am not having my needs assessed through a conversation with someone and I have to provide all of my personal and private health details over a web forum

unaware of the availability of these services. Within the community, there is considerable confusion about available services, the role of MyAgedCare and the complexity involved in obtaining aged care services. Those seeking aged care help often ask for assistance from family members who form advocacy roles, but in doing so, they also disempower the individual requiring support and inhibit forming patient-centred care. The themes and issues outlined within Table 1 demonstrate a number of complexities that need to be addressed within the digital service area, in particular the elements needed to provide proactive and easy to use services.

Table 2 outlines the different responses to the question, ‘what do you think of MyAgedCare?’ The majority of responses provided negative feedback. Individuals seeking aged care assistance are usually doing so under uncertainty, fear or urgency and therefore can be highly emotional, and this needs to be taken into account when analysing the results. Individuals involved in the case study were those who required palliative care, those who were deteriorating quickly and identified that they required urgent assistance because they were no longer independent or were a carer/family member organizing care on behalf of a loved one requiring palliative care. There are numerous questions that required for the assessment within MyAgedCare to determine whether an individual requires support, can live at home or needs to be moved to a nursing home. These questions were deemed by respondents as being highly intrusive, especially when they are asked in an online forum. Although there is an understanding that the responses are

TABLE 2 Responses to 'What do you think of MyAgedCare?'

Aggregate dimensions	Themes	Voice of the users
Lack of support	Assistance provision	-Rude staff
		-Staff demanding to speak to client directly despite acknowledgement of advocate availability
	Confusing	-Hearing impairment impacting communication
-Language barriers		
-Terminology used by staff		
-Questions deemed by clients as intrusive and unnecessary		
-Inaccurate information provided on website		
-Clients unable to understand the different services and costs involved—written information only with a lack of visual representation		
-Sometimes inaccurate representation of available services		
-Availability of services for under 65 years		
Difficulty accessing		-Vision impairment
		-A lack of comprehension
	-Unreliable or no internet in the home (particularly rural and remote)	
	-Mobility impairment—unable to leave home to use public access computer	
	-Inability to express urgency	

necessary, to ascertain where government funds are allocated, the digital format provides no ability for individuals to explain their responses or seek additional information.

7 | DISCUSSION

The results of this case study demonstrate considerable differences between the system provided and the

expectations and needs of the system required by service users. As per the results of a multidimensional stakeholder analysis, there are a number of stakeholders who remain outside of the consultation, information and design phases of the services. Stakeholders of the MyAgedCare platform are the individuals who are eligible to use the service. However, in this research, the stakeholders explored are the patients, carers, healthcare providers and allied health practitioners utilizing the MyAgedCare platform. These patients are those who are older than 65 years and have or are utilizing the platform to obtain services for Palliative care from the Australian Government. One of the results of the multidimensional stakeholder analysis identified that the government (MyAgedCare) excluded some of the stakeholders in consultations prior to the implementation of the platform; including carers, service providers, family members, non-users and extended healthcare practitioners. The three different stakeholders that were analysed play different roles within the system. Patients are the service users or beneficiaries, whereas the allied health practitioners are those who make the referrals for the patients to obtain services, working as healthcare workers, and the healthcare providers are the case managers who ensure that the services provided to patients meet their current conditions and requirements. There are ongoing interactions between the patient and MyAgedCare to obtain the necessary services, particularly as needs often change quickly, and services may be required urgently. Constant interaction also occurs between the health professional, the system and the patient. The role of the healthcare provider is to ensure that the services provided meet the ongoing and changing needs of the patient and allied health practitioners, to provide patient-centred care within the budgetary constraints. Interestingly, both the patient and the allied health practitioner are impacted by the service provided. If the services provided to the patient are deemed as beneficial to the patient, then the patient can feel empowered by patient-centred care. A beneficial experience in this research is defined as one that is useful and/or acceptable. The allied health practitioner in turn feels as if they have achieved their role as case manager and health worker, by providing the best outcomes for their patients.

The problem is that although there are multiple stakeholders within the system, the individual stakeholder needs are not being met. There are a variety of different needs and requirements of each stakeholder, especially when considering the application of patient-centred care. At present, stakeholders do not perceive that they are informed and/or are not consulted on the changes in the system, regardless of their role within it. The perception is that information provided is not

always clear and does not automatically provide the details in such a manner as to ensure understanding and informed decision-making, necessary in patient-centred care.

When focusing on the digital components and systems, previous research has identified that there are issues regarding digital access in seniors within Australia, which has significant impacts on how an individual may access services. Digital inclusion research outlines that digital inclusion tends to decline as age increases, whereby those aged 65+ are the least digitally included group in Australia, 14.2 points below the national average (Thomas et al., 2018), thus affecting the human capital component of the digital system, putting greater pressure on obtaining supports (either by phone or with healthcare practitioners).

Therefore, after taking these two key points into consideration, the analysis demonstrated two primary themes for individuals within this case research. Firstly, informed choices are difficult. Secondly, it is difficult to understand terminology and why there are so many questions. These issues relate directly to both the human capital and support components of the digital system quadrant and can be addressed.

8 | CONCLUSION AND FUTURE RESEARCH

As the system stands, through the adoption of a multi-dimensional stakeholder analysis, this research has provided a better understanding of the digital system and environment within the user-centred model. There is an opportunity to identify key factors that can potentially provide better care, as we are providing a broader understanding of the different needs that people have and the areas requiring attention. There is a combination of factors that should be explored when evaluating the impact of digital health on patient-centred care. These include issues with the complexities in the design of the digital health system to better suit the needs of patient-centred care. By considering the responses through the user-centred model, a number of initial barriers as well as potential enablers for digital adoption were identified. However, prior to considering the process for user-centred model, we need to take into account prevalent variables such as digital divide in individuals older than 65, as there is clear evidence on how digital inclusiveness plays a key role in patient-centred care in digital health.

Through the multidimensional stakeholder analysis, key stakeholders such as health practitioners have provided the following two key findings. Firstly, there is a direct link between technology and emotions; because

stakeholders are the centre of this model, it is important to understand how this impacts the use of the system. Health practitioners all agreed that there is a high level of emotion and sensitivity when it comes to the use of digital health services, which is only intensified with the nature of services provided within MyAgedCare (e.g., palliative care). Secondly, it is extremely important to acknowledge and understand that the system has to be personalized to a degree when it involves aged care services (e.g., displays empathy). Healthcare professionals stated that the acknowledgement through the system highlighted the importance of displayed empathy and patient-centred care and assisted with providing a digital health platform that is not disruptive.

Within the community, greater advocacy and information need to be provided on the availability of services and the manner in which they are obtained and training provided on the use of the MyAgedCare platform. This will assist in empowering clients, increasing patient-centred care and continuing to build and support the use of the MyAgedCare platform (and digital health platforms generally). This forms a vital component increasing human capital and the level of support provided and can potentially assist in decreasing the digital divide and enhancing digital inclusiveness. As the results presented in this research are from a single case study, it is understood that they cannot be generalized to the wider population. Therefore, future research recommended to expand the system in understanding the complexities involved in MyAgedCare and other digital health platforms. Future research will have a particular focus on policies that will inform user model to encourage maximum digital inclusiveness.

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Appendix 4: Focus Group Questions

Systemic Governance Framework for eGovernment Digital Transformation

The purpose of this focus group is to obtain feedback on a new systemic governance framework for effective digital transformation. This framework was created as part of PhD research, which has been seeking to understand the impacts of digital transformation on users. Specifically understanding how if changes were made to the digital transformation process, digital services and products created could be more inclusive.

The focus group will start with introductory questions to understand you better, the next part will outline the terminology used and questions related to the current situation, followed by providing the framework and approach for feedback.

The responses to this focus group are anonymous.

- 1. What industry do you work in?**
- 2. What is your role?**
- 3. Length of time in your role?**
- 4. What experience or engagement do you have in Digital transformation?**
 - More than 5 years
 - 3 to 5 years
 - 2 years
 - 1 year
 - Less than 1 year
- 5. What tasks of your day-to-day operations are online?**
- 6. What percentage of your tasks/operations is completed online?**
- 7. Linking back to the last question, how does this percentage compare to 3 months ago?**
- 8. What has been your role in digital transformation projects?**

9. In your current situation what is the percentage of propriety software use (in house created software, e.g. viper) compared to commercial off the shelf software (e.g. Microsoft)?

Definitions for the purpose of this research:

Framework - Is a real or conceptual structure which intended to serve as a support or guide the building of something which expands the structure into something useful.

Approach - A way to deal with a situation or problem, this gives rise to methods. This can include the way something is taught or implemented within an organisation.

Effective - Successful in producing the desired or intended result.

Digital Transformation - Digital transformation is the process of the use and integration of new, fast and frequently changing digital technology as a means to solve problems or enhance operations. This includes the integration of digital technology into all areas of a business, organisation or government to alter how they operate and deliver services and value to customers.

System - A set of things working together as parts of an interconnecting network; a complex whole.

Constituent systems - Part of a whole and making up part of the broader system.

Value-added - the amount of value of a process increased by the addition of a new element.

Completeness - the state or condition of having all the necessary or appropriate parts.

Validity - Quality of being logically or factually sounds; soundness or cogency.

10. In your opinion, what are the challenges affecting digital transformation?

11. In your organisation, is there a step-by-step decision making guide that you utilise in your digital transformation endeavours?

- Yes
- No
- I Don't Know

12. If yes, is it a formalised process?

- Yes
- No

13. If No, do you see the need for one?

- Yes

- No

14. If 'I Don't know', would it be beneficial to obtain more information in the digital transformation process?

- Yes
- No

15. Are you guided by your intuition and experience to work through the digital transformation process?

16. What are the limitations of your existing approach?

17. Does your current approach allow you to identify all of the necessary stakeholders, their views and where they fit in the broader digital transformation?

- Yes
- No

18. Do you see value in a step-by-step approach to guide your digital transformation?

- Yes
- No

19. If yes, Why?

20. If no, Why not?

21. In your opinion, will a standardised approach help you and your organisation be more effective in managing digital transformation?

- Yes
- No

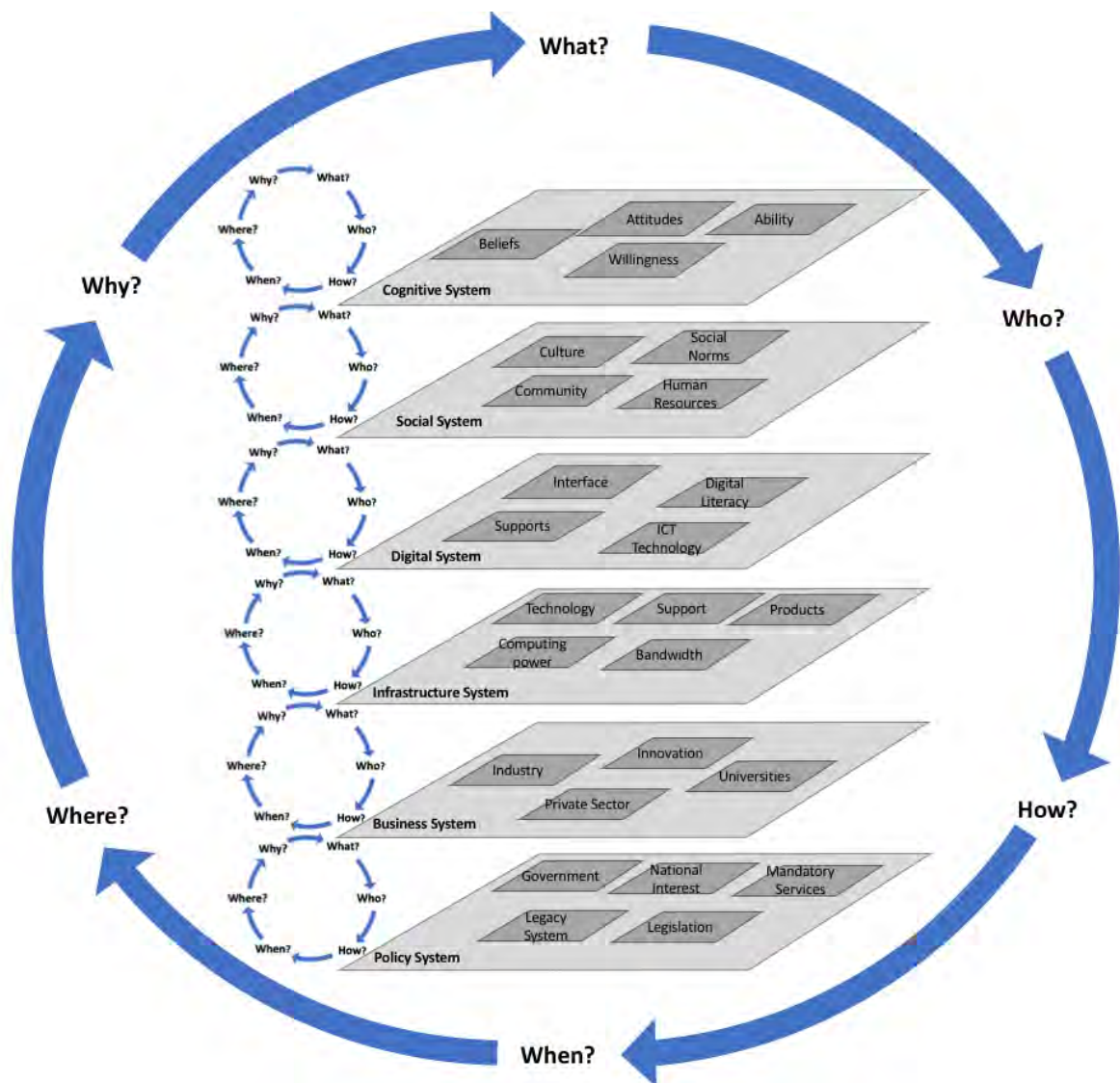
22. If Yes, Why?

23. If No, Why not?

Framework for the identification of the constituent systems and the system as a whole impacting digital transformation.

This framework identifies the 6 constituent systems which make up the broader system (or system as a whole) impacting digital transformation (and as a result end-users). For example, the cognitive system includes elements specific to the individual, their beliefs, willingness, attitudes and ability to use digital services. These elements influence the goals of the system

(in this case the individuals), by understanding the effects various elements within the system digital transformations can be better equipped to manage the system.



Approach for understanding the constituent systems outlined within the framework

This approach outlines the questions that should be asked of every constituent system and the broader system. To apply the approach, a matrix should be created for each consistent system within the framework. The responses to questions will be different for each question outlined within the approach.

For example, the cognitive system will have different results than the social system and the broader system. By answering these questions, a deeper understanding of the various views,

goals and needs of each constituent system and how they relate to the broader digital transformation system. This will help with undertaking digital transformations that are more holistic.

What?	How?	When?	Who?	Where?	Why?
What is the purpose of the system?	How external factors might affect the system?	When do reviews occur?	Who are the stakeholders in this system?	Where in the system is the feedback coming from?	Why is this approach meaningful to stakeholders?
What are the areas in the system that need development?	How management constraints are taken into consideration?	When is feedback provided?	Who are the decision makers in the system?	Where are the constituent systems within their respective lifecycles?	Why this approach was chosen?
What is the approach?	How is feedback provided?	When is feedback received?	Who is responsible for providing support?	Where are the boundaries of the system?	
What are the known constraints/risks?	How are the needs being met?	When is change documented?	Who manages risks in this system?	Where are the interfaces between systems?	
What's the role of people?	How well can the approach perform in this system?	When is system intervention most effective?	Who will use the system?		
What's the role of technology?	How do constituent systems interact with each other?	When interactions between constituent systems occur?	Who defines success measures in this system?		
What are the characteristics of an acceptable solution?	How is emergent behavior documented and observed?	When are legacy components considered?			
What are the measures of success in the system?	How are risks addressed within this system?				
What are the incentives for the constituent systems to belong to the broader system?					

Example of the applied approach in the eGovernment space

	Cognitive	Social	Broader System
What is the purpose of the system?	<i>The different levels of ability in individual users could hinder their capacity, attitudes towards and willingness to adopt digital services provided by government.</i>	<i>The different community members could have cultural and social norms which impact on others within the communities adoption of digital services</i>	<i>Meeting the needs of the users, the businesses, policy makers and ensuring there are appropriate supports and infrastructure in place to encourage the transformation.</i>
What is the approach?	<i>Provide opportunities to education on how to use the services, their value and foster an environment of willing participation in digital services through transparent decision making (providing all information individuals require to make decisions)</i>	<i>Provide information and advertisement material that appeals to the expectation and requirements of the various cultural and social needs (e.g. consult with Cultural and Linguistically Diverse experts).</i>	<i>Create a digital service interface that is inclusive and provides multiple avenues for access and support for various users</i>

Questions on the framework and approach:

24. How strongly do you agree that the framework and approach is complete?

25. What would you add to the framework?

26. Are there any options other viewpoints or stakeholders not taken into consideration?

27. What questions would you add to the approach?

28. Is the framework set out clearly?

- Yes
- No

29. If No, Why not? What would you change?

30. Do the questions within the approach cover the entire set of questions that are needed to completely understand each and every constituent system?

31. In your opinion, are the framework and approach flexible enough to be adapted and adopted in other industries?

- Yes

- No

32. If Yes, Why?

33. If No, Why not?

34. In your opinion, are the constituent systems outlined within the framework consistent with elements that should be considered when undergoing digital transformation?

- Yes
- No

35. If Yes, Why?

36. If No, Why not?

Closing questions

37. In general, what are your overall perceptions, concerns and opportunities associated with digital transformation?

38. In your opinion, can you see that the approach and framework suggested within this research will be useful? Please explain your response

39. Looking at the current situation of COVID-19, what has your organisational response been?

40. What went right?

41. What went wrong?

42. In the near future, do you foresee the approach undertaken in response to the COVID-19 situation by your organisation to be effective?

43. Did you have a step-by-step approach in place to guide your COVID-19 response?

44. Would you have benefited from having a step-by-step approach in place to mitigate risks and build in contingencies?

45. Were you able to identify all the relevant stakeholders and risks involved?

46. This final question is open, please include any additional comments or thoughts you may have on the digital transformation process and digital transformation generally?

Thank you for your time, in the near future results will be available upon request.