A Process Model for Continuous Public Service Improvement:

Demonstrated in Local Government Context for Smart Cities

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Dedication

I would like to dedicate this thesis to my father Late Rakesh Pratap Singh, and my mother Ms. Jivendra Singh. Thank you so much for your love, support, and all the sacrifices you did for me. A special feeling of gratitude to my husband Dr. Shrawan Baghel for his immense support and guidance throughout my PhD journey.

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Abstract

The new era of the smart city is accompanied by Information and Communication Technology (ICT) and many other technologies to improve the quality of life for the citizen of the modern city, that in turn, has brought immense opportunities as well as challenges for government and organizations. Local authorities of the cities provide multiple services across different domains to the citizens (e.g. transport, health, environment, housing, etc.). Citizens are involved during different stages of smart city services and provide their feedback across those domains. Existing smart city initiatives provide various technological platforms for gathering citizens' feedback to provide improved quality of services to them. Even though technological developments have resulted in a higher degree of digitalization, there is a need for improvement in the services provided by municipalities. There are multiple engagement platforms to obtain citizens' feedback for the improvement of smart city services and to transform public services. However, limited studies consider the challenges faced by practitioners at the local level during the incorporation of those feedback for further service improvement. As a result, city services fail to fulfil the need of citizens and do not meet the goals set by existing engagement platforms. Technology-oriented solutions in the public sector domain require a logical and structured approach for the transformation of public services and digitalization. Enterprise Architecture (EA) can provide this structured approach to transform public services by providing a medium to manage change, and to respond to the need of multiple stakeholders including citizens. Thus, this research proposes a process model based on the guidelines of EA and the collaboration with practitioners that would assist local authorities to provide improved services to the citizens and fulfil their needs.

List of Publications

Singh, P. and Helfert, M. (2019) 'Smart cities and associated risks: Technical v/s non-technical perspective', CHIRA 2019 - Proceedings of the 3rd International Conference on Computer-Human Interaction Research and Applications, (Chira), pp. 221–228. doi: 10.5220/0008494402210228.

Singh, P., Lynch, F., & Helfert, M. (2020). Smart City Development: Positioning Citizens in the Service Life Cycle (Citizens as Primary Customer). CHIRA 2020 - Proceedings of the 4th International Conference on Computer-Human Interaction Research and Applications.

Singh, P.; Lynch, F. and Helfert, M. (2021). Role of Citizens in the Development of Smart Cities: Benefit of Citizens' Feedback for Improving Quality of Service. In Proceedings of the 10th International Conference on Smart Cities and Green ICT Systems - SMARTGREENS, ISBN 978-989-758-512-8, pages 35-44. DOI: 10.5220/0010442000350044.

Singh, P., Lynch, F. and Helfert, M. (2022) 'Analysis of Citizens' Feedback from the Lens of Smart City Framework: A Case Study Based Approach', *Communications in Computer and Information Science*, 1612 CCIS, pp. 107–124. doi: 10.1007/978-3-031-17098-0_6.

Singh, P., Lynch, F. and Helfert, M. (2022) 'TOGAF for the Transformation of Public Services based on Citizens' feedback: In the context of Smart Cities', pp. 1–19. (Submitted for review to journal " Digital Policy Regulation and Governance")

Table of Contents

Contents

List of Figures

List of Tables

List of Abbreviations

SC: Smart City

DS: Design Science

DSRM: Design Science Research Methodology

EA: Enterprise Architecture

TOGAF: The Open Group Architecture Framework

ADM: Architecture Development Method

BPMN: Business Process Model and Notation

ICT: Information Communication Technology

IoT: Internet of Things

ITIL: Information Technology Infrastructure Library

IS: Information Systems

IT: Information Technology

PPN: Public Participation Network

1 INTRODUCTION

A smart sustainable city is an innovative city that utilizes information and communication technologies (ICTs) and other means to improve quality of life, proficiency of urban operations and services, and competitiveness while making sure that it meets the requirements of present and future generations from economic, social and environmental viewpoints (Mohanty, et al., 2016). Smart cities do not optimally reach their goals if the end-users, the citizens, are not involved in their design (Anthony, et al., 2019). One of the main goals of smart cities is to address citizens' concerns and their needs, which should be considered as a client requirement in the design process of the services (Pourzolfaghar and Helfert, 2017). Hollands, (2008) claims that if smart cities want to empower social, environmental, economic, and cultural development, then they must be beyond the use of ICT. Nevertheless, existing literature seems to be biased toward solving the technical problems and ignoring the existence of non-technical ones which involve management, policies, and citizens, thus creating a void in the field (Habibzadeh et al., 2019; Nam and Pardo, 2011).

Policymakers and developers appear to consider smart city projects entirely as a technological initiative and ignore all other dimensions of smartness which include social elements as well (Kumar, 2019; Bednar and Welch, 2019). For instance, citizens' requirement is often neglected, at the cost of technology and strategic development which is a critical component for developing a successful smart city (Heaton and Parlikad, 2019a). Even though smart city projects empower and improve the citizens' lives, their role is often vague (Gupta et al., 2019; Peng et al., 2017). Consequently, decisions on the selection, implementation, and deployment of smart city services should be made according to the actual needs of local citizens (Gupta et al., 2019). Smart cities should value citizens' feedback and their input (Mueller et al., 2018). Nevertheless, they are asked to contribute to a set of initiatives that have already been determined in their scope, and how would they operate in a real environment (Cardullo and Kitchin, 2019). Therefore, governments and organizations need to improve their services for the citizen who is the most important stakeholder of the digital nation (Kar et al., 2019).

There is enough evidence from the literature that shows the importance of the citizens' feedback for the improvement of smart city services and to transform public services. Some of them include platforms for obtaining their feedback, providing services based on their input, co-designing and co-creating solutions with citizens, etc. In addition, many initiatives have been taken to engage with citizens at different levels (Singh, et al, 2021; Singh et al., 2020). Nonetheless, city services still fail to fulfil the need of citizens, and it is unlikely that such technology-oriented initiatives will fulfil the citizen-oriented smart city goals (Bastidas et al., 2021; Singh et al., 2021; A. Wolff et al., 2020; Alruwaie, et al., 2020; Abella et al., 2019; Andreani et al., 2019; Gupta, et al., 2019; Heaton and

Parlikad, 2019b; Simonofski et al., 2019; Cardullo *et al.*, 2018). Many local leaders felt that technology-oriented companies mainly focused on costly products that would fail to fulfil the need of the local community (Mondschein et al., 2021).

Therefore, this research introduces a process model to structure the relationship between citizens' feedback and continuous service improvement to meet the need of citizens. This thesis defines the set of activities and concepts to support the improvement of public services based on the citizens' feedback. A process model is developed as a resulting artefact to capture the key activities and concepts impacting service improvement, and for addressing the challenges faced by city authorities. Business Process Modelling Notations (BPMN) has been used as a base language to develop the process model. The rest of this chapter has been structured as follows: Section 1.1 provides an overview of the research background. Section 1.2 provides an overview of the underpinning case study for this research. Section 1.3 discusses the observation and research gap identified in this study. Section 1.4 provides an overview of the research problem and motivation for this research. Section 1.5 defines the objectives of the research, and Section 1.6 formalises the research questions. Finally, Section 1.7 provides a summary of the organization of this thesis.

1.1 Research Background

The following sections first provide an overview of the research background on different levels of citizens' participation to understand their involvement in the design and improvement of city services. Secondly, it provides an overview of the role of citizens in the field of smart cities, and finally, it provides an overview of Enterprise Architecture in the context of smart cities.

1.1.1 Citizen Participation

Arnstein, (1969) discussed different ways of citizens' participation in the planning process and renewal programmes. The author has described the planning process as a top-down technocratic exercise in which there is little focus on citizens' views or their desires. A normative theory of public participation has also been discussed in the literature that emphasises two meta principles i.e. fairness and competence (Webler and Tuler, 2000). Fairness focuses on what people are allowed to do in a deliberative policy-making process when they come together to accomplish understandings and make public decisions in a fair process (Webler and Tuler, 2000). Competence is associated with the construction of the best potential understandings and agreements, considering what is known to the participants at the time the discourse takes place (ibid). On one hand, direct citizen participation is seen as a mistrust, on the other hand, indirect citizen participation has its advantages, for instance, it protects them from the danger of direct involvement and meets the needs of a complex post-industrial society (Roberts, 2003). Existing studies have discussed many frameworks, tools, and models to

understand the participation of citizens. Cardullo and Kitchin, (2019) draw on and extend Sherry Arnstein's work on citizen participation to create a conceptual tool for unpacking the different ways in which smart city frames citizens. Their analysis shows that smart city initiatives are rooted in civic paternalism, stewardship, and a neoliberal conception of citizenship that prioritizes market-led solutions to urban issues instead of being focused on the social, civil, and common good. Citizen participation has been found as a key challenge to develop smart city projects as the main objective of those cities is to improve the quality of life for the citizens of the city (Tadili and Fasly, 2019). Therefore, all activities should be completed in cooperation with different stakeholders and citizens otherwise smart cities will not achieve the goals they intend to achieve (ibid). Government needs to create appropriate conditions for the enablement of the local communities (Van der Graaf and Veeckman, 2014).

Arnstein, (2019) offers a typology of citizen participation in eight rungs with each rung showing the power of citizens in determining the plans or programs for their cities as shown in Figure 1. According to this, Arnstein views citizens' power as the high point for producing cities that reflect the actual need and desires of citizens. However, in reality, it is difficult to achieve "bottom-up, inclusive, and empowering citizen involvement" in the decision-making of cities (Cardullo and Kitchin, 2019). Based upon Artim's theory of citizen participation (Arnstein, 1969); Simonofski et al., (2019) proposed a framework to structure and evaluate citizen participation in smart cities. Their participation has been classified into three categories as depicted in Figure 2. These categories have been defined as Citizens as Democratic Participants, Citizens as Co-Creators, and Citizens as ICT Users. Citizens as Democratic Participants aim to verify that citizens' opinions have an impact on the process of decision-making (Simonofski et al., 2019). Citizens as co-creators propose better ideas and solutions to decrease the risk of failure during the early stages of the process (Simonofski et al., 2019). Finally, Citizens can also contribute as ICT users by proactively using smart city infrastructure (Simonofski et al., 2019; Anthopoulos et al., 2016). This study focused on one of the offline engagement programs, the Public Participation Network (PPN) in Ireland to investigate the role of citizens' feedback in the improvement of the existing public services, and adapted Simonofski et al., (2019) framework to understand their participation in the context of this study. The rationale for selecting this framework is that existing research focusing on citizen participation does not provide a holistic overview of different approaches to participation in the context of smart cities. In addition, the researcher wanted to understand and examine different levels of citizens' participation and position their participation in the context of this study. Thus, this study found Simonofski et al., (2019) framework for citizen participation as the most appropriate one to understand their participation.
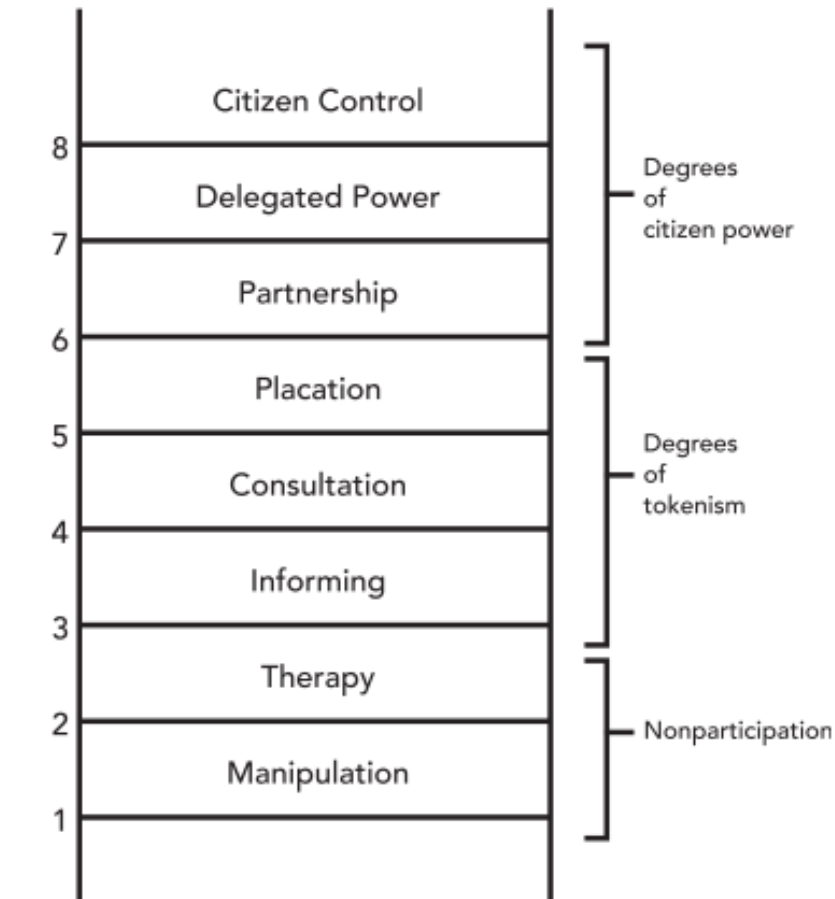
Figure 1: Ladder of Citizens' Participation (Arnstein, 2019)

The PPN engagement program selected within the context of this research can be classified under the category of "Citizens as Democratic Participants (Demonstrated co-relation between participation activities and achievement of goals)" as it satisfies the criteria (6,7,8) in Figure 2 which have been discussed as follows: The practitioners who were involved in the engagement activities provided a set of documents that indicated the formalisation and transparency of the course of action (criterion 6). Secondly, the PPN program provided evidence of the interaction between citizens and other relevant actors from the Council (criterion 7). Finally, citizens who participated in PPN program provided their inputs for setting up the priority of the projects (criterion 8). Practitioners are professionals with relevant experience and expertise from City/County Councils of Ireland who were involved in capturing citizens' feedback, decision-making process, and improving existing public services. This study further examined other secondary sources of data such as supplementary documents provided by practitioners firstly to understand the existing citizens' engagement activities and to investigate the impact of citizens' feedback for improving existing services. Secondly, to investigate the challenges faced by practitioners in the overall engagement process to meet the need of citizens/community. One of the main goals of the PPN program is to address highlighted issues or concerns by the

community and to provide improved services to them. However, isolated and unstructured internal processes within the system are some of the contributing factors for not meeting citizens' requirements and addressing their concerns effectively. The following section provides a detailed discussion on how existing literature supports citizens' inputs and feedback in the field of smart cities.
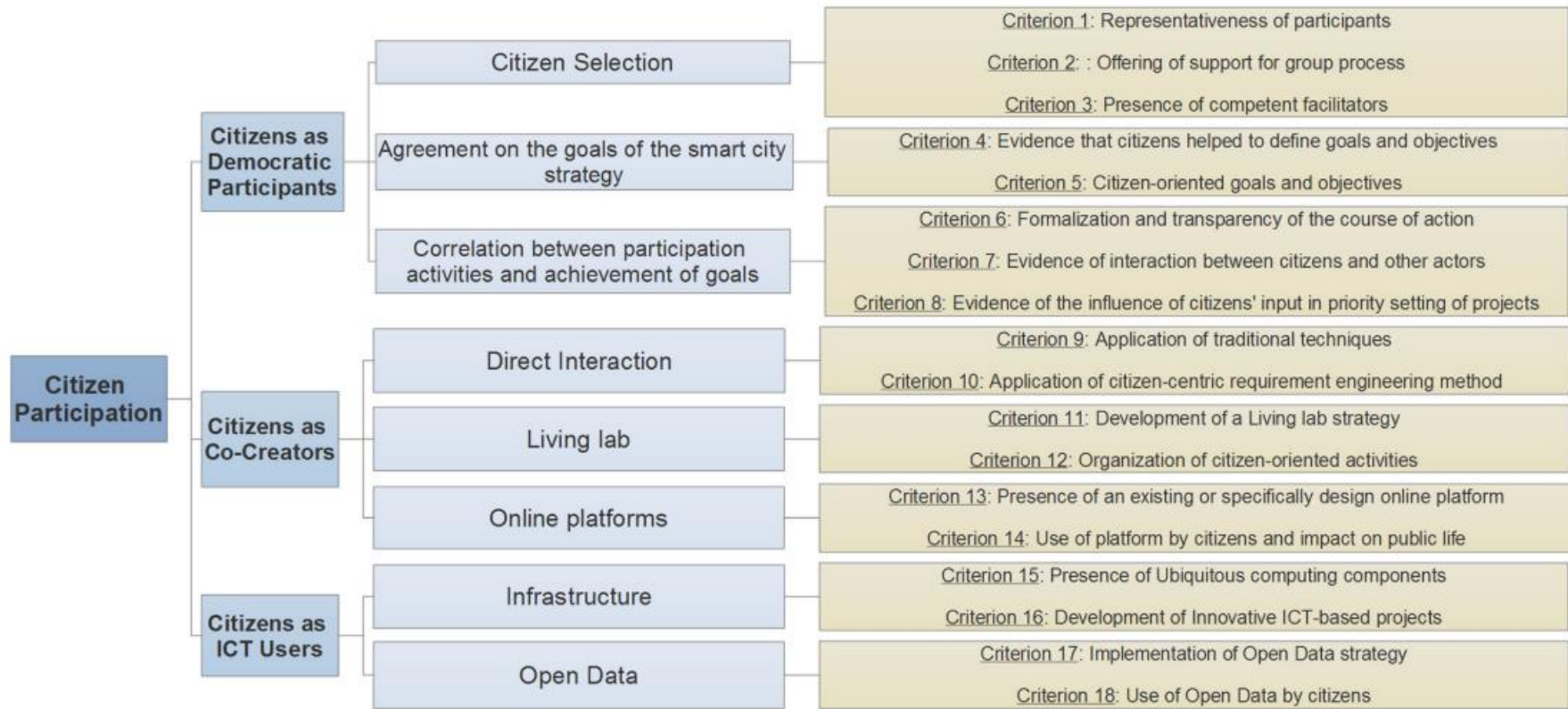
Figure 2: Classification of Citizen Participation

1.1.2   Role of Citizens in the Field of Smart Cities

Citizen engagement is needed in smart city projects to ensure that solutions are developed to meet the real need of citizens (Pétercsák *et al.*, 2016). Although technological developments have resulted in a higher degree of digitalization, there is a need for improvement in the services provided by municipalities (Bosdriesz et al., 2018). Citizens' satisfaction with the city can be predicted based on material and environmental well-being, public services and facilities, and a sense of community (Macke et al., 2019). Numerous studies have proposed solutions based on the citizens' feedback and experiences to design and improve smart city services. A methodology has been presented to design and re-design the smart city services based on citizens' experiences (Abella, et al., 2019). Heaton and Parlikad, (2019) proposed a framework that aligns infrastructure assets with city services for meeting citizens' requirements. Another study examined the impact of citizens' feedback on service performance (Allen *et al.*, 2020). Wolff et al., (2020), proposed a typology and a set of design templates that highlight citizens' capability to contribute to the design of smart cities. Similarly, Simonofski *et al.*, (2019) proposed a framework to define a citizens' participation strategy. These studies focused on providing quantitative indicators to improve the design of the services, aligning the city's infrastructure with citizens' requirements, delivering value to citizens by providing smart city solutions, analysing the impact of citizens' feedback on resolving urban service requests, turning data into services by providing tools for co-design processes, etc. However, none of the existing studies focused on the other side of the system i.e. city authorities who engage with communities, and users of the services, and focus on providing improved services to the citizens (Connolly, et al., 2017). As a result, city services do not meet the goals set by existing solutions that capture their feedback to improve existing services. Some of the contributing factors include the management, process, and structure of the organisation (Habibzadeh et al., 2019). Therefore, existing solutions in the public sector domain require a logical and structured approach for the transformation of public services and digitalisation (Helfert, et al., 2018). Enterprise Architecture (EA) can provide this structured approach for the transformation of the public services to provide improved services to the citizens (Bastidas et al., 2021). EA can support the transformation and digitalization by providing a medium to manage complex systems, and to respond to the need of multiple stakeholders (Jnr, 2021; Bastidas et al., 2021). The next section provides an overview of the EA framework in the context of smart cities.

1.1.3   The Enterprise Architecture in the Context of Smart Cities

Enterprise Architecture (EA) is a fundamental configuration of a system, incorporated in its components, environment relationships, and the principles influencing its design and evolution (ISO, 2011). It "is a holistic approach to systems architecture with the purpose of modelling the role of information systems and technology in the organization, aligning enterprise-wide concepts and

information systems with business processes and information" (Barateiro, et al., 2012, p.3301). Smart cities are extremely complex Systems of Systems (SoS), and the emerging trend in urban planning is towards adding more smart systems into the urban environment (Clement et al., 2017). Enterprise Architecture can be used to manage the complexity of smart cities and can support the digital transformation of public services (B. A. Jnr, 2021). Enterprise Architecture has been extensively adapted for planning, governance, managing constant change, complexity, and aligning organisations for achieving a common goal (Niemi and Pekkola, 2020). If cities are modelled as urban enterprises, EA can assist in smart city development and transformation (Bastidas, et al., 2017). EA in the context of cities is composed of principles, a set of models and methods that can support strategic planning and design of cities (Jnr, 2021; Goerzig and Bauernhansl, 2018; Babar and Eric, 2015). It does not provide a specification for the implementation of the projects rather it is a high-level description wherein its artefacts provide high-level guidance for the development of the projects (Boyd and Geiger 2010). It also supports controlling the city's constant system transferring strategies into actual daily implementation (Anthony Jnr, 2020). It can be utilized to provide a complete narrative of the smart city by describing the significant IT artefacts and business processes (Zimmermann et al. 2016).

EA framework has also been suggested as a way to manage multi-stakeholders and the service-oriented nature of smart cities (Pourzolfaghar et al., 2019). It provides information systems, business processes, and infrastructure required for smart city development (Goerzig and Bauernhansl, 2018). It builds transparency by documenting the tangible state of the city systems and provides city administrators with the control to manage complex processes and information systems (Anthony Jnr, 2020). It creates a blueprint of the current and future state of the Information Systems and Data for supporting urban development activities (Jnr and Petersen, 2022). Moreover, it assists in improving decision-making by forming a structured and transparent decision process (Tamm, et al., 2022). It is used by most organizations to develop business values and proficiency and provides a global approach for designing suitable services (Safaei, et al., 2022). Even though EA has so many benefits to offer, its application in the smart city is scarcely noted in research (Goerzig and Bauernhansl 2018; Anthony Jnr, 2020). The architectural approach can provide a common framework to model stakeholders' concerns (Anthopoulos and Fitsilis, 2014). Besides, it radically reduces the risks, timeline, and potential mid-project failures as compared to other approaches ("The Open Group Guide Starting an Enterprise Architecture Capability in the Government Sector," 2018). EA Layers (e.g. Information, Technology, Business) divide a system into different but interlinked components, layers, and key concerns (Bastidas, 2021). Additionally, the understanding and analysis of future smart cities will become much easier and more understandable by conceptualizing smart cities as urban enterprises (Mamkaitis and Helfert, 2016; Anthopoulos and Fitsilis, 2014). Existing concepts of Enterprise Architecture

Management and modelling methods are suitable for structuring an EA for smart cities (Bastidas et al., 2021). Consequently, EA has been identified as a suitable approach for managing the complex unstructured processes of the Council, the implementation of their smart services strategy, and the incorporation of citizen feedback for continuous service improvement. By adopting an EA approach, city authorities would be guided in their transformation of the public services based on the feedback of citizens. A detailed discussion has been provided about EA and its application in the context of this study in section 2.5 in chapter 2. The next section provides an overview of the project with County Council A which was selected as a primary case study for this research whereas other case studies were used as a confirmatory case studies to confirm the validity of the research problem and designed solution in different contextual settings.

1.2   Project with County Council A

County Council A was selected as an underpinning case study for this research. This case study was selected first to investigate how local authorities engage with citizens and work on citizens' feedback for improving existing services. Secondly, to investigate the challenges faced by practitioners in the overall engagement process to meet the need of citizens/community. To retain the anonymity of the program and the Council, the original names have been anonymised. County Council A provides public services across different domains such as housing, planning, environment, roads, community development, etc. Similarly, other County Councils also provide various public services to the local community. The focus of this study is public services that are provided by local authorities in Ireland. PPN is an offline engagement platform by which local authorities engage with the community and try to address their concerns across those public services. A detailed discussion has been provided on public services in the context of this study in section 2.1 in chapter 2. The citizen engagement program (Community prospect) under the umbrella of the Public Participation Network (PPN) was selected to investigate the research problem from the real-world environment. This program aims to engage with the local community and prioritize projects/services that are important to them. It invites members of the community to contribute to the process and provides an opportunity to discuss their views and visions for future development (*Community Prospect*, 2019). This program captures the community's view on below areas (County Council A, 2011):

1. To find out the current status of the cities/towns.
2. The vision for the future of their cities/towns.
3. Issues that matter most to them across different services.
4. The priority list of projects and action plans.

It was found during this case study that practitioners faced challenges while incorporating citizens' feedback during the implementation of their action plans for further service improvement. Consequently, they failed to address the community concerns and fulfil their need. Thus, this study proposed a process model based on the findings from the literature review and in collaboration with practitioners to address those challenges. The process model captures different components associated with the community engagement process and illustrated how Enterprise Architecture (EA) can be applied to fulfil the need of the community while addressing the challenges faced by city authorities. This project adapted TOGAF EA guidelines to provide a set of key activities and artefacts for a local government to guide them in their existing citizen engagement process for providing improved services to the community. It involves activities and artefacts from Architecture vision, Business Architecture, and Requirement management phases to address the challenges faced by the local authority. The project involves the modelling of activities associated with citizen engagement and encapsulates the key activities from adapted phases of TOGAF ADM. It guides city authorities in their action implementation plans for continuous service improvement. The BPMN language was adopted for modelling those activities following the guidelines of TOGAF ADM. The next section provides a discussion about the observation of the researcher and identified research gap.

1.3   Observation and Research Gap

The importance of citizens' feedback in the field of smart cities has been emphasized significantly in the literature (Singh et al., 2020; Simonofski et al., 2019; Cardullo and Kitchin, 2019). This research investigated various citizens' engagement platforms and programs that enable smart city stakeholders to capture citizens' feedback for the transformation of public services and cities. Some of the examples from Ireland include Unheardvoices, Civiq, PPN, etc. PPN is an example of an offline engagement program whereas Unheardvoices and Civiq are online tools to obtain citizens' feedback on different services and policymaking. Similarly, there are various platforms in the literature that provide solutions to engage with citizens at different levels and to obtain their feedback. Even though there are multiple platforms and solutions to obtain citizens' feedback, city services still fail to fulfil the need of citizens.

This research made some observations during the investigation of the problem from literature and practitioners' viewpoint. Firstly, this research identified that most of the existing studies mainly focused on capturing citizens' feedback via different platforms. Secondly, previous studies primarily focused on the technical side of the system for engaging with citizens at different levels to improve city services. Nevertheless, city services are likely to fail because of the ignorance of non-technical factors which involve process, management, structure, and citizens (Habibzadeh et al., 2019). Third, existing studies do not consider the challenges faced by practitioners during the incorporation of

citizens' feedback for continuous service improvement at the local level. As a result, city services do not respond to the concerns and needs of citizens.

Enterprise Architecture (EA) can assist practitioners in providing improved services to the citizens while addressing the challenges faced by them during the incorporation of citizens' feedback. This study adapted the TOGAF EA framework as a reference to address identified challenges in this study. The proposed solution encapsulates different components of the citizen engagement process and captures key activities from TOGAF ADM phases to align practitioners' action implementation plans based on citizens' feedback for continuous service improvement. The proposed solution in the form of a process model will provide a structured approach to practitioners to take appropriate decisions for fulfilling the need of citizens. The adapted phases from TOGAF ADM will enable city authorities in providing improved services to the citizens by considering the following:

1. **Architecture vision**

This study found that there is a lack of understanding about how the long-term vision should be defined based on the feedback of citizens to achieve the desired goals. The Architecture vision phase from the TOGAF EA framework can be useful to develop a business plan by providing details about problem definitions, processes, objectives, and responsibilities for achieving the anticipated goals (Pourzolfaghar et al., 2016). Therefore, this study adapted key activities and artefacts from this phase to address the identified challenges associated with the vision of the project in the context of this study.

2. **Business Architecture**

This study also observed during the problem investigation phase that there is a lack of consideration of quality factors which could be useful to measure the performance of the services and to address citizens' concerns. TOGAF Business architecture can guide how an enterprise (Council) needs to work to achieve its goals and react to the strategic drivers for addressing different stakeholders' concerns such as city authorities, service providers, and citizens (The Open Group Standard, 2018). Hence, this study utilised concepts such as KPIs, quality factors, drivers, and contracts from the Business Architecture phase for assessing service performances based on citizens' feedback.

3. **Requirement change management**

This study also identified that citizens' requirements often change over the period. Therefore, the constantly changing requirements of citizens should be managed based on the priority of their needs. TOGAF Requirement change management phase can assist in this process by driving the whole process of managing the new requirements while considering any changes in their specifications during the

11

development phase (Kornyshova and Barrios, 2018). As a result, this study adapted some of the activities and artefacts that support managing the constantly changing requirement of citizens within the scope of this study. The next section provides the motivation for this research and a research problem identified in the context of this study.

1.4 Motivation and Problem Statement

Technocratic solutions for the urban problems alone cannot bring improvement to the quality of life in a smart city, rather this approach can misalign the stakeholders' expectations (Marek, et al., 2017). As a result, it is unlikely that citizens oriented platforms such as Living Labs would fulfil the citizen-centric smart city goals for which the root cause appears to be a citizen engagement model (Cardullo et al., 2018). The situation has become more complex with increased digitisation, and there is a gap from the process of implementing the initiatives to the actual participation of citizens (Vidiasova and Cronemberger, 2020; Goerzig and Bauernhansl, 2018). Therefore, innovative models, methods, and tools are required that can transform strategy into action (Goerzig and Bauernhansl, 2018). There are multiple platforms to obtain citizens' feedback for improving smart city services and to transform public services. However, in practice, it is not clear how those feedbacks are linked with the improvement of the services to meet the ultimate goal of "Improving quality of life" for the citizens of the city. Moreover, these platforms do not consider the challenges faced by practitioners during the incorporation of citizens' feedback at the local level. Consequently, these services fail to fulfil the need of citizens, and do not achieve the goals set by existing citizen engagement platforms.

This study proposes a process model that would assist practitioners in continuously providing improved services to the citizens. It provides detailed activities and artefacts to structure the relationship between citizens' feedback and continuous service improvement. It provided a structured approach in the form of a process model to showcase how citizens' feedback can be incorporated for providing improved services to the citizens while addressing the challenges faced by practitioners. This will ensure that services are improved continuously based on the feedback of citizens.

Figure 3 demonstrates the general process of designing the proposed process model. The first step in that direction was to identify the design guidelines that were used to guide the design process of the process model. Then, the key activities and concepts were specified and defined based on those identified design guidelines. Design guidelines were validated based on the findings from the literature and collaboration with practitioners. Then the key activities and concepts were modelled using BPMN modelling language that supported in structuring the relationship between citizens' feedback and service improvement. It also addressed the challenges faced by practitioners during the incorporation of citizens' feedback. It provided activities that can guide them in their action implementation planning

process for continuous service improvement. Lastly, the model was validated by practitioners from two different County Councils in Ireland. The next section provides the research objectives and research questions addressed in the context of this study.
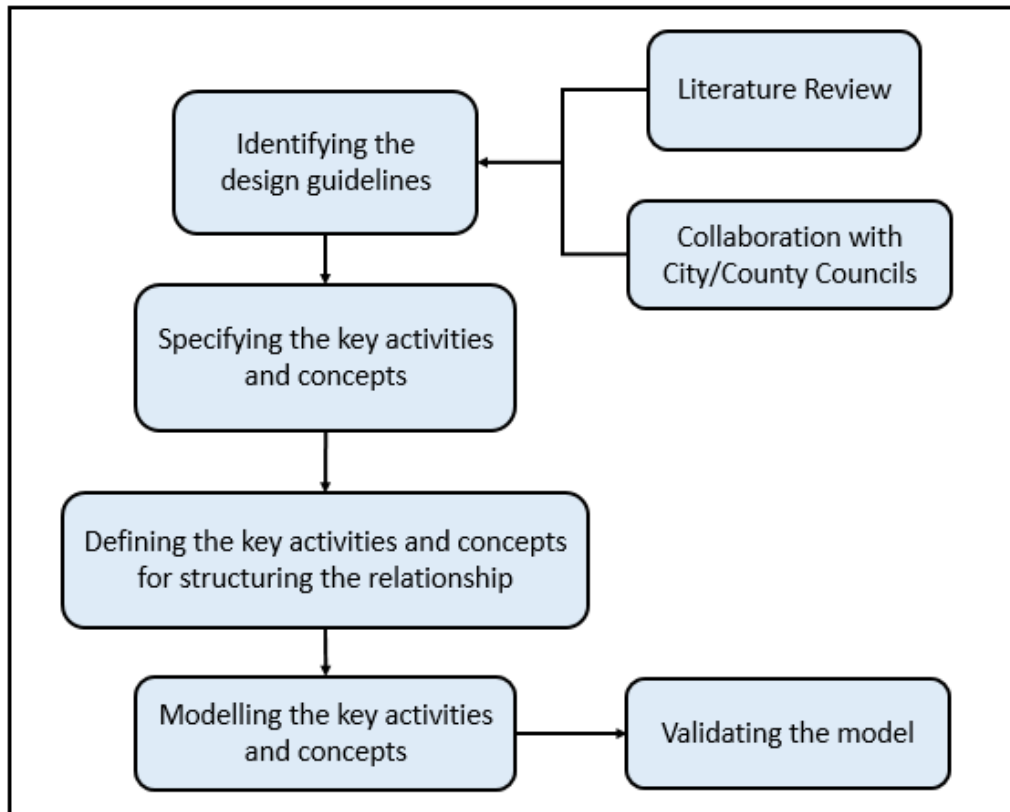
Figure 3:The process of designing the process model as a blueprint

1.5 Research Objectives

The main research objective of this research is to structure the relationship between citizens' feedback and continuous service improvement to meet the need of citizens. To answer the broader research question of how to support the structuring of the relationship between citizens' feedback and continuous service improvement in the context of Design science research context, the following sub-objectives are identified: (1) Identify the design guidelines that support in structuring the relationship using literature review findings and feedback of practitioners. (2) Identify the concepts and activities that support in structuring the relationship following the identified guidelines. (3) Conduct case studies to validate the identified concepts and activities by following ex-post evaluation strategies.

1.6 Research Questions (RQ)

To address the identified research problem and research objectives as discussed in sections 1.4 and section 1.5, the following research questions have been proposed.

Main research question

How to support the structuring of the relationship between citizens' feedback and continuous service improvement to ensure that services meet the needs of citizens?

To solve the main research questions a set of sub-research questions has been proposed:

RQ1: What are the design guidelines that support in structuring the relationship between citizens' feedback and continuous service improvement?

Research question 1 aims to consider the guidelines to design a model that supports in structuring the relationship between citizens' feedback and service improvement.

RQ2: What are the concepts and activities that support in structuring the relationship between citizens' feedback and continuous service improvement following the identified design guidelines?

Research question 2 aims to provide concepts and activities that have been identified following the guidelines resulting from RQ1.

RQ3: How do the proposed concepts and activities support in structuring the relationship between citizens' feedback and continuous service improvement for meeting the need of citizens?

Research question 3 aims to apply and evaluate identified concepts and activities resulting from research question 2.

1.7   Thesis Organization

This study adopted a Design Science Research (DSR) approach for conducting this research. Design science consists of two basic activities, build and evaluate where the building is the process of developing an artefact for a definite purpose; and evaluation is the process of determining how well the artefact performs (March and Smith, 1995). The design science research approach was guided by (Peffers et al., 2007; Ostrowski and Helfert, 2012). This thesis is organised based on the different phases of the DSR framework. The remainder of this thesis is structured as follows.

Chapter 2: Literature Review

Chapter 2 presents results from the literature review findings. This research initially conducted scoping review by following a structured approach proposed by (Webster and Watson, 2002). The aim of scoping review was to have an overview and understanding of the research domain. The findings from the scoping review provided a path to investigate the identified research gap in more detail. As a result, this study further conducted a systematic literature review by following a three-stage methodology proposed by (Yigitcanlar et al., 2019, p.352). This further assisted in validating the

identified research problem. The findings from this chapter have already been published by the researcher (Singh, et al., 2020; Singh and Helfert, 2019).

Chapter 3: Research Methodology

Chapter 3 provides an overview of the followed research methodology for the current study. It also explains the underpinning philosophy of the research. This chapter describes the philosophical assumptions, research methods, and approaches used to answer the research questions identified in this research. Furthermore, it provides the rationale for chosen research design in the context of this study. It provides a discussion on adapted research methods and techniques as a part of the Design Science Research (DSR) methodology.

Chapter 4: Problem Investigation

Chapter 4 discusses the challenges that were identified during the problem investigation phase of the DSR methodology. Moreover, the findings from the design and development phase further assisted in refining the problem space. The literature review chapter highlighted the research gap from a literature viewpoint whereas chapter 4 outlines the identified challenges from the practitioners' perspective. It provides a discussion on significant factors which are important to consider for the improvement of the services and to meet the need of citizens. This chapter includes findings from two case studies (Pilot case study, case study A). The findings from the pilot case study have already been published by the researcher (Singh, et al., 2022). The findings from case study A have been submitted for journal publication.

Chapter 5: Design and Development

Chapter 5 provides the detail about the design and development phase of the proposed artefact following the design science research guidelines as discussed in Chapter 3. Case study A was conducted during the problem investigation phase, and it continued until the final artefact was evaluated with practitioners who were involved during all phases of the DSR methodology. This chapter provides detail about the role of practitioners from case study A during the design and development phase of the artefact.

Chapter 6: Demonstration and Evaluation

Chapter 6 provides detail about the ex-post evaluation of the process model with practitioners from two County Councils of Ireland. The model was demonstrated by the researcher and a brief overview was provided of the different components of the model. Focus group discussions and semi-structured interviews were conducted in which practitioners were asked to provide their inputs and feedback on

the proposed process model. The feedback from the practitioners was then fed back into the next iterations for further improving the artefact. Multiple case studies were conducted to demonstrate and evaluate the applicability of the process model in the real-world environment.

Chapter 7: Conclusions and Future Thoughts

Finally, chapter 7 outlines the conclusion and direction for future work that need to be communicated to a wider range of research communities. Chapter 7 discusses the conclusion and contribution of this thesis to provide evidence that this research accomplishes the aim and answers the main research question. Finally, it provides the boundaries and future direction of this research.

2 LITERATURE REVIEW

In this chapter, existing studies that support citizens in the development of smart cities were reviewed and analysed to identify their involvement during different stages of smart city services. This research initially conducted scoping review by following a structured approach proposed by (Webster and Watson, 2002). The aim of the scoping review was to understand the domain and find out the shreds of evidence for supporting the relevance of the proposed research objective as discussed in chapter 1. This further assisted in justifying the identified research gap. Lastly, it provides reasoning to confirm if the investigated research problem has value in practice. Based on the findings from the scoping review, this study further conducted a Systematic Literature Review (SLR) to investigate how citizens contribute during the various stages of smart city services by following the three-stage methodology, proposed by (Yigitcanlar et al., 2019, p.352). The first stage is the Planning stage which defines objectives and review procedures for a systematic review. The second stage is the Review stage comprising descriptive and organisational analysis. The third stage is the Reporting and dissemination stage containing analysis and synthesis of the results based on the established objectives. The research aim was to investigate the contribution of citizens during the lifecycle of smart city services and to explore existing research in this field. The inclusion conditions were set as academic journal articles accessible online in full-text that are appropriate to address the identified research questions as outlined in Chapter 1. The literature review process for SLR has been depicted in Appendix A. Section 2.1 provides a brief discussion about public services in the context of this study from smart cities' viewpoint. The next section 2.2 provides a detailed discussion of the literature review on existing smart city challenges. Section 2.3 provides a discussion of the existing literature from the lens of the ITIL framework to understand the role of citizens during different phases of smart city services. Then, to understand the relationship between smart city components and citizens' feedback, Section 2.4 provides a discussion on Enterprise Architecture layers to position citizens in smart city architecture. This assisted in analysing the impact of citizens' feedback on the other components of the smart city services. The following sections present results from the literature review process.

2.1 Public Services in the Context of Smart Cities

Smart cities are the result of urbanisation efforts that are driven by municipalities in which many services provided to the local community can utilise ICTs (Kar *et al.*, 2019). Some of the examples include the usage of smart devices in various public domains such as parking places, street lights, electric grids, etc. (ibid). The uttermost aim is to accomplish sustainable cities for favourable public services, well-suited living environments, rectified city management, etc. (Wu *et al.*, 2018). At present, citizens are demanding public services similar to the way private companies provide (Hodijah, et al.,

2018). The smart city initiative can be broadly expanded into various domain areas such as transportation, waste management, healthcare, energy, etc. (Peng, et al., 2017). The public services provided by local authorities in Ireland also distribute across those domains and have been represented in the form of a service catalogue as discussed in section 5.3.2.2.2 in chapter 5. Government should look at the experience of citizens for providing better public services to them in which collaborative efforts by citizens and the government can lead to novel public services for a smart society (Verma, 2022). More specifically, the interrelationship between individual public services and the convenient smart city customer interface is extremely important (Wirtz, et al., 2020). It is also important to highlight that smart services in different domains address different needs that also vary based on the local conditions and context (Peng, et al., 2017). Existing literature provides a wide range of smart services and applications in various domain areas. For instance, smart transportation service covers smart parking, smart buses, smart traffic lights, etc. (Peng, et al., 2017). Likewise, smart waste management services can include the deployment of smart bins in public areas, households, etc. (ibid). This research aims to examine the existing public services that are provided by local authorities of Ireland in the context of smart cities across those domains. The next section provides a detailed discussion of different smart city challenges.

2.2 Smart City Challenges

Smart cities are complex systems that involve multiple stakeholders such as city authorities, third parties, citizens, and services that improve the quality of life and deliver sustainable growth (Connolly, et al., 2017). The key element of future smart cities is to fulfil the ever-increasing needs of citizens (Javed *et al.*, 2022). Even though smart cities were initiated as digital cities (e.g. databases, web portals, virtual realities, etc.), they soon advanced to information systems that deliver various kinds of services to local communities (Anthopoulos and Fitsilis, 2009). The new era of a smart city is accompanied by Information and Communication Technology (ICT) and many other technologies to improve the quality of life for the citizen of the modern city, that in turn, has brought immense opportunities as well as challenges for government and organizations (Singh and Helfert, 2019). Innovative technologies increase uncertainty and complexity, and there is a need to look beyond technology (Jennings, 2010). The implication of smartness in the urban or metropolitan context not only specifies employing cutting-edge information and communication technologies but also policy and management-related concerns (Nam and Pardo, 2011; Jennings, 2010). Jennings, (2010) highlighted that 50 percent of IT projects fail due to the lack of consideration of non-technical factors such as policy, organization, and management. Therefore, it is noteworthy to understand the importance of those non-technical factors in the cities that involve the management of key processes, and key stakeholders within the organization who take important decisions and contribute towards

the effective delivery of smart city services (Singh and Helfert, 2019). Moreover, addressing problems only from the technical viewpoint does not solve the problems from the non-technical side that involve behavioural elements (e.g. process, management, etc.) as well (ibid). For example, it is important to define who will be using the services and what are the operating rules and policies for using them (Anthopoulos and Fitsilis, 2010). Government plays a significant role in society as they provide access to a range of necessary public services to citizens and business, and there is a huge demand to deliver efficient services (Lynn, et al., 2022). The usage of digital technologies can provide many benefits in this context and the digitalisation of public services has been a persistent item on the agenda of policymakers (ibid). There are various platforms by which government engages with citizens and evaluate public services based on their feedback. For instance, with the help of the PPN program in Ireland, people provide their feedback on various public services they use daily within their areas which may not necessarily be ICT enabled. Therefore, the evaluation of such services depends on the place in which they are being provided. For example, in some parts of the cities, communities still use traditional car parking service using a ticketing system. They shared their experience with the current parking system via the PPN program and highlighted the need of having an effective parking service facility in their local area. On one hand, a part of the community is still using old traditional way of parking service, on the other hand, people from other part of the cities are using e-parking service. It is important to note that even with e-parking service, community highlighted their dissatisfaction as they also faced challenges in terms of registration and booking free spaces for their vehicles as discussed in section 4.1 in chapter 4. It shows that the evaluation of the services can be performed at different levels and it differs from place to place in which people are using it. Gao and Krogstie, (2010) also observed the similar situation for mobile services and highlighted that context plays a critical role that can affect people's perception on using such services. The environment, preferences, and needs of the wider communities will affect the opinions and views of individuals concerning the usage of smart city services (Peng, et al., 2017). Therefore, it is imperative to look into the existing challenges of smart cities not only from technical viewpoint but also from social perspective. The next section provides a detailed discussion on considering socio-technical perspective for smart cities.

2.2.1 Socio-technical Perspective in Smart Cities

A smart city needs to be implemented according to local constraints and opportunities, taking into consideration the diverse culture, requirements, and features of cities in different geographical areas and countries (Dameri et al., 2019). Smart cities should focus on using ICT if they want to empower social, environmental, economic, and cultural development (Hollands, 2008). To make citizen-centred smart cities, many initiatives have been taken in that direction (Lorquet and Pauwels, 2020). However,

such initiatives are mostly used by public sector organisations to change the way citizens behave instead of giving them more influence in public sector processes (Pedersen, 2020). Nakamura and Managi, (2020) argued that citizen satisfaction is an important metric in evaluating city performance as it would ultimately affect the benefit and comfort of city inhabitants. A sense of community should be incorporated in policy making which considers citizens' evaluation of smart sustainable cities, public services, and facilities (Macke et al., 2019). Citizen engagement is a fundamental requisite for the accomplishment of sustainable and inclusive urban development (Corsini et al., 2019).

Smart cities deal with complex processes, and they require methods that can include technology, human elements, and organizational issues (Johnsen, 2018). The development of smart cities should consider a wider perspective along with technology, data, public infrastructure, services, and human resources (Wu et al., 2018). However, at present there is too much dependency on technology (Pierce and Andersson, 2017). Other governance-related smart city challenges include less transparency, standalone city services, absence of human resources, liability, collaboration, lack of local-level leadership and coordination, disintegrated structures, etc. (Heaton and Parlikad, 2019; Pierce and Andersson, 2017; Bolton and Foxon, 2015). Additionally, the city development planning process has also become complex and difficult due to the involvement of multi-stakeholders in e-government projects (Simonofski and Snoeck, 2019). Cities can only be recognized as smart when there is an investment in the growth of humans along with social and environmental capital (Yigitcanlar et al., 2019). The term social is not only important from the citizens' viewpoint but also from the different stakeholders' points of view who directly or indirectly engage with people and the services (Singh and Helfert, 2019). Yet, the people element is often neglected at the cost of technology and strategic development which is a critical component for developing a successful smart city (Heaton and Parlikad, 2019). Thus, a socio-technical perspective is required when organizations embark on smart initiatives to address new challenges for enterprises and service providers (Ekman, et al., 2019; Bednar and Welch, 2019). Nevertheless, the impact of social factors has not been investigated enough in smart city projects (Bouzguenda, et al., 2019). Subsequently, there is a requirement to consider urban issues beyond technological innovation to address smart city challenges instead of just focusing on technology and neglecting other factors around it (Yigitcanlar, et al., 2019; Singh and Helfert, 2019). One of the factors is placing citizens' concerns and their interests at the centre of the smart cities by considering their inputs and feedback in smart city development (Mueller *et al.*, 2018). Therefore, to examine citizens' role in such initiatives, this study further investigated their involvement during various stages of smart city services based on the different phases of the Information Technology Infrastructure Library (ITIL) framework (Dreyer et al., 2019). The next section provides a detailed discussion of it and highlights the identified research gap in the existing studies.

2.3   Positioning Citizens in the Service Life Cycle (ITIL)

ITIL framework has been selected for understanding the involvement of citizens (Social side) during different phases of smart city services. ITIL framework has been found suitable for quality-based services which use information and technology and can help to progress from concept to improvement during the life cycle of the services (Dreyer et al., 2019). Thus, this framework was considered adequate to investigate citizens' involvement in the development of smart cities and to analyse how services are improved based on their feedback. The ITIL framework consists of five phases as shown in Figure 4. In the first phase, the process objective is defined based on the requirements of the customer, a Service Strategy (SS) is established, and the essential capabilities are defined (ibid). The second phase is Service Design (SD), which uses a prebuilt strategy for designing the services ("ITIL: Key Concepts and Summary," 2020). In the Service Transition (ST) phase, the distribution of the designed services is implemented (Dreyer et al., 2019). The fourth phase is Service Operation (SO), which contains activities such as maintenance, failure management, and the execution of processes and task for the delivered services (Dreyer et al., 2019). The last phase of the lifecycle is Continual Service Improvement (CSI), which is based on learning from the successes and failures of the past ("ITIL: Key Concepts and Summary," 2020). Appendix H provides a summary of the existing studies that have supported citizens during different stages of the service life cycle in smart city development. The literature review findings highlighted that the majority of the existing studies focused on the initial phases of the ITIL framework, and captured citizens' feedback and their input for the smart city services. A detailed discussion has been provided in the following section.
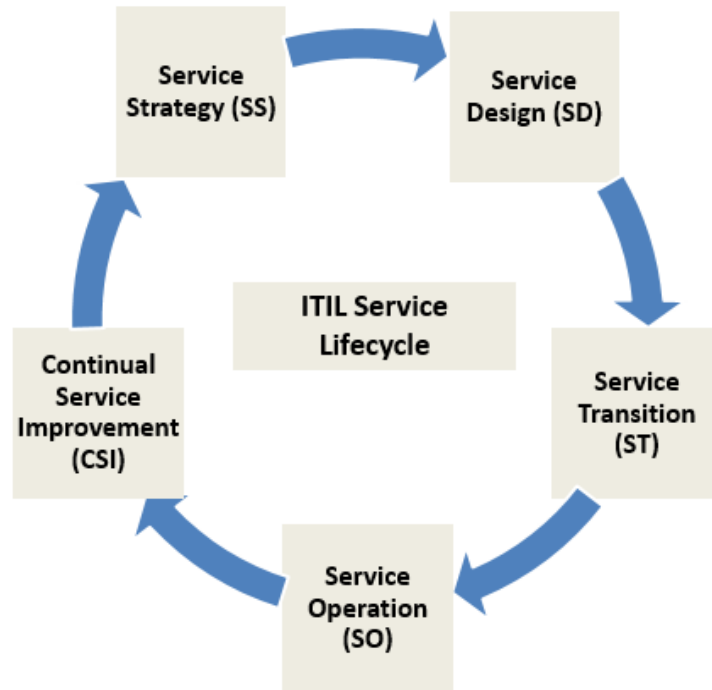
Figure 4: Service Lifecycle Phases

2.3.1   Service Strategy (SS)

In the first phase, a service strategy is established based on the requirement of customers, and accordingly, capabilities are defined ("ITIL: Key Concepts and Summary," 2020). Although the technological components of smart cities are included enough in the literature, the importance of the citizens' role has often been neglected (Johannes and Snoeck, 2019). To achieve people-centric smart city transformations, it should consider the diverse needs of its citizens, and should be approached from a transdisciplinary perspective (Brandt et al., 2018). Conversely, one of the key barriers to smart city development is a lack of citizen involvement (Rana et al., 2019). As a result, there is a requirement for new bottom-up tools to co-produce services with citizens (Ludlow et al., 2017).

A major challenge for governments is to design and implement innovative strategies through technologies for collaboration and communication with citizens to achieve effective and efficient services (Góngora and Bernal, 2015). To address this challenge, online government portals can be used for public engagement based upon which new policies can be defined by policymakers (Weerakkody et al., 2017). They can be benefited by considering citizens' active participation (Javed, et al., 2018). Business models can also be applied to define strategies during the planning phase to evaluate the value that City councils can offer to the citizens (Timeus, et al., 2020). Moreover, contextual factors such as drivers for participation, the legal requirements, the citizens' characteristics, and the degree of centralization can influence citizen participation strategies in smart city development (Simonofski et al., 2019).

2.3.2 Service Design (SD)

This phase uses a prebuilt strategy for designing the services ("ITIL: Key Concepts and Summary," 2020). Even though Smart City projects legitimise and improve the citizens' lives, their role in SC development is ambiguous (Gupta et al., 2019). Many times, smart cities do not meet their goals if the citizens are not engaged in their design (Johannes and Snoeck, 2019). One of the main objectives of smart services is to address citizens' concerns and needs (Pourzolfaghar and Helfert, 2017). It has been suggested that citizens' needs should be considered as a client requirement in the design process of the services (ibid). Besides, citizens should not be treated as passive customers as they are crucial stakeholders who can generate valuable ideas (Johannes and Snoeck, 2019). Nevertheless, there is a lack of suitable tools which can support citizens in many parts of the co-design process (Wolff et al., 2020). To support citizens in the co-design process, Wolff et al., (2020) introduced design templates to enable citizens in converting their ideas into technology applications. Correspondingly, a threefold design research model was proposed for co-creating proposals by sharing a common design path among different stakeholders of the smart cities (Andreani et al., 2019). Likewise, a participatory approach has been discussed for future cities that aim to achieve real-world impact (Peter, et al., 2016). Another experience-driven approach has been suggested for utilising and supporting citizens' ideas (Ojala et al., 2015).

2.3.3 Service Transition (ST)

The service transition phase describes the way smart services will be implemented (Dreyer *et al.*, 2019). Public sector organizations have started to discover ways to employ big data to provide smarter solutions for cities, and trying to install and integrate big data into smart cities (Okwechime et al., 2018). The authors reveal that organizations have the capability to practice big data to rectify the problems that cities are facing. Furthermore, with open data, citizens and other stakeholders would be able to contribute to the decision-making process that would enable the development of new solutions for undertaking urban issues (Okwechime et al., 2018). Nevertheless, a noteworthy number of citizens are not even prepared to compact with the technologically focused eGov system (Shareef et al., 2016). Data-driven innovation can impact the transformation of public sector systems and can create societal benefits including reduced pollution, fewer traffic jams, better energy efficiency, and novel applications to improve citizen experience interacting online with the government (Janssen et al., 2017). Moreover, the incorporation of ICT in a city can offer a new range of opportunities and can transform the city with the assistance of citizen participation by utilising the capability of infrastructure and open data (Johannes and Snoeck, 2019). Yet, there is a discontinuation between the prospective and real impact of data resources on the public, and citizens are not able to use them for any significant purposes (Shareef et al., 2016). Furthermore, the formats of open data,

presentation, and contents indicate that most of the output does not consider the impending positive impact of sharing huge amounts of information on individual decision-making, citizens' lives, and social welfare (Cabitza et al., 2018). To overcome this limitation, the authors presented a methodology to personalize suitable information about services according to the profiles and preferences of citizens. Nonetheless, the use of open data alone cannot offer sufficient reasons for the engagement of citizens (Gagliardi et al., 2017). Therefore, an integration of open data along with basic explanations and visualization has been used to form new and open services for communities (ibid). Similarly, if custom-made tools are provided, everyone in a society can play a significant role in the development of smart cities, and citizens can be benefited from it (Van der Graaf and Veeckman, 2014).

2.3.4   Service Operation (SO)

The fourth phase is Service Operation (SO), which focuses on meeting the expectations of end users and includes activities like maintenance and failure management for delivering effective services (*ITIL: Key Concepts and Summary*, 2020). It will capture how citizens can support to further improve the services at the operational level by proving information on any type of service failure or maintenance-related issues. Mobile applications can enable citizens to report damages and other issues related to the city's infrastructure (Abu- Tayeh, et al., 2018). It will provide a platform to capture citizens' inputs at the operational level to rectify the issues quickly and provide solutions for the services (ibid). Correspondingly, Zhu, Yan and Song, (2022) proposed a theoretical model to assist smart city managers in understanding citizens' reactions during public emergencies, and their behaviour towards smart city services. However, there are very limited studies that focused on this phase from the citizens' viewpoint.

2.3.5   Continual Service Improvement (CSI)

Continual service improvement is an important part of the framework which focuses on further improving the services based on past successes and failures. It is vital to consider this aspect for smart cities as well to provide a better quality of services to the citizens (Singh, et al., 2020). It is possible to achieve outstanding KPIs from implemented services but it can lead to unsatisfied users (Sofiyabadi, et al., 2016). Thus, once services have been implemented, monitoring has to be carried out to determine if the actual impact varies from the anticipated one from the user's perspective (Abella et al., 2019). Furthermore, with the integration of an information flow, a rich quality of user behaviour data can be generated for improving the services based on the users' needs (Solaimani et al., 2015). Likewise, a methodology has been proposed to comprehend the interaction among citizens and services to improve the design of smart cities by considering their feedback for continual improvement (Abella et al., 2019). Similar to the service operation phase, there were not enough studies that focused on this phase from the citizens' standpoint.

2.3.6 Discussion

Smart city practices should be surrounded in all aspects of city governance including smart citizens (Janssen et al., 2015). Smart sustainable cities need to bridge the gaps between social sustainability, digital public participation, and community engagement (Bouzguenda, et al., 2019). Smart city planners need to underline more on the requirements of people as their requirements mostly influence and shape the environment rather than just focusing on technology or infrastructure (de Lange and de Waal 2013; Schaffers et al., 2011; Gupta, et al., 2019). Nevertheless, the impact of ICT on the quality of citizens' life and urban development is still unclear (Nicolas *et al.*, 2020). For achieving people-centric smart city transformations, it should consider the diverse needs of its citizens and should be approached from a transdisciplinary perspective (Brandt, 2018). Citizens' participation in the planning and decision process can enhance the abilities and functionalities of the government for development of the sustainable cities (Kumar, et al., 2018). Hence, citizens should be involved during all phases of smart city services along with the other stakeholders of the city, and services should be designed as per their requirements (Singh, et al., 2020; Marrone and Hammerle, 2018). Nonetheless, extant literature mainly focused on the initial stages of smart city services where they intend to support citizens' feedback in the planning and design of the services. Their primary concern is to involve citizens in service strategy, design, and transition phases. However, the feedback captured during the service operation and the service improvement phases is of paramount importance. This feedback is invaluable as it ensures that effective smart city services are designed according to the needs of the citizens. Moreover, it is not well understood from the literature how that feedback is incorporated to make any improvement to the existing services.

The above discussion highlighted that most of the studies have considered citizens' inputs and their feedback during the initial stages of smart city services. This study argues that considering their involvement only during the initial stages won't make the services successful until equal attention has been given to all the phases of the services from the citizens' viewpoint. Therefore, the focus should also be given to validating the effectiveness of the services based on citizens' feedback, and their experiences while making sure their need is fulfilled.

This study selected the ITIL framework as a lens to understand the role of citizens' feedback during different phases of smart city services and to identify the research gap. Furthermore, the researcher wanted to analyse the relationship between citizens' feedback and the other components of the services for which the ITIL framework was not suitable. Enterprise Architectural approach was found appropriate for this purpose as it captures "the structure of components, their inter-relationships, and the principles and guidelines governing their design and evolution over time" (The Open Group, 2018, p.11). It provides representation to the city service operations that facilitate the services (Anthony Jnr,

2020). It also assists in understanding the complexity of smart cities while analysing the inter-relationship between different components of the cities including the concerns of various stakeholders e.g. citizens, city authorities, and service providers (Pourzolfaghar et al., 2019). As a result, it was found as an appropriate approach to analyse the relationship between citizens' feedback and its impact at the component levels of the service. The next section provides detail about adapted smart city enterprise architecture framework that assisted the researcher in analysing this relationship.

2.4 Enterprise Architecture Layers for Positioning Citizens in Smart Cities

One of the critical aspects of smart cities is the citizens' viewpoint which is crucial for delivering effective services but has been neglected in the majority of the existing EA frameworks (Pourzolfaghar et al., 2018). Therefore, this research adopted the Smart City Enterprise Architecture Framework proposed by the author to understand the role of citizens in smart city services from an architectural viewpoint as it considers citizens' perspective and was found as the most suitable one among other EA frameworks for the context of smart cities (e.g. Mamkaitis, et al., 2016; Bastidas, et al., 2017; Jin et al., 2014; Antonio Cortés, 2011). It provides a holistic viewpoint to analyse the impact of their feedback at a component level from different layers' perspectives (e.g. Information, Technology, Service, etc.). It assisted the researcher to analyse the relationship between citizens' feedback and its influence at the service level. The framework consists of four layers. The first layer is the service layer which defines appropriate goals, scope, etc. for the services concerning the smart city requirements, concerns, and priorities. The second layer is the context layer which encapsulates the information regarding the strategies, priorities, stakeholders, and their concerns to deliver effective services to the citizens. The third layer is the information layer identifying the data elements, the data interrelations, and the data flows required to support service function (Minoli, 2008; Pourzolfaghar et al., 2019). The last layer is the technology layer which supports the information and application functions from the information layer. The architecture layers have been derived from (Pourzolfaghar et al., 2019). The following sections provide insight into the existing literature on the involvement of citizens in the development of smart cities from the lens of these layers.

2.4.1 Service Layer

It is possible to have outstanding performance indicators for the services, but if citizens are not satisfied with the delivered services, then it can disappoint them in the end (Sofiyabadi, et al., 2016). It is also important to assess service performance based on the citizens' experience and satisfaction levels (Nakamura and Managi, 2020). The service layer defines the aim and scope of the services that are related to smart city requirements, concerns, and priorities (Pourzolfaghar et al., 2019). One of

the activities of this layer is to define an experience and value proposition that the service is intending to provide. The emphasis is on considering citizens' feedback to understand the smart city requirements, concerns, and priorities from their perspective. E-participation in the form of providing service feedback has a positive impact on the performance of delivered service (Allen et al., 2020). Moreover, E-government systems are more likely to be re-used by the citizens if they recognise that the experience with those new systems is better than the traditional ones (Alruwaie et al., 2020). Citizens can be encouraged to provide feedback and rate on their experiences which can be used to shape services as per their requirements (Silva, et al., 2018a). However, it remains unconvincing whether new government-citizen interface collaboration has achieved the fundamental goal of improving service quality for citizens (Allen et al., 2020). Soft assets such as organizational capital, social capital, and information and knowledge-related capital help to understand citizens' role to support building and maintaining the key areas of smart city development (Wataya and Shaw, 2019). These are further linked to the cycle of improving the quality of services, and also a prime source of innovative value creation for SC development (Wataya and Shaw, 2019). Citizens reporting applications can also allow citizens to proficiently share information that is associated with government services (Abu-Tayeh, et al., 2018). Moreover, various online platforms can assist in obtaining citizens' feedback once services have been delivered (Alizadeh, et al., 2019). Sentiment analysis techniques can be used for citizens' participation and to improve the efficiency of public services (Verma, 2022). Nevertheless, at present, there are very limited studies that guide how to evaluate such systems based on citizens' Quality of Experience (QoE) (Ballesteros et al., 2015). QoE can be observed by citizens which would provide indicators about how the quality is being represented, delivered, and perceived by the users (citizens) (Nepal *et al.*, 2019). It would ensure that users can accomplish desired goals with satisfaction, efficiency, and effectiveness in a specified context (Ballesteros, et al., 2015).

2.4.2   Context Layer

This layer captures the smart city context information about strategies, priorities, stakeholders, and their concerns to deliver effective services to the citizens (Pourzolfaghar et al., 2019). Linders et al, (2018) emphasized that there is a requirement to flip the service delivery model of traditional e-government systems from the "pull" approach towards a "push" model. By using this push model approach, government proactively and impeccably delivers just-in-time services to citizens designed around their specific needs, circumstances, preferences, and location (ibid). Furthermore, citizen-administration relationships can facilitate a better understanding of governance arrangements, and could additionally lead to better sustainable development (Janowski, 2018). Similarly, Cellina et al., (2020), proposed a framework where the key application functionalities were co-designed with a

group of interested citizens which resulted in even more significant impacts in terms of urban governance practices. Likewise, Vidiasova and Cronemberger, (2020) identified different levels of understanding regarding how citizens identify smart city initiatives; although many respondents were direct and elaborated on many aspects of a smart city, their understanding remains diffused and vague despite high levels of engagement with traditional e- government technologies (Vidiasova and Cronemberger, 2020). Additionally, strategic drivers such as Transparency (TRANS), Collaboration (CO), Participation and Partnership (PP), Accountability (ACC), and Communication (COM) can help smart city rulers in the development of public policies and improve QoL (De Guimarães et al., 2020). Nonetheless, major public resources are invested in technical solutions, but the appropriate means of assessing success (social value) is still unclear or remains uncultivated in light of the expectations of citizens (Vidiasova and Cronemberger, 2020).

To obtain user value, smart city governance should work closely with citizens and diverse stakeholders to identify the set of services by prioritizing citizens' requirements for a long-term city transformation that can fast-track smart city development (Kumar et al., 2019). However, current standards, guidance, and specifications have little focus on the requirements of the citizens within a Smart City framework (Heaton and Parlikad, 2019). To address this issue, Heaton and Parlikad, (2019) proposed a framework that offers a direct line-of-sight from citizen requirements, the infrastructure assets supporting used services, and the services used within the city to validate if citizen requirements have been fulfilled. Additionally, satisfaction surveys can also be used as the product of strategic planning (evaluation of the strategy's success), and secondly, as the input to strategic planning (problem issues should be dealt with in strategy) which are vital for public policy planning (Kopackova, 2019). Citizens as participants in policymaking have moved to the centre of the discourse on transparency, and their opinions, challenges, and responses need to be shared and observed (Brunswicker et al., 2019). To optimize citizen participation outcomes, platform administrators might consider either increasing private value perceived by the citizen or public value where private value has a greater effect on continuous e- participation intentions than public value creation (Ju et al., 2019). There is a requirement for cities to involve non-traditional stakeholders in urban planning processes such as social change initiatives, citizen groups, and informal sector representatives (Schröder et al., 2019). Citizen satisfaction is an important parameter for evaluating city performance, that can be evaluated based on citizens' life satisfaction and subjective city evaluation rather than only based on municipal service evaluations and objective performance data (Nakamura and Managi, 2020; Ballesteros, et al., 2015).

2.4.3 Information Layer

This layer identifies the data elements, data flows, and the interrelations between data required to support service function (Pourzolfaghar et al., 2019). This layer plays a vital role in identifying the data that has originated from the citizens' side and how it further supports any function of the service. Data collected from all geo-participation approaches can be brought together to support decision-making, service delivery, and government operation (Zhang, 2019). It is imperative to leverage the data requirements of both the government and the citizens to produce techniques to provide feedback and initiate secondary usage of data such as using data for Application development, producing public services, etc. (ibid). Social media data can inform the decision-making process where citizens discuss their concerns about urban projects and leave meaningful observations (Alizadeh et al., 2019). Citizens communicate with smart city services using different platforms such as smartphones, computers, and other smart devices (Silva, et al., 2018b). Thus, it is important to manage data privacy or security-related issues with it (ibid). Recent innovations in mobile data and cloud offer new prospects for enhancing the quality of government and governance and fulfil the expectations of citizens (Linders, et al.,2018). Similarly, online data can enable users to visualize what actions to take, and can also be used by governments for various purposes including decision-making, policy processes, communication, and interaction with citizens (Matheus, et al., 2018). In addition, data produced from user-generated content can be used to create predictive models that can help local government to shift from reactive responses to proactive ones (Dameri *et al.*, 2019).

The aim of open data is towards improving government transparency, motivating citizen participation, and unlocking commercial innovation (Ma and Lam, 2019). Citizen-generated open data can provide an information basis for cooperative governance wherein significant information is produced about issues such as air quality, the maintenance of public space, and many more (Cellina *et al.*, 2020). Open data impact the creation of smart city services and ideas, and citizens' life can be improved if cities optimize and nurture the ecosystems by reusing their data for creating innovative services (Abella, et al., 2017). However, many interlacing barriers hinder the adoption of open data, for instance, the non-existence of a public participation mechanism, unsatisfactory public feedback, and consumption statistics create the stakeholders unknowing of the true requirements of citizens (Ma and Lam, 2019).

2.4.4 Technology Layer

This layer focuses on supporting information and the system/application functionality with the help of technological components (Pourzolfaghar et al., 2019). It provides an overview of the advanced technologies supporting citizens' inputs with the help of information or application functions to deliver effective services to the citizens (ibid). While technology provides cheap and effective ways to engage citizens in addressing various issues, there is no replacement for offline face-to-face engagement

(Horgan and Dimitrijević, 2019). Salvia and Morello, (2020) argued that hybrid forms of interaction that combine online and offline platforms have an important role to play in reaching citizens. Nonetheless, it is vital to understand that greater direct access to public information may improve transparency and facilitate citizen engagement, but at the same time, it may overwhelm citizens with too much information as well (Lee, et al., 2020; Jae and Viswanathan, 2012). Textual information tended to cause greater information overload, specifically for those with an inclination for visual information processing (Lee, et al., 2020). El- Haddadeh et al., (2019) highlighted that the use of IoT offers a unique opportunity for both governments and citizens to work closely together to improve current public services despite various challenges associated with it. While citizens feel empowered and add value to existing services through consuming and co-creating, governments will have the opportunity to utterly exploit the potential of innovative technologies to better optimize their distribution of public services (El-Haddadeh et al., 2019). Government considers technology acceptance by citizens as an important factor and essential element for the development of successful smart cities (Sepasgozar *et al.*, 2019). Digital urban services are not limited to e-government systems rather it covers a wide range of services that citizens utilize on a daily basis such as Google Maps, smart parking apps, E-governance portals, and share-economy (e.g.UBER) (Sepasgozar *et al.*, 2019). Platform technologies such as data analytics, IoT, and social media can also change the role of transparency in policymaking (Brunswicker, et al., 2019). In the domain of mobility-related applications, smartphone technologies, and platforms were found to be an effective tools for including citizens and influencing social trends and behaviours in different mobility directions using Information Communication Technology (ICT) technologies (Di Dio *et al.*, 2018). Initially, ICT-integrated city operations promoted the concepts of a digital city, information city, and telicity, and later on, the concept of IoT established the term smart cities that support city operations with minimum interaction of humans (Silva, et al., 2018). There are numerous approaches for utilizing ICT and data to full fill citizens' needs and their livelihoods while widely sharing the smart city benefits (Trencher, 2019). There is a need for technologies that can fulfil the specific need of citizens, for instance, senior citizens may need urban environments which are elderly-friendly (Jelokhani-Niaraki, et al., 2019). In this context, Quick Response codes (QR codes) on mobile platforms offer an innovative way to effectively allocate various types of information to the public (Lorenzi *et al.*, 2014). Authors propose this system for park navigation and to provide incentives for using parks through gaming applications that would provide improved safety, more effective distribution of information, and improved feedback. Likewise, Graph-based technology has been designed using Apache Spark and GraphX to assist citizens in making mobility-associated decisions and to assist traffic authorities in traffic regulations by applying graph algorithms (Rathore *et al.*, 2018). Moreover, there are many data analytics techniques and

algorithms for identifying solutions to smart city problems, such as text analytic techniques that can be used for channeling citizens' inputs (Chong *et al.*, 2018). Similarly, Living Labs (LL) use Lo-Fi technologies to advance digital invention and engage with local citizens to co-create digital interferences and apps that are aimed to solve local issues (Cardullo *et al.*, 2018). However, the advancement and usage of participative smart city software interfaces try to produce an idyllic citizen who can keenly subscribe to the ideas of technological solutions promoted by SC discourses (Cardullo *et al.*, 2018).

2.4.5 Discussion

The initiatives around the involvement of citizens in smart city development are increasing significantly to enhance the quality of life for the citizens of these cities through better public services. There is a plethora of studies discussing various technologies and platforms to obtain citizens' feedback for providing a better quality of services to them. Nonetheless, there are very limited studies that demonstrate how citizens' feedback is incorporated for continuous service improvement (Singh, et al., 2020).

The earlier discussion examines past work regarding different aspects of citizens' involvement in smart city services and classifies the existing literature through the lens of a smart city framework. The literature review findings provide an overview of studies that support citizens' feedback from different layers' viewpoints. For instance, citizens' feedback captured at the service layer can assist in finding the experience of citizens after the delivery of the services, whereas the feedback at the context level represents the role of citizens in co-designing or co-producing the services. At the information and technology level, various platforms and technologies have been discussed which can assist in providing improved services to the citizens.

The adapted smart city framework provided an overview of the different components and their interaction in a complex smart city system. It provided different layers to analyse the relationship between citizens' feedback and the other components of the system. It encapsulated the end user's perspective and maintenance phase of the services. However, it did not cover the complex workflow between different stakeholders of the system who are responsible for capturing citizens' feedback and further service improvement. Moreover, it did not capture the relationship for closing the feedback loop from the citizens' end from the service layer to the context layer as highlighted in red colour in Figure 5. Therefore, this study argues that to continue providing improved services to the citizens, the feedback loop needs to be closed. This will assist in refining the requirements at the context layer based on which further changes can be implemented at the information and technology layer.
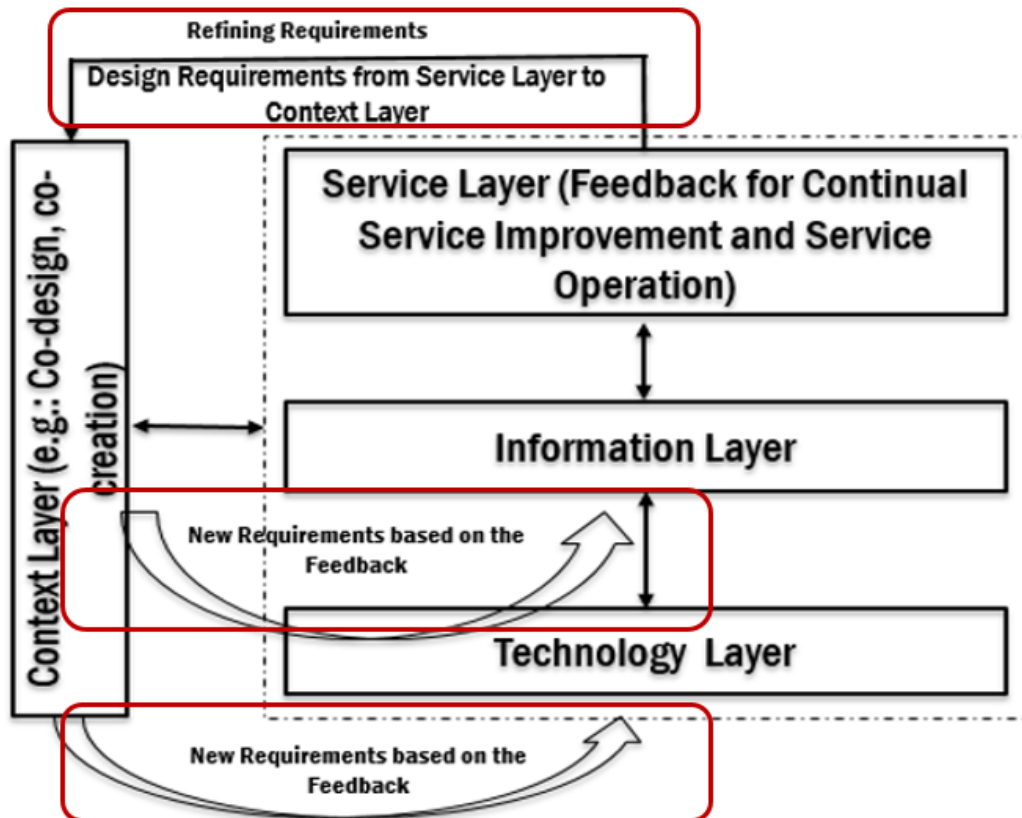
Figure 5: Architectural layers adapted from Pourzolfaghar et al., (2019)

The findings from this review and analysis further strengthened the research gap as discussed in section 2.3.6. To address the identified research gap, this study proposes a process model that has been developed based on the findings derived from the literature review as discussed in earlier sections, by collaborating with practitioners from County Councils of Ireland, and by following the TOGAF EA guidelines. The next section provides the rationale for selecting an EA framework to design the proposed solution, and for specifically adapting TOGAF EA in the context of this study.

2.5 The rationale for Selecting Enterprise Architecture Framework

The European smart city project defines a smart city as a city that performs well in 6 features including smart economy, environment, mobility, living and governance, and people, and thus creating a challenging landscape for smart city architectures (Kakarontzas et al., 2014). A clearly described problem, processes, and objectives can assist in addressing those challenges, and as a result, city authorities can make informed decisions regarding smart city priorities (Pourzolfaghar, Bezbradica and Helfert, 2016). However, multiple challenges are faced by municipalities and cities in transforming and digitalising city services and there is a need of providing more efficient public services (Bastidas et al., 2021). Smart cities deal with higher complexity wherein city services need to respond to multiple stakeholder concerns and goals (ibid). EA provides different methods and frameworks to deal with

complexity and change in public or private organizations (Anthopoulos, et al., 2010). Enterprise Architecture supports the idea that organisations can be improved or designed logically to better describe the fundamental structure of the enterprises (O'Brien, 2018). It provides a holistic overview of the As-is state as well as the To-be state of the processes and structures of the system (Jnr, 2020). It demonstrates the fundamental structure of a system, its components, environment, and the relationships and rules that govern its design and evolution (Anthony et al., 2019). In addition, it supports in planning, leading, designing, and managing processes within systems' current, transitionary, and future states (Jnr, 2020). The benefits of implementing EA include improved customer satisfaction, organisational collaboration and communication, decision-making, interoperability, increased efficiency, reduced complexity, and risk, providing a high-level overview of the organisation along with the direction to improvement, flexibility (Niemi and Pekkola, 2020; Napitupulu et al., 2018; Lankhorst, 2017; The Open Group, 2018). These benefits help to translate the business strategy into enterprise change by identifying, communicating, planning, and enabling the organization's evolution to the desired future state (Jacobson, 2009). It was initially used to bridge the gap between the business need and the ICT strategy of the companies that have also been employed in a smart city context to bridge the needs of a city with ICT (Petersen et al., 2019). Digital transformation of city services enabled municipalities to move from a traditional operation-based approach to the digital one, and there have been numerous studies that highlight the importance of enterprise architecture for digital transformation in making cities smarter (Anthony Jnr, 2020). EA assists in strategy formation, aligning organisations with their strategic purposes, and simplifying the organisation's implementation (O'Brien, 2018). In the context of cities, the EA approach can support the transformation of cities based on the strategic planning and needs of citizens (Bastidas, et al., 2017).

The sudden proliferation in urbanisation is of growing concern for city authorities as they face challenges in delivering services to the citizens. As a result, they should be ready to transform themselves to operate smartly (Gobin-Rahimbux et al., 2020). Enterprise architecture can address this need by providing a strategic context for the growth and reach of the digital capability to respond to the continuously changing needs of the business environment (The Open Group, 2018). It has been found as a most powerful tool to support the examination of flexibility for digital transformation which offers a high-level overview of the IT systems and business of an organisation, and their relationship (Gong, Yang and Shi, 2020). This study argues that the enterprise architecture can provide insights to understand the interrelationship between different components of the Council and their relationship with each other. For instance, it would assist to analyse the relationship between citizens' feedback and its impact at the service level by considering different architectural domains (E.g. Architecture

vision, business architecture, requirement change management, etc.). Moreover, the root cause of the problem identified in this study is composed of different elements and belongs to different domains such as vision, requirement mapping, requirement management, etc. In addition, there was a need to provide a solution that can capture all those elements together and provide a holistic overview of the system to address the challenges faced by practitioners. EA would provide a holistic overview of the complete system that captures both sides of the Council, one that interacts with citizens and captures their feedback, and another that works upon those feedbacks for further service improvement while addressing the challenges faced by practitioners. Traditional transformation methods such as process improvement, IT governance, strategic planning, and program management lack in providing a holistic picture and the adhesive component that would hold the transformation together (Niemi and Pekkola, 2020).

Public service transformation affects many aspects of cities which include strategy, organisational structure, stakeholders, technological infrastructure, and information systems (Bastidas, 2021). EA has been used to develop digital services and is recognised as a suitable approach for digital transformation, and for obtaining better services for enterprises and citizens (Dang, et al., 2020). It provides an integrated and comprehensive overview of the complete system constituted of multiple elements (Foorthuis et al., 2012). The purpose of this study is to obtain such a comprehensive understanding of the system within the Council which involves multiple stakeholders and their interaction within the system who work on citizens' feedback to provide improved services to them. The basic assumption of this study is that local government needs to capture the relationship between different components working in isolation and have a structured approach that would guide them in transforming existing public services. A case study with County Council A was conducted to understand how does local government capture citizens' feedback and works upon them to provide improved services to the citizens. EA was used to analyse the interrelationship between various elements of the system and how does those elements impact the continuous service improvement process while capturing the complex workflow between them. Currently, practitioners lack a structured approach and are not able to see the broader picture of the system which involve multiple stakeholders, departments, processes, constraints, vision to fulfil citizens' need, etc. EA would provide this broader picture and guidance to the practitioners in addressing citizens' needs while capturing the complexity and relationship between those elements, which is critically important for continuously providing improved services to the citizens. Therefore, this study found the enterprise architecture approach as the most appropriate one to design the proposed solution in the context of this study. The following sections provide a review and comparison of existing EA frameworks that were considered for this study.

2.5.1 Zachman

Zachman was the first enterprise architecture framework introduced by John Zachman in 1987 (Zachman, 1999). It provides a logical structure to classify and organise the descriptive representation of an enterprise that is significant to the management and development of enterprises (Lankhorst, 2017). It has six viewpoints which include planner, owner, subcontractor, builder, designer, and user, whereas another dimension of the framework deals with questions: what, where, how, who, when, and why (Urbaczewski and Mrdalj, 2006). It establishes the interaction between different roles in the design process, provides product abstraction i.e. what material it is made of, and how it works, and where the components are related to each other (Lankhorst, 2017). Advantages of this framework include being easy to understand, addressing enterprises as a whole unit, defining independent tools/methodologies, etc. (ibid). However, it does not provide any guidance on the order of the activities, or their execution, rather ensures that all views are clear and represent the overall system without considering the sequence in which they are established (Dumitriu and Popescu, 2020). Moreover, it does not provide any compliance rules for implementing the framework (ibid).

2.5.2 **DoDAF**

The Department of Defence Architecture Framework (DoDAF) defines three views (Agarwal, et. al, 2017). The first one is operational which presents and describes activities, tasks, operational components, and information flow needed to accomplish an operation. The second one is technical which represents the minimum set of rules prevailing in the interaction, arrangement, and interdependence of system elements. The last view is a system that describes systems and the relationships supporting the activities of interest (Agarwal, et. al, 2017). DoDAF was originally developed for the US department of defence to provide a common united approach for military services, commands, and defence agencies (Lankhorst, 2017). Even though it has a very specific target, it can be extended to system architectures (ibid). Nonetheless, there is a tendency to be dependent on outside vendor capability and support for organisations to capture, analyse, model, and distribute vital information represented in the form of operational, system, and technical views (Anderson et al., 2008).

2.5.3 **FEAF**

The focus of The Federal Enterprise Architecture Framework (FEAF) is to facilitate interoperability, information exchange among agencies and entities, and the development of the federal processes of the government (Dumitriu and Popescu, 2020). The main goal is to boost interoperability levels within government entities by using a unified enterprise architecture approach for the entire federal government (ibid). It contains guidelines and is oriented toward enterprise architecture in contrast to

IT architecture. However, it does not prescribe the approach for developing the products (Urbaczewski and Mrdalj, 2006).

2.5.4 TEAF

The Treasury Enterprise Architecture Framework (TEAF) defines views as compared to the columns and perspectives as compared to the rows in the Zachman framework and thus creates a matrix (Diamond *et al.*, 2014). It focuses on establishing a common enterprise architecture structure, common terminology, integration, information sharing, and exploitation of collective requirements across departments (ibid). It guides the redesign of the business processes for several sections to meet the legislation requirements in a rapidly changing technology environment (Mohamed *et al.*, 2012). Nonetheless, it does not provide a detailed description and techniques for creating the resulting work product that is suggested within the matrix (Leist and Zellner, 2006).

2.5.5 TOGAF

The TOGAF standard is an open enterprise architecture framework that provides tools and methods to assist in the production, acceptance, usage, and maintenance of an EA (*The Open Group Standard*, 2018). It is based on an iterative process model maintained by best practices and a re-usable set of existing architecture assets (ibid). The purpose of TOGAF is "to optimize across the enterprise the often-fragmented legacy of processes (both manual and automated) into an integrated environment that is responsive to change and supportive of the delivery of the business strategy" ('The Open Group Standard', 2018, p. 6). Architecture Development Method (ADM) forms the core of the TOGAF standard and explains a method for managing and developing the lifecycle of an EA. ADM is a manual reference to the architecture that provides a detailed method on how to develop and manage enterprise architecture (Harani, Arman and Awangga, 2018). TOGAF ADM is popularly used as it contains architectural process, offers standardisation, and support the evolution of architecture (Osadhani *et al.*, 2019).

2.5.6 Discussion

The most commonly used EA frameworks are TOGAF and The US Federal Enterprise Architecture Framework (FEAF) in which about 32% of public sectors use TOGAF to implement EA while about 25% use FEAF (Ansyori, et al., 2018;). TOGAF is the more popular EA framework as it is easy to understand and provides a clear process for implementation (Bouafia and Molnár, 2019; Anggraini, et al., 2019). It has been found as the most reliable enterprise architecture in the world in which 80% of the companies from the list of 50 global companies use it (Kotusev, 2018). TOGAF provides a methodology for planning, designing, and implementing EA and is provided by the Open group without any charges (Dumitriu and Popescu, 2020). The implementation of EA with TOGAF ADM reflects multiple

stakeholders' needs while considering the current and future needs of an organisation (Firmansyah and Bandung, 2017). The ADM helps Architects to develop a snapshot of the enterprise's decisions and their implications during specific time intervals (The Open Group, 2018). TOGAF ADM can assist to detail processes and focus on the operational activities of the organisations. It provides steps to develop the target architecture of an organisation for achieving its strategic objectives (Girsang and Abimanyu, 2021). It focuses on processes and provides flexibility to combine different artefacts and approaches (ibid). This is in line with the aim of this study, more specifically, this research focuses on the three ADM phases of the TOGAF framework i.e., Architecture vision, Business architecture phase, and Requirement change management for this study as the identified challenges from the case studies and literature review belong to those three domains. Therefore, this study found TOGAF ADM as the most suitable one for addressing those challenges. The next provides detail about the implementation of the TOGAF EA using existing modelling languages.

2.5.7   EA Modelling

TOGAF ADM offers textual guidelines to adjust and implement EA processes (Kornyshova and Barrios, 2018). However, textual guidelines can be very long to read, understand and follow, not only for non-technical users but also for domain users (Figl, 2017; Kornyshova and Barrios, 2018). Furthermore, TOGAF only suggests using the ADM method for the implementation purpose without providing any detail on how (Kotusev, 2018). There are EA modelling tools such as Enfocus Solutions, Sparx, iServer, Abacus, and Bizzdesign that can facilitate the visualisation and modelling of TOGAF EA activities and support its artefacts (Kornyshova and Barrios, 2018). Nonetheless, none of them provide detail about how to model the textual description of TOGAF ADM guidelines (ibid). Furthermore, stakeholders at the Council wanted to have a process that is visually appealing and easy to understand. Visual representations are considerably easy to comprehend and follow, more specifically, visual process models meet user preferences in a better way as they provide a more thorough and precise representation (Kornyshova and Barrios, 2018). The flow of an organisation's business activities can be visually represented by process models (Figl, 2017). Business process model represents the enterprise's processes to analyse and improve them from their current state (as-is) to the future state (to-be) (Chinosi and Trombetta, 2012; Bailey, 2006). In addition, there was a need to capture the multiple stakeholders' concerns and the complexity of the workflow that involves community engagement coordinators, service providers, and other departments who are responsible for improving and delivering the services. Consequently, this study proposed a process model using Business Process Model and Notation (BPMN) for capturing the workflow between different stakeholders responsible for capturing the citizens' feedback and improving the services, and to model the textual guidelines of TOGAF ADM. BPMN is a standard that provides comprehensive notations for

demonstrating business processes, and captures the detailed workflow of the process, their inputs and outputs as compared to other graphical notations such as ActiMate, UML business and activity diagrams (Kornyshova and Barrios, 2018). It offers a representation that can be understood by all business users including technical developers responsible for implementing technology and executing processes, and the business individuals who will monitor and manage those processes which is in line with the aim of this study (Avila et al., 2020; White, 2004). Additionally, it supports the formation of different perspectives by providing the flexible architecture (Ramos-Merino et al., 2018). Some of the benefits of implementing BPMN models include process analysis and improvement, requirement specification, better understanding, and communication (Indulska, Marta et al., 2009).

2.6   Chapter Summary

This chapter provided a research background on the role of citizens during different stages of smart city services. The scope of the research was identified while conducting a literature review by following a structured approach proposed by (Webster and Watson, 2002). Additionally, a thorough systematic literature review was conducted by following the three-stage methodology, proposed by (Yigitcanlar et al., 2019, p.352). This chapter first analysed the role of citizens in the development of smart city services based on the different phases of the ITIL framework. It was observed from this analysis that most of the existing studies mainly focused on citizens' participation during the initial stages of the service lifecycle. However, this study found that the later stages of the service life cycle play an important role to deliver effective services to the citizens, and to measure the actual impact of their participation during the design process. Moreover, this study classified existing literature from the lens of an adapted smart city framework and highlighted the role of citizens in the development of smart city services from an architectural viewpoint. This classification aimed to understand citizens' roles at various levels (e.g. service, context, information, and technology levels).

In light of the above literature findings, this chapter highlighted the significant research gap in the previous studies which mostly focused on the technical side of citizen engagement and initial stages of the service lifecycle and thus fail to fulfil the need of citizens. To address this research gap, this study further proposes Enterprise Architecture as a basis to design the proposed solution for which the detail has been provided in chapter 5. This study follows the Design Science research approach, and one of the important elements of this methodology is to underpin the problem not only from a literature viewpoint but also to provide its relevance in the real environment. Therefore, this study further investigated the problem in the real environment by collaborating with practitioners from County Council A in Ireland. A detailed discussion has been provided in chapter 4. The next chapter provides a detailed discussion of the adapted methodology for this research and how it has been followed in the context of this study.

3 RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides an overview of the Design Science Research (DSR) methodology for the current study. This chapter describes the philosophical assumptions, research methods, and approaches used to answer the research questions as discussed in section 1.6. Furthermore, it provides the rationale for chosen research design in the context of this study. Case studies were conducted to identify the challenges from practitioners' viewpoints in existing citizens' engagement platforms and to support service improvement based on the guidance provided by (Yin, 2009). This discussion continues by providing a detailed discussion of various data analysis approaches. Finally, it describes the applied methods and techniques for addressing the validity and reliability of this research. The following section provides the philosophical assumption of this study.

3.2 Philosophical Underpinning

The purpose of this research was to explore the role of citizens' feedback in smart city services and to transform public services to meet the need of citizens. Thus, this study explored how local authorities in Ireland improve services based on the citizens' feedback that is captured via multiple platforms instead of focusing on quantifiable measures. As a result, the positivist approach was not considered a suitable choice for a philosophical position. Furthermore, as discussed in chapter 2, the non-technical factors also play a significant role in providing improved services to the citizens. As a consequence, taking this into account, reality needs to be explored and constructed subjectively which cannot be known by quantitative analysis. Moreover, the focus of this study was not to undertake a historical analysis of changing or persistent organisation structures as supported by critical realism philosophical assumptions (Saunders, et al., 2019). Thus, it was also excluded from this study. Similarly, as postmodernist who seek to question the established ways of thinking and being vocal towards alternate worldviews is not in line with the aim of this study (i.e. to understand multiple realities from citizens' and local authority's viewpoint in different contexts). Another philosophical assumption is pragmatism which focuses on understanding human nature via an empirical study of people's daily lives (Holton and Burnett, 2005). However, as the focus of this study was more on understanding the experience of practitioners and citizens, this approach was not suitable for this study.

In the context of this study, this research found that existing literature seems to be more inclined towards solving the technical problems, and ignoring the existence of non-technical ones that include process, management, structure, and citizens (Habibzadeh et al., 2019). Moreover, local governments are more concerned with implementing citizen participation initiatives, and obtaining citizens'

feedback instead of achieving particular results out of those participation (Pina, et al., 2017). This research investigated existing citizen engagement platforms that capture citizens' feedback and examined their role in the improvement of smart city services to understand the reality from their viewpoint. Moreover, this study investigated the challenges from practitioners' viewpoints in mapping citizens' requirements to understand their point of view and reality. Accordingly, the ontological standpoint of the work is that knowledge is created subjectively and based on stakeholders' observation of reality which is not separable from the researcher. From an epistemological perspective, knowledge is being developed through lived experiences. The Interpretivist approach can help to understand the dynamics between citizens and local authorities and to uncover realities from individual perspectives for achieving the ultimate goal of improving the quality of life for the citizens of the city. This can only be achieved through the in-depth study of the experiences of the community who provide their feedback on multiple services, and by understanding the perspective of local authorities who engage with the local community and try to address their concerns. Consequently, an Interpretivist perspective is considered the most appropriate philosophy for this research which takes on a subjective ontological viewpoint of the world in which reality is constructed socially (Saunders et al. 2012). The next section provides detail about the followed methodology for conducting this research.

3.3 The selection of the Research Methodology

The research process is a systematic way of defining the research objective, managing data, and communicating the findings with well-established guidelines (Marvasti, 2018). Research methodology is an approach to systematically solve the research problem and may be considered a science of studying how research is performed scientifically (Kothari, 2004). Research method on the other hand is understood as a collection of methods or techniques used for conducting the research (ibid). The researchers must decide which research methods to employ for the collection of data to address specific research questions which can be quantitative, qualitative, or a combination of both (Bhattacherjee, 2012). Researchers need to know not only research methods or techniques but also the methodology that guides how to apply them (Kothari, 2004). In the following section, the Design Science Research Methodology (DSRM) is selected as the main research methodology to guide this research within the field of smart cities and Information Systems. A detailed discussion has been provided for selecting DSRM in the context of this study.

3.3.1 Information System (IS) and Methodology Selection

Information System involves a broader range of socio-technical artefacts such as modelling tools, methods for IS evaluation, decision support systems, etc. (Gregor and Hevner, 2013). An

interdisciplinary field cutting across people, technology, organisational issues, non-technical side of smart cities and services would fit well with the compelling thoughts of IS researchers (Peng, et al., 2017). Socio-technical perspective is needed when organisations undertake the idea of smart initiatives (Bednar and Welch, 2019). This research considers the complex workflow between multiple stakeholders from different departments within the Council, public services, and technical solutions as a part of the social-technical system. The investigation of such a complex system involving social and technical sides allows the researcher to choose the appropriate research methodology from a qualitative or quantitative viewpoint.

There are two research paradigms in Information Systems (IS), behavioural science and design science. Behavioural science is understood as a problem-understanding paradigm while design science is known as a problem-solving paradigm (Helfert, Donnellan and Ostrowski, 2012; Hevner et al. 2004). Behavioural science tends to verify and develop theories that predict human and organisational phenomena whereas design science seeks to create artefacts that address a specific problem. Behavioural science usually starts with a defined hypothesis and gathers data either to prove the hypothesis or disprove it (Hevner, Chatterjee 2010). On the other hand, Design science focuses on a problem-solving approach, and produces an artefact that should be designed and evaluated iteratively for achieving the defined objectives. Behavioural science aims to explore and validate generic cause-and-effect relationships whereas design science aims at the creation and evaluation of the "generic means-ends relations" (Winter, 2008). The goal of behavioural science is to discover truth while the objective of design science is utility (Hevner et al., 2004). They both are essential in the field of IS research as they focus on the socio-technical side of the system which includes organisation, people, and technology (ibid). There are two major divisions of design science research, one focuses on the development of the novel artefact and holds a dominant view, whereas the other focuses on artefact design theory (Carlsson *et al.*, 2011). Design science focuses on the development of the artefact and does not require formal theories for the design of the artefact (Peffers, et al., 2018). Hevner et al., (2004) highlighted that Behavioural science has its origins in the natural sciences, while Design science follows an engineering approach in which solving a particular problem is a key which is in line with the aim of this study as well.

There are multiple reasons for adopting design science research in the context of this study which has been discussed as follows. Firstly, Design science is a well-established research methodology in the field of IS and its goal is to extend the capability of people and organisations in solving IS problems (Drechsler and Hevner, 2016; Walls, et al., 2004). Secondly, the main aim of this research is to structure the relationship between citizens' feedback and continuous service improvement for addressing the challenge of having a lack of structured approach to providing improved public services to the citizens

in a local government context in Ireland. This relationship is captured in the form of an artefact (process model) which is a product of the design science research. Thirdly, design science defines a process for creating and evaluating such artefacts which are critical for this research and also enhances the quality of the resulting artefact. Finally, it provides a framework for incorporating different research methods (e.g. qualitative and quantitative) and assists in continuously evaluating and improving the artefact (Peffers *et al.*, 2007).

3.4 Design Science Research Methodology

This study adapted Design Science Research Methodology (DSRM) approach for conducting this research. Design science consists of two basic activities, build and evaluate where the building is the process of constructing an artefact for a definite purpose; and evaluation is the process of determining how well the artefact performs (March and Smith, 1995). Design science research begins by recognizing and representing opportunities and problems in the real application environment (Henver, 2007). It focuses on creating "things" or artefacts that serve a particular human purpose and address "wicked" problems (Rittel and Webber, 1973). Wicked problems are characterized by unstable requirements and constraints, complex interactions among subparts of the problem and its solution, and flexible processes and artefacts to produce effective solutions (Hevner et al., 2004). The underlining problem identified within this research can be classified as a wicked problem since it involves unstable requirements from the citizens' end. Additionally, constraints from City Councils in fulfilling these requirements, unstructured processes, and the complex interaction between multi-stakeholders such as the council, service providers, citizens, etc. for providing improved services, all compound this problem. Peffers et al., (2007) defined six steps for implementing the Design Science Research Methodology (DSRM). These phases have been defined as (1) motivation and identifying the problem, (2) define the objectives, (3) design and development, (4) demonstration, (5) evaluation, and (6) communication. This research combined phases 1 and 2 into the Problem investigation phase. Similarly, phases 4 and 5 were combined into the Demonstration and evaluation phases. This is because this study conducted those steps together during different stages of this research. Figure 6 represents how the DSR methodology was applied in the context of this research. The remaining chapters of this thesis have been organised based on the different phases of DSR methodology. The following sections provide a detailed discussion of the different phases of DSR and its application in this thesis.

    I.   Problem investigation

    II.   Design and development

    III.   Demonstration and evaluation

    IV.   Communication
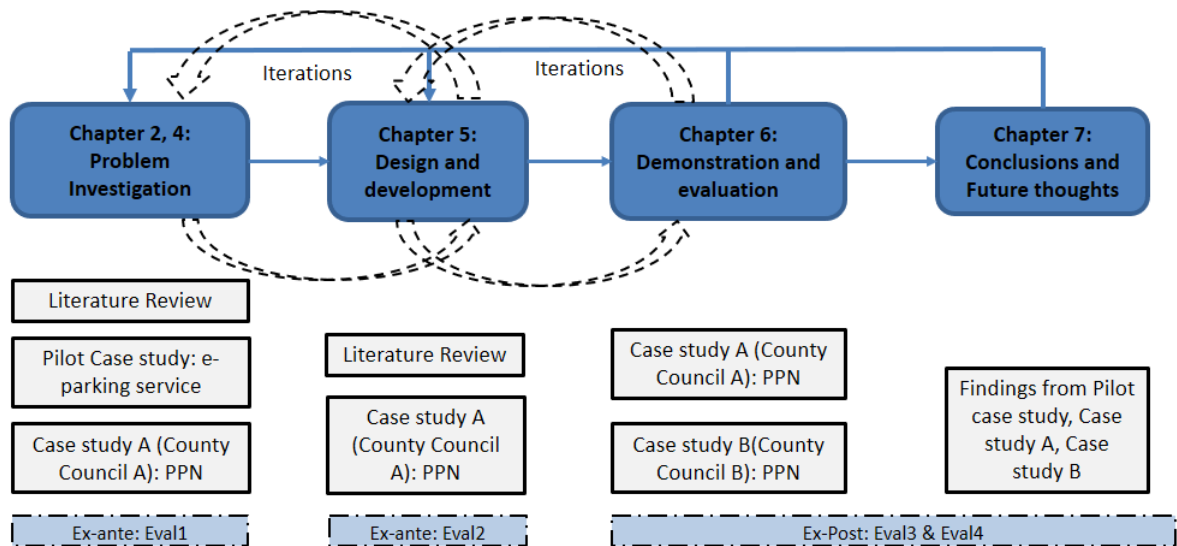
Figure 6: DSR methodology adopted in this research

3.4.1 Phase One: Identifying the Problem, Motivation, and Research Objectives

This research initiated the investigation of the problem in a real environment after performing the scoping review followed by a systematic literature review. The identified research problem, the motivation for this research, and the objectives are presented in Chapters 1 and 2. Sections 1.1.1 and 1.1.2 presented a review of the literature findings on the role of citizens during different stages of smart city services and to transform existing services. Section 1.1.3 provide the relevance of EA in the context of smart cities. Section 1.2 provides an overview of the project with County Council A. Section 1.3 discusses the observation and research gap identified in this study. Section 1.4 provides a brief overview of the research problem and motivation for this research. Section 1.5 defines the objective of the research and Section 1.6 formalises the research questions for this research. Chapter 2 presented the literature review findings and associated work on the role of citizens in smart city services and public service transformation following a systematic literature review as suggested by Yigitcanlar *et al.*, (2019). Research gaps are discussed in Section 2.2.6 and in Section 2.3.5 which further guided the formulation of the research questions and objectives as defined in Chapter 1.

Moreover, this research selected the first case study (e-parking service) in Ireland to explore how such services are designed by local authorities and to examine what kind of feedback was provided by the citizens. The findings from this case study laid a path firstly to explore how local authorities engage with citizens and gather their feedback for improving existing services. Then, the second case study A (Community prospect (PPN)) was conducted with County Council A to understand local authorities' perspective on the overall engagement process and how they incorporate citizens' feedback for improving existing services. Chapter 4 provides detail about both case studies. The second case study

continued until the solution was developed and evaluated iteratively with the practitioners from County Council A.

3.4.2 Phase Two: Designing & Development

This research followed a reference model as defined by Ostrowski and Helfert, (2012) for the design and development of the proposed artefact (A Process Model) as shown in Figure 7. The construct layer of the reference model guides the design of the artefact by providing techniques to develop the artefact which is missing in the majority of the existing DSR frameworks (Alturki et al., 2011). Three main activities were identified as crucial in this development (Ostrowski and Helfert, 2012). These activities were literature review, collaboration with practitioners, and relevant modelling techniques. A systematic literature review was conducted by following a three-stage procedure as proposed by (Yigitcanlar et al., 2019, p.352). The second step was a collaboration with practitioners which played a substantial role in the design process. Structured interviews, focus groups, and direct observations are the most common ways of collaboration (Yin, 2009). Finally, for the modelling purpose, Business Process Model and Notation (BPMN) were selected to design the process model.
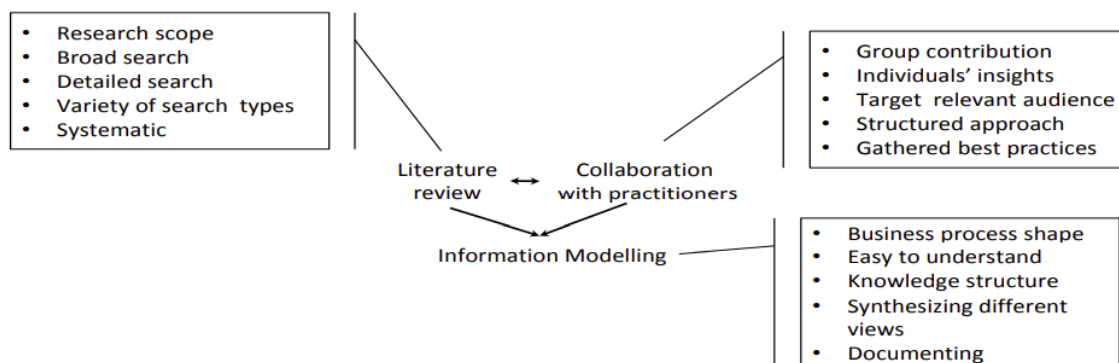
Figure 7: The Construct layer of the reference model (Ostrowski and Helfert, 2012)

This study provided the details of the artefact design and development activities in Chapter 5. Firstly, it discussed the derived design guidelines based on the literature review and interviews conducted with practitioners in County Council A. Secondly, it presents the set of activities that were carried out for designing the artefact. Lastly, it presented artefact development and implementation specification. Then, the artefact is demonstrated and evaluated during the ex-ante evaluations with practitioners. The artefact was further refined based on the practitioner's feedback obtained during the iterative process of evaluations. Finally, the ex-post evaluation was conducted with practitioners and the details have been provided in Chapter 6.

3.4.3   Phase Three: Demonstration and Evaluation

The aim of the demonstration and evaluation phase of the DSR methodology is to determine that the artefact works to achieve its objectives. Additionally, it considers how well the developed artefact addresses the problem. The main technique for evaluating this research was set to be a case study approach in which a Confirmatory Focus Group(CFG) discussion was used as a data collection method to evaluate the usefulness of the process model (Yin, 1981; Yin, 2009). The CFG was selected for this purpose as it provides confirmatory proof of an artefact's usefulness in the real environment (Tremblay, Hevner and Berndt, 2010).

This section provides an overview of the evaluation strategies followed in this study to evaluate the proposed process model during different stages of the research investigation process. Evaluation is a key activity in the DSR process because it provides feedback to improve the later development, and ensures the rigour of the research if completed appropriately (Venable, et al., 2016). This study conducted ex-ante evaluation 1 to validate the specified problem and to design the proposed solution (Model) as discussed in section 4.3 in chapter 4. Based on the practitioners' feedback, the artefact is evaluated iteratively and improved in the subsequent cycles. This process is repeated until the objective of the research is met. During the first evaluation cycle, the research problem was investigated and validated by the practitioners. The proposed artefact was then evaluated during the second evaluation cycle as discussed in section 5.4 in chapter 5. The purpose of this evaluation was to assess whether the design specification is understandable and meaningful to all of its stakeholders (Sonnenberg and Vom Brocke, 2012). Based on the conducted interviews, further design changes were made to improve the artefact in the next iteration of the design cycle.

Finally, this study shows the usefulness of the artefact in the real world by collaborating with practitioners from County Councils (County Council A and County Council B) in Ireland. This evaluation was performed by conducting confirmatory focus group discussions and semi-structured interviews with practitioners. During the evaluation process, different components of the process model were demonstrated to the participants, and they evaluated the process model based on: (a) an outcome of the artefact against the traditional approach of citizens' engagement process; (b) if it assists them in a better decision making of tracking the progress of the service improvement; and (c) to provide better requirements specification and guidance for continuously providing improved services to the citizens.

This study evaluated the outcomes of this research during different stages of the DSR methodology based on the strategy and methods provided by (Sonnenberg and Vom Brocke, 2012; Helfert, et al., 2012). The evaluation of the artefact constitutes evaluating its components for applying it in the real environment, and measuring if the proposed artefact solves the identified problem and serves the

objective of the research. This thesis demonstrated and evaluated the proposed artefact in multiple case studies in two County Councils of Ireland. The rationale behind selecting both County Councils was that they both follow similar processes for gathering citizens' feedback on different services using the same program (PPN). These case studies include multiple sources of data as a shred of evidence such as semi-structured interviews, focus group discussions, internal documents, etc. Practitioners' feedback assisted in improving the artefact during different stages of the artefact development and evaluation. The details have been provided in Chapter 6.

3.4.4   Phase Four: Communication

The last phase of the DSR methodology is Communication which is associated with communicating the problem, and the effectiveness of the solution to a wide range of audiences such as professionals, and the research community (Peffers *et al.*, 2007). Design science research should be communicated effectively to a wider range of audiences including technology and management (Hevner and Chatterjee, 2010). The results from this study have been communicated to different audiences during various stages of artefact development and evaluation. This includes publishing papers at international conferences and presenting results to domain experts. Moreover, this research provided a detailed overview of the proposed artefact to the practitioners in two different County Councils of Ireland. The results for this phase have been discussed in chapter 7. The next section provides detail about the research approach followed in this thesis.

3.5   Research Approach

There are three common approaches for conducting the research which include qualitative, quantitative, and mixed methods (Marvasti, 2018). The choice of research approach is associated with the type of data that needs to be collected for answering the research questions. Quantitative research focuses on numerical manipulation and representation of data (Kamolson, 2007). The focus of quantitative research is to measure the hypothesis quantitatively based on previously developed theories or with the proposed one (Holton and Burnett, 2005). Qualitative research is a systematic scientific inquiry that tries to build a holistic, mostly narrative description to inform the researcher's understanding of a social phenomenon (Prashant and Astalin, 2013). It is conducted to explore an issue or problem (Creswell, 2015). Qualitative research approaches usually need formulated research questions to be explored and developed during the research process itself instead of testing any hypotheses using empirical data (Mason, 2002). The source of data for qualitative research includes interviews, documents, questionnaires, the researcher's reactions and impressions, and participants' observations (ibid). Qualitative data analysis has an extensive history in the social sciences, and it seeks to answer questions of 'how and why' (Mattimoe *et al.*, 2021). It is more beneficial to explore institutional phenomena, describing participants' understanding and their perceptions, producing

concepts, and theories that are directly related to a particular environment (Hathaway, 2016). Qualitative research is cultivated through different types of information provided by the participants who participate in the research inquiry (De Gialdino, 2009). Qualitative research methods assist researchers in understanding social and cultural contexts in which they live (Myers, 1997). It stands for an approach instead of focusing on a particular set of techniques which depends on the nature of the phenomena to be studied (Strong, 1980).

The mixed-method research approach provides the ability to design a single research study that addresses questions about measurable variables along with the complex nature of the phenomenon from the participants' viewpoint (Marvasti, 2018). The utility of the mixed method approach can be seen in two ways. The first approach is associated with collecting both types of data and then integrating, or comparing it, which involves merging numeric data with text (Holton and Burnett, 2005). The second approach involves linking both qualitative and quantitative data collection and analysis (ibid). In this approach, the researcher first produces statistical results and then a follow-up in-depth interviews can be followed.

This study opted for a qualitative research approach, and multiple factors contributed to the selection of this choice. Firstly, it is in line with the philosophical standpoint of this research i.e. Interpretivist approach which is based on a subjective ontological perspective of the world in which reality is constructed socially (Saunders et al. 2012). Secondly, existing studies in the field of citizen engagement and smart cities propose many solutions to improve services based on community feedback. However, none of them provides a holistic view of how services are improved based on citizens' feedback. Besides, these studies do not capture the other side of the system which is the local authority that engages with citizens locally and address community concerns. Therefore, this research aimed to explore how local authorities capture citizens' feedback for improving existing services. Consequently, this research further wanted to explore how such services are improved by local authorities and what is the role of citizens/community in it. This motivated the researcher to investigate the existing citizen engagement platform, and to examine how services are improved based on community feedback in different County Councils of Ireland. This assisted the researcher in understanding the reality from different stakeholders' perspectives which could not be achieved with quantitative data analysis. Hence, the qualitative research approach was found to be the most suitable approach for the investigation of the problem in the real environment and to understand the phenomena from a social perspective. The next section provides detail about different qualitative research design approaches.

3.5.1 Qualitative Research Design

There are different categories of qualitative research designs: Narrative research, grounded theory, ethnography, action research, case studies, phenomenology, and participatory action research which have been discussed as follows (Marvasti, 2018; Sein *et al.*, 2011; Creswell *et al.*, 2007)**.**

Narrative: Narrative is a massive and diverse genre that can be found on different platforms (Turn and Studies, 2022). The process of implementing this research involves the study of one or two individuals, collecting data through their stories, reporting their experiences, and chronically ordering the connotation of their experiences (Creswell *et al.*, 2007).

Grounded Theory: Grounded Theory Methodology (GTM) provides explanations about why people behave in a particular way. It allows researchers to advance in theoretical interpretation of the topic while grounding it in empirical data or observation (Patricia Yancey and Turner, 1990)**.** If theory development is the goal of the researchers, then they should deploy a maximum number of procedures in this approach (Wiesche and Yetton, 2017).

Ethnography: The focus of ethnography is to recognize beliefs, norms, social structures, and other aspects, and try to comprehend the changes in culture within a group over some time (Marvasti, 2018). The main feature of ethnography is that the researcher spends a noteworthy amount of time on the ground, takes notes, and live there for data collection purpose which is a significant part of the study (Myers, 1997).

Phenomenology: Most simply, "phenomenology means the study of phenomena" which could be events, experiences, or situations (Prashant and Astalin, 2013)**.** It takes the perspective that people living in the world can designate meaning to a situation, and can make judgments about it (Fereday and Muir-Cochrane, 2006)**.**

Action Research (AR): The action research method deals with producing prescriptive design knowledge by building and evaluating IT artefacts in an organisational setting. The produced design knowledge must create innovative artefacts addressing the organisation's needs (Mullarkey and Hevner, 2019)**.**

Participatory Action Research (PAR): There has been a lot of interest in the field of social and environmental sciences for PAR methods which involve education, collaborative research, and an action-oriented approach toward social change (Alexander *et al.*, 2007). In this method, the researcher and all participants collaborate at all levels during the research process to help find a solution for a social problem that affects the community (Creswell *et al.*, 2007).

Case study: The case study approach investigates and explores a contemporary phenomenon within its real-life context, most specifically when the boundaries between context and phenomenon are not evident (Yin, 2013). It consists of an in-depth examination of a complex phenomenon (Yin, 2013). The source of the case study can come from many sources such as documentation, interviews, direct observation, physical artefacts, and archival records (Yin, 2009). A case study is also referred to as a naturalistic design which is different than the experimental one in which the researcher seeks to employ control and manipulate variables of interest (Greenwood, 2011). The next section provides detail about the adapted research design approach in the context of this study.

3.6   Choosing a Suitable Research Design for This Thesis

This study found a case study to be the most appropriate one for the objective of this research. The case study approach investigates and explores a contemporary phenomenon within its real-life context, most specifically when the boundary between context and phenomenon is not evident (Yin, 2013). It consists of an in-depth examination of a complex phenomenon (Yin, 2013). The source of the case study can come from many sources such as documentation, interviews, direct observation, physical artefacts, and archival records (Yin, 2009). The case study is also referred to as a naturalistic design which is different than the experimental one in which the researcher seeks to employ control and manipulate variables of interest (Greenwood, 2011).

This study adapted multiple case studies approach as it was well suited to the philosophical assumptions and research motivation of this research. Eisenhardt, (1991) describes multiple case studies as "a powerful means to create theory because they permit replication and extension among individual cases" (Eisenhardt, 1991, p. 620). The data sources from different cases should be comparable even if they vary in depth and nature (Greenwood, 2011). Multiple case analyses should be of the highest quality, no matter what analytic techniques have been chosen (Yin, 2009). In a multiple-case study approach, several cases are selected which can be studied sequentially or concurrently to generate a wider perspective of the particular issue (Greenwood, 2011). Multiple case studies contain both individual studies of the cases, and cross-case analysis (Yin, 2009). It normally provides a robust base for building theories (Eisenhardt, 1989). The replication logic in multiple case studies fulfil two objectives in subsequent cases: a) It will allow the development of new perceptions and concepts. b) It permits the replication of previous findings (Dai, 2006).

In addition, the selection of the case study approach originates from the personal experience and belief of the researcher to understand the complex unstructured processes of community engagement, and service improvement, and to explore the experience of different stakeholders at the Council who engage with citizens at the local level. Furthermore, considering different County

Council's viewpoint and their challenges in addressing citizens' concerns is a key factor in the context of this research which has been neglected in the majority of the existing work. Therefore, a single case study approach would have limited the generalisability of the findings. As a result, multiple case studies provided an opportunity to leverage and strengthen the findings of this research. Multiple case studies enabled the researcher to explore differences and similarities within and between two Counties of Ireland.

This study conducted the first pilot case study to investigate the research problem from the real environment during the problem investigation phase of this research. The findings from this case study assisted the researcher in the selection of the subsequent case studies, and to evaluate the proposed solution in two different contextual settings. Then, this research further explored the citizen engagement process in two County Councils of Ireland. The practitioners from the Councils provided insightful information about their community engagement process and the impact of citizens' feedback at the service level. Based on the collaboration with practitioners, this study discovered that most of the existing solutions seem to neglect some of the significant factors which could impact the improvement of the services. As a consequence, city services fail to fulfil the need of citizens. Hence, based on the collaboration with practitioners, and literature findings, this study proposed a process model as a resulting artefact. The process model assisted in structuring the relationship between citizens' feedback and service improvement to continuously provide improved services to the citizens. The next section provides adapted research methods and techniques in the context of this study.

3.7   Data Collection Methods

This section outlines the research methods and techniques that were used for data gathering and conceptualisation of concepts during different phases of DSR methodology.

3.7.1   Qualitative Interviews

The most important data-gathering tool in qualitative research is qualitative interviews (Myers and Newman, 2007). Qualitative research involves a combination of observations, document reviews, and interviews and provides a way to look into the variables in a natural setting (Prashant and Astalin, 2013). The most important data-gathering tool in qualitative research is qualitative interviews (Myers and Newman, 2007). This research found semi-structured and focus group interviews as the most appropriate methods for data collection in this research. They both are informal and are flexible to be combined with a variety of other methods and theories (Hechavarría, et al.,2013). Artefact designers can utilise several different methods such as focus group discussion, expert interviews, surveys, field research, etc. to address the challenges of creating new products that did not exist before and ensure that there is a need for them (Chatterjee and Hevner, 2010). This study utilised focus group discussions

along with semi-structured interviews during different stages of artefact development and evaluation. The below section provides detail about semi-structured interviews and focus group discussions.

3.7.1.1 Semi-structured Interviews

Semi-structured interviews are a combination of structured and unstructured interviews, where questions are predetermined before conducting the interview but the interviewer provides flexibility to the interviewee in terms of elaborating and explaining a specific issue with open-ended questions (Mann, 2011). Semi-structured interviews are the most commonly used qualitative research method in information systems (Myers and Newman, 2007). In this type of interview, researchers explore the experiences of the participants in which researcher encourage them to talk about issues associated with the open-ended research questions (Tong A, al., 2007). The questions can be re-ordered and re-worded based on the response of the participants (ibid). This research method unfolds the topic in a conversational style and provides a chance for the participants to explore issues that they think are important (Hechavarría, et al., 2013).

The purpose of conducting semi-structured interviews in the context of this study was to understand what kind of challenges practitioners faced while engaging with citizens and to improve services based on the captured feedback. The researcher wanted to find out the issues based on the experiences of practitioners and citizens in different County Councils of Ireland. It includes discussing the lived experiences of practitioners while engaging with the local community and the challenges they faced in terms of addressing their concerns. Additionally, the researcher wanted to provide flexibility and time to the practitioners so that they could elaborate on the challenges in detail instead of providing specific answers to the pre-defined questions. Therefore, semi-structured interviews were found to be most appropriate as they allow researchers to determine participants' viewpoints about their experiences relating to a research topic (McIntosh and Morse, 2015).

3.7.1.2 Focus Group Interviews

Focus group interviews are defined as a moderated discussion among a group of people who discuss a topic based on the direction of the moderator/interviewer/facilitator (Chatterjee and Hevner, 2010). The moderator of the focus group discussion keeps the discussion going on the given topic and allows the participants to discover the subject from different angles (Hechavarría, et al., 2013). Focus group discussions can generate very high-quality data that can be a significant result for the interviewer (Mann, 2011). The key part of the focus group discussion is the interaction between numerous participants, and the creation and testing of new concepts and interpretations (Rodrigues *et al.*, 2010). The researcher can also modify its structure and content based on the specific needs of the research project, which makes it a very flexible data collection method (Rodrigues *et al.*, 2010).

The motivation for conducting focus group discussions was to evaluate the artefact with practitioners and observe the interactions and opinions of different individuals which further assisted in conceptualising different concepts (Mason, 2002). Moreover, practitioners' conversation with each other about the artefact, and their opinions on community engagement aspects provided valuable input for validating the issues in a real environment. For ex-ante evaluation, this study conducted exploratory focus groups (EFGs) discussion for improving the design of the artefact iteratively until it could be released in the real environment (Tremblay, et al., 2010). Then, by employing confirmatory focus groups (CFGs), the utility of the artefact was established during the ex-post evaluation stage of this research. Hence, focus group discussions were considered appropriate for evaluating the design and usefulness of the artefact. The next section provides data analysis approach applied in the context of this study.

3.8   Data Analysis Approach in This Research

There are three different theorizing strategies i.e. inductive, deductive, and abductive which can be adopted by design theorists (Gregory and Muntermann, 2011). In inductive analysis, the development of codes and their application are completed together (Rietjens, 2015). With inductive reasoning, the researcher develops theoretical propositions or explanations from the data as a part of the process in which the strategy is to move from specific to general (Mason, 2002). The deductive approach on the other hand uses classification or typology before collecting the data which requires an in-depth understanding of the phenomenon and a detailed literature review for developing the theories (Holton and Burnett, 2005). The third one is an abductive approach in which the researcher aims to find out new things that include variables and relationships (Dubois and Gadde, 2002).

In most of the cases, where theory is present, the deductive approach would be the most suitable one to be used, on the contrary, inductive reasoning can be applied when little theory is known about the phenomena (Holton and Burnett, 2005). Inductive reasoning is a bottom-up approach in which codes and themes emerge from the data itself, on the other hand, deductive reasoning is a top-down approach in which researchers use various ideas, concepts, and topics to code and understand the data (Braun and Clarke, 2012). Abductive reasoning is seen as different than mixing deductive and inductive reasoning in the research (Dubois and Gadde, 2002). It allows the researcher to evaluate theories and create new knowledge over continuous discourse between empirical pieces of evidence and theoretical conceptualisation (Järvensivu and Törnroos, 2010). It can be used to synthesize a justification, the induction preposition which is verified afterward by following an inductive approach (Paul, 1993). However, the research draws on a combination of this reasoning (Mason, 2002).

Van de Ven, (2007) describes how multiple cycles and iterations between three reasoning approaches (i.e. inductive, deductive, abductive) are desirable for the development of good theory. This research followed a design science research methodology in which this reasoning was combined in different ways (Gregory and Muntermann, 2011). This study first selected one of the smart services for the investigation of the problem during the problem investigation phase of the research methodology (DSR). The objective of this investigation was to firstly understand how such services are designed by the local authorities. Secondly, to know what kind of feedback was provided by the citizens for this service. After analysing their feedback (Review comments), it was observed that those comments could be useful for improving the services further. Therefore, this study mapped citizens' feedback to predefined quality factors of the services to address citizens' requirements (Singh, Lynch and Helfert, 2021). This mapping was performed by following a deductive approach in which different ideas, concepts, and topics are used to code and understand the data (Braun and Clarke, 2012).

This study further investigated the problem from practitioners' viewpoint and wanted to explore how services are improved based on the citizens' feedback. Based on the literature review findings, and the interviews with practitioners, this study started detecting themes and consistencies from the data, following an inductive reasoning approach. This approach provided a rigorous method for the coding and classification of the literature results, and interview data that further assisted in the development of the artefact. Lastly, to evaluate the resulting artefact during the initial and later stages of research, this research followed an inductive approach. This process allowed the final artefact to emerge inductively without any prior knowledge about what would be the components of the final artefact. The feedback from practitioners assisted in refining the proposed process model and mapping the components of the model correctly. The following section provides an overview of a modelling language that was adopted for the design of the proposed process model.

3.8.1 BPMN

This research used a BPMN process modelling language to capture the concepts and activities which are required for structuring the relationship between citizens' feedback and continuous service improvement. The Business Process Model and Notation (BPMN) is a standard way of representing the processes taking place in essentially every type of organization, some of the examples include incident management, travel booking procedures, e-mail voting systems, etc. (Chinosi and Trombetta, 2012). BPMN is an important standard for process modelling and has received a high level of attention in Business Process Management (BPM) sector (Recker, 2008). It provides capability to the businesses for understanding and defining their internal and external processes with the help of business process diagrams (White, 2004). It has been considered as a core enabler for new initiatives in the sector of Enterprise Architecture (Owen, et al., 2003). The flexible architectures derived from the use of BPMN

support the creation of different perspectives (Ramos-Merino *et al.*, 2018). BPMN is famous in both business and IT sectors in which 51% of the respondents use it for multiple business purposes such as process improvement, documentation, stakeholders' communication, etc. whereas 49% use it for technical reasons (e.g. service analysis and workflow engineering, process simulation, etc.) (Recker, 2008)**.** It allows modellers to represent various connected stages of processes in detail along with their inputs/outputs, links and dependencies (Kornyshova and Barrios, 2018)**.** BPMN models can be created using different tools available online, for example, Bizagi enables organizations to create business processes and document them in a central cloud repository (*Bizagi Modeler*, 2022). It provides a better understanding of each stage and recognizes process improvement instances for increasing the organization's efficiency (ibid). The following sections provide a detailed discussion of the validity and reliability of this research.

3.9   Validity and Reliability of this Research

The validity and reliability of this research have been discussed in the context of the qualitative research paradigm as a part of the conducted case studies within the DSR methodology. The reliability and validity of the qualitative research paradigm are conceptualized as trustworthiness, quality, and rigor (Maxwell, 1992). The criteria to ensure trustworthiness in a qualitative research setting are credibility, dependability, transferability, and confirmability (Stenfors, et al., 2020; Morse *et al.*, 2002). This study adapted those criteria to ensure the reliability and validity of this research. Table 1 provides an overview of the criteria as defined by (Stenfors, et al., 2020). A detailed discussion has been provided in the following section.

Table 1: Criteria to ensure the trustworthiness of qualitative research

Criteria	How to recognise it
Credibility	There is alignment between theory, research question, data collection, analysis, and results. The sampling strategy, the depth and volume of data, and the analytical steps taken are appropriate within that framework.
Dependability	There is sufficient information provided such that another researcher could follow the same procedural steps, albeit possibly reaching different conclusions.
Confirmability	The researchers show how they made their findings through detailed descriptions and the use of quotes.
Transferability	A detailed description of the context in which the research was performed and how this shaped the findings.

3.9.1   Credibility

This study selected a design science research approach to investigate the problem from a real-world environment. It allowed the researcher to explore the research problem based on the lived experience of citizens and city authorities who are responsible for providing public services to the citizens. The

rationale behind selecting the DSR approach has been discussed in section 3.3. The research opted multiple case study approach as an underlying research design under the umbrella of DSR methodology. This allowed the researcher to understand the problem in different contextual settings and to analyse it from the practitioners' viewpoints. Furthermore, this research found semi-structured and focus group interviews as the most appropriate methods for data collection in this research. Semi-structured interviews and focus groups allowed the researcher to investigate the problem in detail, and understand the opinions and experiences of practitioners in a complex environment setting (Hechavarría, et al., 2013). A detailed discussion has been provided in sections 3.5 and 3.6 regarding the selection of the research design (multiple case studies) and data collection methods. Another strategy used to evaluate the quality of this research is the selection criteria that have been used to recruit participants (Stenfors, et al., 2020). This research aimed to examine how practitioners capture citizens' feedback and improve existing services. Therefore, the researcher recruited those participants who were responsible for capturing citizens' feedback and for designing/improving the services. The results obtained from the analysis of data during ex-ante and ex-post evaluations of the artefact provided enough evidence to answer the defined research questions in chapter 1.

3.9.2 Dependability

This research followed the inductive and deductive data analysis approach during the different phases of the DSR methodology. A systematic literature review was conducted to validate the research problem and to define the scope of this study. Moreover, multiple case studies were conducted with two different County Councils of Ireland for investigating the research problem and to further evaluate the proposed solution with practitioners. This study conducted validation checks while performing the data analysis across the cases and within the cases which is in line with the guidelines suggested by (Yin, 2013). Moreover, this study kept the records of data obtained via interviews, and focus group discussions as evidence throughout the research process. Data collected from multiple case studies provided evidence for improving the construct validity (Yin, 2009). Coding procedures were employed in which the researcher tried to find out the patterns, causal links, and categories between the cases, and consequently strengthened the results further (Yin, 2013). The interpretations achieved by the researcher after following the pattern-matching procedure potentially increased the dependability of the research (ibid).

A chain of evidence was stored safely without any bias which increases the overall quality of the case study. This study maintained a database of various sources of data including references to the Council's internal documents, literature reviews, and the result of the analysed dataset which can be traced back to find out the sources cited in this research. This study recorded online interviews and focus group discussions which are stored securely on the personal cloud database. These recordings

are presented as actual evidence which shows the time, place, and participants of the interviews/focus group discussions. The anonymity of the data has been followed by the ethical guidelines as suggested by (Sim and Waterfield, 2019; Wiles *et al.*, 2008). Additionally, this study followed specific protocols for conducting interviews and focus group discussions as guided by (Hechavarría, et al., 2013). This process can capture the relationship between cross-referencing and following methodological procedures in each case study as suggested by (Yin, 2009).

3.9.3   Confirmability

Confirmability is enhanced by the inclusion of quotes or similar research data (Stenfors, et al., 2020). Chapters 4, 5, and 6 provide detail about the analysed data with supporting quotes from the participants. It included data from the Nvivo database, reports of the researcher, notes were taken by the researcher obtained from the result of interviews, document analysis, or observations. This study developed an NVivo database for storing and analysing the data collected from multiple sources (e.g. interviews, focus groups, etc.), formulated a case study protocol, and followed an ontological engineering approach for the development of the artefact. Data analysis results have been discussed throughout the DSR phases. Chapter 7 provides detail about the theoretical and practical implications of this research which has been considered another marker of high-quality qualitative research (Stenfors, et al., 2020). The findings from this study can be transferred to other County Councils in a similar contextual setting.

3.9.4   Transferability

The data triangulation technique confirms the transferability of research data as triangulation emphasises using multiple sources of evidence that provide numerous measures of the same phenomena. This study validated the constructs with practitioners within each case following an iterative approach. This research utilises numerous sources of evidence such as supplementary documents provided by practitioners, semi-structured interviews, and focus group discussions (Yin, 2009). It included the examination of the causal relationships investigated during the case studies, factors that influenced the artefact design process (i.e. Enterprise Architecture guidelines (*The Open Group Standard*, 2018)), and modelling tools used for developing the artefact (Thomas Allweyer, 2016)). Furthermore, a systematic literature review was conducted to collect the design guidelines and requirements for addressing the specified problem. This research conducted multiple case studies in different County Councils of Ireland. It involved the application of the developed artefact in two different environments. The proposed artefact has been designed based on collaboration with practitioners and by applying the existing knowledge of the literature. The next section provides the summary of this chapter.

3.10 Chapter Summary

This chapter outlines the adopted research methodology that provided guidance for conducting this research. It includes justification and rationale for the adapted philosophy, research methods, and techniques. It provided detailed guidelines employed for conducting this research. The design science research framework was discussed for the development and evaluation of the artefact. Furthermore, different research methods and techniques were outlined as a part of the phases of the design science methodology. Lastly, it provided detail about the validity and reliability of this research by providing various examples and evidence. The next chapter 4 provides detail about the problem investigation phase of DSR methodology.

4 PROBLEM INVESTIGATION

This chapter discussed the challenges that were identified during the problem investigation phase of the DSR methodology. Moreover, the findings from the design and development phase further assisted in refining the problem space. The literature review chapter highlighted the research gap from a literature viewpoint whereas this chapter outlines the identified challenges from the practitioners' perspective. In addition, a pilot case study was conducted to investigate the problem from the citizens' perspective who utilise smart city services. This chapter discusses some of the significant factors which are important to consider for the improvement of the services and to meet the need of citizens. This chapter includes findings from two case studies (Pilot case study, Case study A). The findings from the pilot case study have been published by the researcher in a conference (Singh, et al., 2021). This section provides the rationale for conducting a pilot case study (e-parking service) and has been discussed as follows: During the initial stages of this research, the focus was first to understand how smart city services work in the real environment, and what kind of feedback citizens provide towards them. After analysing the feedback of citizens for this particular service, the researcher discovered that citizens were unsatisfied with the service and provided meaningful feedback in the form of review comments. As a result, on one hand, citizens were providing meaningful feedback, on the other hand, it was not clear if that feedback had any impact to improve the services further. Therefore, to understand the relationship between citizens' feedback and service improvement, this study further investigated e-parking services in detail to examine how such services are designed and improved based on the citizens' feedback by local authorities of the cities/counties. The detail of this case study has been provided in the subsequent sections.

4.1 Pilot Case Study: e-parking service

An exploratory and deductive case study approach was used to investigate the research problem from the real environment. This study selected one of the smart services (i.e. e-parking) provided by different City/County Councils in the Republic of Ireland for the pilot case study. Moreover, some of the existing citizen engagement platforms were examined to analyse how citizens' feedback from those platforms is utilised for improving city services. Four semi-structured interviews were conducted with three different County Councils of Ireland to understand the design process of city services, and to analyse the role of citizens' feedback in it. Interview questions have been provided in Appendix B. Semi-structured interviews were used as a primary source of data collection as they unfold in a conversational style and offer participants to explore the issues that are important to them (Hechavarría, et al., 2013). Participants were selected based on their role and involvement in citizens'

engagement-related projects/activities and/or who were involved in the service design process of the services. Table 2 provides the detail of the conducted interviews.

Table 2: Interviews detail from three County Councils in Ireland

Participants	Role	Time
Participant 1	Digital Strategy Manager	
Participant 2	Service Design Manager	30-45
Participant 3	Innovation and Engagement Lead	Minutes
Participant 4	IT Service Design and Support	

Additionally, online data (review comments) was collected and analysed for a smart service (e-parking) that allows users to pay for their parking via an application platform. This App requires registration details and vehicle-related information from the users. It does not require users to display a parking disc while their car is parked. Some of the cities in Ireland provide these services to the citizens. This service offers a wide range of ways to pay for parking, and one of them is a free parking app for smartphone users. Some of the advantages of using this service include a quicker, more convenient, better, cheaper, and easier car parking facility for the citizens. The demand for e-parking services increased as cities got busier in Ireland. However, the challenge was not only to locate a space for the motorist but a free space for them. Thus, this challenge was addressed with the launch of e-parking services in various cities in Ireland. Now, the community can use e-parking services to locate accessible parking. It provides real-time information about the nearest vacant accessible space. The e-parking service works by using a network of Internet of Things and sensors to identify the arrival and departure of the vehicles in real-time. Then, the data is passed to the e-parking system and making it easier for the users to locate vacant accessible parking spaces. The next section provides findings based on the analysed data from this case study.

4.1.1 Findings from the Pilot Case Study (Data analysis and results)

This section highlights some of the key issues found during the interviews. It provides practitioners' viewpoints about the role of citizens' feedback in the design process of the services. The result from the interviews provided insight into how the requirement is provided for e-parking service and if citizens' feedback had any role in it. Participant 3 highlighted that she was not sure if citizens' inputs are fed into the service design process or to measure the performance of the services. *"I am not sure if there is any input from the citizens in the actual design process of the services or for measuring the quality of the service from their perspective"* [participant 3, Innovation and Engagement Lead]. It was also discovered during the interviews that various citizen engagement activities are organised by Council for obtaining citizen feedback. However, these activities do not follow any formal design

process to design services. *"There are of course citizen engagement activities that the council undertakes through consultations and other activities but they don't follow a formal service design process"* [participant 2, Service Design Manager]. Table 3 provides a summary of the conducted case study which has been designed according to the template and guidance provided by (Greenwood, 2011; Baxter et al, 2008).

Table 3: Case Study Design for e-parking service

Context: According to the literature citizens play a vital role in the design and development of smart city services to provide effective services to them. Therefore, this study investigates their role in the design of smart city services in an Irish context and highlights existing issues from the citizen' end based on the feedback they provided for one of the smart services in Ireland.
The Case: E-parking service in City/Counties of Ireland
Objective: • To understand the experience of citizens towards this service. • To understand how requirements are provided to design such smart city services.
Study Design: Exploratory deductive approach.
Data Collection: Interviews, and online review comments from end users.
Analysis: Qualitative data were analysed to identify the challenges from citizens' viewpoint. Based on this analysis, their feedback was classified against the associated service requirements.

Furthermore, the researcher also reviewed some of the online platforms that capture citizens' feedback for understanding their views on different aspects of the city (e.g. For policy-making, improving services, reporting issues, rating proposals, etc.). It was found during the investigation, that practitioners were not able to measure the impact of the feedback, and failed to complete the feedback loop from the citizens' end. *"We failed to complete the feedback loop…"* [participant 1, Digital Strategy Manager]. Although there are various online platforms available for capturing citizen feedback, the requirements to design new services are provided by local authorities based on the already implemented solutions. *"the requirement for the existing services are given by considering already implemented similar systems in other locations…"* [participant 4, IT Service Design and Support]. There is no issue in considering the already implemented solutions as long as there is also an opportunity for the community to provide requirements from their end while giving contracts to the service providers. One of the practitioners also emphasised that whenever there is a need to implement a new service for the county, the Council firstly attempts to identify if a similar kind of service has been implemented in any other county. If so, they contact service providers of that service and offer a contract to them for implementing the services in their county. Nonetheless, they do not provide any specific

requirements to the providers. Moreover, they do not consider citizens' feedback for deriving service requirements of the services. *"There is no specific requirement given to the service providers for designing the services"* [participant 3, Innovation and Engagement Lead]. Two key issues emerged from these interviews, first, it was not clear if citizens had any role in the design of the services. Secondly, there are various platforms to gather citizens' feedback, but they do not provide clarity in terms of showing the impact of those feedback in improving the services further.

To investigate the experience of citizens towards the e-parking service, this study analysed the review comments of end users who were using the service. To analyse the online review comments (textual data), this study followed a thematic research approach and guidelines (Mason, 2002; Young and Hren, 2017; Braun and Clarke, 2012). Braun and Clarke, (2012) provided six phases to perform the analysis of the dataset which have been explained as follows: This study first read and reread the review comments provided by end users and took notes on preliminary ideas and thoughts about connecting that feedback with their experience towards the service. This assisted the researcher in understanding how smart services work in the real environment and what kind of feedback was provided for it. Based on the analysis of the feedback, this study found that citizens were not satisfied with the service and often left useful comments. However, it was not clear if the feedback had any implication to improve the existing service. During the second phase, initial codes were formed which were common among the data set, for instance, people Complaining about an extra 1euro charge (E.g. "10% top-up fee without warning. Total scam") were coded as "No Information on Additional Charged Fees". Then as a part of the third phase, codes were converted into more organised themes which provided meaning within the dataset. The identified codes from phase two were further linked to the predefined themes, for instance, the code "No Information on Additional Charged Fees" has been classified as a Quality Factor (Transparency) of the service which can further guide in understanding and structuring the requirements from citizens' end. The fourth phase is about reviewing potential themes whereby the developed themes are being reviewed concerning the coded data and the complete data set. Therefore, all generated themes that are about the Quality factors of the service were revised and checked to ensure that they belong to the correct category of the identified reviewed comment or to others. In the fifth phase, the coded themes were further linked to the identified requirements of the service as described in Table 4. In the final phase, the analysis was reported for conducted case study. This analysis was carried out by using an Excel sheet following a method proposed by (Bree and Gallagher, 2016). This methodology describes the steps for analysing the data based on the colour coding scheme provided in Excel. There were around 46 review comments per county that were being downloaded in the form of an Excel sheet from the app store using the website Heedzy (https://heedzy.com). The review comments were further analysed and classified against the

factors (Themes) associated with the Quality of Experience (QoE) based on different coding colours, which stems from the experience of the user's expectations for the utility of the application or service (Ballesteros et al., 2015).

Table 4: Sample of Impacted Quality Factors and their Links with the Requirements

Sample of Online Reviews *(Source: https://play.google.com/store)*	Codes	Identified Impacted Quality Factors (themes)	Associated Requirements (Adopted from Bastidas, Helfert and Bezbradica, (2018))
"App will not load so cannot access my account, nor can I park my car. It's not an internet issue as my other apps work fine. I uninstalled and then reinstalled it and now it won't let me log in as it says there's no available host... I rely on this almost every day and cannot believe that this has happened"	Application Issue	Effectiveness	Availability/ Software Engineering Tools
"10% top-up fee without warning. Total scam."	No Information on Additional charged Fees	Transparency	Trust
"Charged a processing fee for adding cash to account. It's the last time I'll be using this."	No Information on Additional charged Fees/ Usage	Transparency/ Usefulness	Trust/ City Oriented
"Appallingly bad. Only used it a few times and some of the roads don't have a code applicable. Also if you move to another street within the time you've to pay again, whereas with the disk you can use it for the 2 hours (or whatever the limit is in the area)."	Application Issue	Personalisation	Flexibility
"It won't even accept my car registration. There's no guidance provided or feedback. the city council hasn't responded to emails either."	Application Issue	Usability	Extensibility

4.1.2 Discussion

This study conducted a pilot case study (e-parking service) to investigate the problem from the citizens' viewpoint. Based on the findings from the conducted case study, it was found that citizens did not have any role in the design of the services (e.g. e-parking). In addition, the results demonstrated that citizens were not satisfied with e-parking service, and often provided negative feedback in the form of review comments on the service application. This is in line with the existing studies that highlighted similar issues in the literature (Cardullo *et al.*, 2018; Peng, et al., 2017;

Sofiyabadi et al., 2016). Based on the findings of this case study, it was not clear how citizens' feedback is further linked to further service improvement. In addition, it was found that the citizens provided insightful information about the performance of the services, and how it was working in the real environment. The result demonstrated that citizens' feedback was useful in understanding their needs and could assist in identifying requirements for the services. However, there was a missing link between that feedback and the way city authorities provide requirements for the services for further service improvement.

While this study was investigating e-parking service, the researcher found that there are other engagement platforms that allow local authorities to capture citizens' feedback on different aspects of the cities including city services. Therefore, the researcher was keen to know what kind of impact that feedback had in improving the existing services. Consequently, this research selected an offline engagement platform (Community prospect program) as a second case study (Case study A) with County Council A in Ireland to further investigate the role of citizens' feedback in improving existing city services, and how city authorities address their concerns. Case study A continued until the final artefact was developed and evaluated with practitioners. The feedback from the practitioners further assisted in refining the artefact during the subsequent evaluation cycles. The next section provides detail about this case study and highlighted the challenges that practitioners faced during the incorporation of citizens' feedback for further service improvement.

4.2 Case Study A: Community Prospect (County Council A)

County Council A is located on the west coast of Ireland (Republic of Ireland) with a population of approximately around 130,000 residents. It provides a range of public services to the community, some of them include Housing, Planning, Roads, Environment, Community development, etc. County Council A engages with the local community via an offline engagement program called "Community Prospect". The overview of this program has been provided in section 1.2 in chapter 1. The goal of conducting this case study was to gain a better understanding of how local authorities gather citizens' feedback and address their concerns. Four semi-structured interviews were conducted during the problem investigation and the design and development phase of this research. The interview questions have been provided in Appendix C. This section outlines the identified challenges during the interviews that informed the problem space. The duration of the interviews was between 30 minutes to 60 minutes. These meetings were recorded and transcribed in Microsoft Teams. The details of the interviews can be found in Table 5. Interview data were analysed inductively using NVivo software which has been designed for computer-assisted qualitative and quantitative data analysis.

Table 5: Interview details

Interviewees	Role	No of Interviews	Time
Participant 1	Community Prospect Co-coordinator	1	
Participant 2	Head of Strategic Capital Projects	2	30-60 minutes
Participant 3	Head of Community Prospect Program	1	

The data was analysed and reported based on the guidance of (Greenwood, 2011; Braun and Clarke, 2012). Braun and Clarke, (2012) provided six phases to perform the analysis of the dataset, this section discusses these phases in the context of this study. The first step was to listen to the interview recordings again and again to understand the practitioner's viewpoint about the existing citizen engagement process and the challenges they faced. Then Nvivo software was used to code the transcribed data during the second phase in which initial codes were generated inductively.

During the third stage, codes were converted into more organised themes which provided meaning within the dataset. These themes were then grouped across three domains based on the phases of TOGAF ADM. These themes were associated with a set of challenges that practitioners highlighted and were classified against different ADM phases. The fourth phase was about reviewing prospective themes whereby the developed themes were reviewed for the coded data. Therefore, all generated themes which are in relation to different phases of TOGAF ADM were revised and checked to ensure that they belong to the correct category. In the fifth phase, the coded themes were further linked to the set of challenges that practitioners faced during the incorporation of citizens' feedback. In the final phase, the analysed data were reported for which the detail has been provided in section 4.2.1. Moreover, 13 supplementary documents were provided by practitioners and were used as a secondary source of data to analyse the various aspects of the program. The document analysis was performed manually to identify the common steps in the overall engagement process across different towns/cities of the County. These documents also enclosed the community's feedback on different services.

4.2.1 Findings from Case Study A (Data analysis and results)

This section provides findings from case study A which has been designed according to the template and guidance provided by (Greenwood, 2011; Baxter et al., 2008). Table 6 provides a summary of the conducted case study. This section outlines the challenges that were faced by practitioners during the incorporation of citizens' feedback for improving the existing public services.

Context: This study investigated one of the off-line engagement programs in Ireland to gain a better understanding of how local authorities gather citizens' feedback and address their concerns.
The Case: Community prospect program in County Council A of Ireland.

Objective:
    • To understand how local authorities, obtain citizens' feedback for improving the existing services.
    • To understand the impact of citizens' feedback in the real environment.

Study Design: Exploratory inductive approach.
Data Collection: Semi-structured Interviews, Secondary sources of data.
Analysis: Qualitative data were analysed to identify the challenges from the practitioner's perspective during the incorporation of citizens' feedback to improve existing services.

One of the challenges was associated with the mapping of the requirements (Singh, Lynch and Helfert, 2021). Participant 2 highlighted *"like the major block is how do we match their requirements; the resources is a huge thing because we never have the resources to do everything we want to do exactly"* [Participant 2, Head of Strategic Capital Projects]. Moreover, participant 2 highlighted that the matching of the requirements is not limited to resources but also to the professional expertise and the knowledge that is needed to match the community's requirements. *"How do you, match, sort of professional expertise and knowledge with what the community wants".* In addition, it was pointed out by the participant that empowering citizens is another challenge they faced when the community demands something which is not relevant and would lead to inefficient usage of resources. *"if a community says we want X and you know X is out of date or not relevant anymore or is really not going to be an efficient use of resources, how do you navigate that and how do you, without being condescending or without taking power, ensuring that there it's an empowering and respectful approach?"* [Participant 2, Head of Strategic Capital Projects]. Thus, there was a need to ensure that the community still feels empowered in case their requirements are not fulfilled and realistic expectations are built within the community.

It was emphasized during the interview that it is not only about mapping their requirements, but also about community expectations, and setting up achievable goals *"the expectations are built, that something will be done about it. But if you do sit back and take the time, kind of to analyse, and it's who does that is the question, then? What are the desires of the community? Is this achievable?"* [Participant 3, Head of Community Prospect Program]. Furthermore, it was flagged that consideration should be given to the risks of not meeting the goals and desired outcomes *"so it's about setting goals. realistic expectations for the groups in relation to…. you don't want a situation that it becomes a*

document on the shelf until you review it again. And then you're at the risk, then is that you haven't achieved what you wanted to achieve" [Participant 3, Head of Community Prospect Program].

Another important factor that was identified during the interviews was about Council's capacity to achieve the desired outcomes that Community expects from them. Practitioners highlighted that they cannot always fulfil the need of citizens. As a result, it becomes essential to keep transparency between Council and the community in terms of providing solutions to them and the capacity they require to deliver the expected outcomes. It indicates that feedback alone is not enough to provide improved services to the citizens, there are other factors as well which can hinder the improvement of the services. *"even in setting out the solution, or a proposed solution, that the community would believe that the council is taking some ownership of that, whereas it might not have the capacity to do that"* [Participant 3, Head of Community Prospect Program].

Furthermore, participant 1 highlighted that the Council alone is not responsible for all the services, multiple stakeholders are involved in the process and it is about a partnership among them including the local community. *"Our program really is a partnership, so it would be up to the Community and the Council then to work together or whatever other agency it was….It would rarely be just the Council"* [Participant 1, Community Prospect Co-coordinator]. Also, the focus should not only be given to the planning of the project but also on how does Council plan to work on those plans and address the concerns raised by the Community with monitoring and delivery of discussed actions *"it's all fine and well having the document, but how do you action is? And how do you monitor the actions and the delivery of the actions? Because, you know, the risk is that, you know, the plan is done, everyone's worn out developing the plan. And then well, that's actually only the start of the work"* [Participant 3, Head of Community Prospect Program]. It was also not clear how the community's requirements are managed during the progress review and renewal of the action plans by the practitioners at Council A. Therefore, there was a need to manage the community's constantly changing requirements.

The results from the case study showed that there are multiple challenges faced by practitioners in mapping citizens' requirements, and are associated with non-technical factors such as risk, capabilities, goals, constraints, etc. These challenges were grouped across three TOGAF ADM phases. A detailed discussion has been provided about TOGAF ADM phases in 1.3 chapter 1. This section classified those challenges based on those phases. For instance, Architecture vision captures factors associated with capturing multi-stakeholder concerns including citizens, risk, capacity, goals, etc. Business Architecture addresses challenges associated with the mapping of the citizens' requirements, monitoring the action and delivery of the actions, quality of services, contracts, etc. Finally, the

Requirement change management phase deals with the continuously changed requirements of citizens. A summary of these challenges has been provided in Table 7.

Table 7: Classification of challenges across ADM phases

ADM Phases	Identified Challenges from case study A
Architecture Vision	• Identifying citizens' requirements and their concerns for improving the services • Inclusion of risk factors for capacity, achievable goals, deliverables, timeline, and actions.

Business Architecture	• Mapping citizens' requirements.
	• Monitoring of actions and delivery of discussed issues/services.
	• The closing of the feedback loop from the citizens' end.
	• Evaluation of the services should be based on:
	   ○ Quality of Service(QoS)
	   ○ Quality of Experience (QoE) as perceived by citizens

Requirement Management	Requirement change management based on the new citizens' requirements.

4.2.2 Discussion

This study selected one of the community engagement programs in Ireland as a second case study. The aim of conducting this case study was to understand how city authorities capture citizens' feedback and address their concerns about public services. The findings from this study revealed that practitioners faced challenges in practice when it comes to incorporating citizens' feedback for further service improvement. These challenges were associated with risk, capacity, monitoring of actions and delivery of services, etc. which have been neglected in the majority of the existing studies that focused on citizens' feedback and their inputs for providing improved services to the citizens (Allen et al., 2020; Abu-Tayeh, et al., 2018; Wolff et al., 2020; Cellina et al., 2020). Some of the other challenges were out of the scope of this study as they needed to be addressed by the local government of the cities. For instance, insufficient resources and budget constraints impact the implementation of the changes for improving the services. A few other challenges that were excluded from the scope of this study include having the professional expertise and knowledge that is needed to match the community's requirements within Councils, empowering citizens, and being respectful towards the citizens, etc. The results from this case study highlighted that there are multiple platforms to obtain citizens' feedback to provide effective services to them. Some of the examples from Ireland include Civiq, PPN, Unheardvoices, etc. However, there is still a considerable need for the improvement of the services provided by municipalities (Bosdriesz et al., 2018). Municipalities and cities face challenges to transform and digitize existing public services (Bastidas *et al.*, 2021). This is in line with the findings from this case study that highlighted the challenges faced by practitioners during the incorporation of

citizens' feedback for further service improvement. The next section provided detail about the ex-ante evaluation that was performed to validate the research problem, and objective and in identifying the research gap based on the conducted literature review in chapter 2 and finding from the above two case studies.

4.3 Ex-ante Evaluation (EVAL1: Evaluation Cycle 1)

Evaluation is a key activity in the DSR process because it provides feedback to improve the later development, and ensures the rigour of the research is completed appropriately (Venable, Pries-Heje and Baskerville, 2016). The Ex-ante evaluation (EVAL1) was performed for scoping the problem and to validate it from the real-world environment. Based on the practitioners' feedback, the proposed artefact is developed and evaluated iteratively in the subsequent cycles. This process is repeated until the objective of the research is met. During the first evaluation cycle, the research problem was investigated and validated by the practitioners based on (Sonnenberg, C. and Brocke, J.V., 2016). Questions were asked to the practitioners related to their existing citizens' engagement process and how they address citizens' concerns based on their feedback. The detail of followed evaluation strategy is provided in Table 8.

Table 8: The detail of evaluation cycle 1 (Ex-ante 1)

Inputs	Output	Evaluation Criteria	Evaluation Methods
• Observation of the Problem • Research Need • Design Objectives	• Justified problem statement • Justified research gap • Objective	• Importance • Novelty	• Literature review (Chapter 2) • Semi-structured interviews

The practitioners highlighted challenges during the incorporation of citizens' feedback from various viewpoints. Additionally, literature findings were used to identify similar challenges and the solutions that have been provided. The results confirmed the identified research gap in the existing studies i.e. existing citizen engagement platforms that capture citizens' feedback do not consider the challenges faced by practitioners during the incorporation of citizens' feedback at the local municipal level. Moreover, it is not clear how that feedback is linked with the improvement of the services to meet the ultimate goal of "Improving the quality of life" for the citizens of the city. Consequently, these services fail to fulfil the need of citizens and do not achieve the goals set by existing citizen engagement platforms. The inputs from the practitioners and literature findings further guided the design of the proposed artefact.

4.4   Chapter Summary

This chapter provides a discussion on the problem investigation phase of this research. The findings from two case studies were discussed to highlight the problem from the real world and based on the experience of practitioners who engage with citizens at the local level. The first case study (e-parking service) laid a path to conduct the second Case Study A (Community prospect) with County Council A in Ireland. This case study then continued until the final artefact was developed to address the problem and was further evaluated by practitioners. The findings from both case studies in this chapter guided to validation of the research problem and in identifying the research gap based upon which the proposed solution was developed and evaluated in the next iteration of the DSR cycle as discussed in chapters 5 and 6. The next chapter provides detail about the design and development of the proposed artefact to address the identified challenges from the literature (Chapter 2) and practitioners' viewpoint as discussed in this chapter.

5 DESIGN AND DEVELOPMENT

This chapter provides the detail about the design and development phase of the proposed artefact following the design science research guidelines as discussed in chapter 3. Case Study A (With County Council A) was conducted during the problem investigation phase. This case study continued until the final artefact was evaluated with practitioners who were involved during all phases of the DSR methodology. This chapter provides detail about the role of practitioners from Case Study A during the design and development phase of the artefact. This chapter discusses identified design guidelines based on the findings from the literature review in chapter 2 and the collaboration with practitioners in County Council A. These design guidelines assisted in the design and development of the artefact, for which the details have been provided as follows.

5.1 Design Guidelines

Design guidelines have been defined as a "Context-dependent directive, based on extensive experience and/or empirical evidence, which provides design process direction to increase the chance of reaching a successful solution" (Fu, et al., 2015, p. 3). The guidelines address a broader range of design levels and are typically based on experts' opinions (Kim, 2010). Guidelines are more context-dependent and variable as compared to the principles (Fu, et al., 2015). Additionally, they need to be continuously reviewed and updated to meet the new changes which could be technical or environmental (Kim, 2010). The next section discusses the relevance of the design guidelines in the context of this study. These design guidelines guided the design process of the resulting artefact (i.e. a process model).

5.2 Relevance of the Design Guidelines

This section presents design guidelines that support in structuring the relationship between citizens' feedback and continuous service improvement to meet the need of citizens. The presented guidelines are the result of the build and evaluate cycle of the artefact. The findings from the literature and practitioner's collaboration were presented as evidence to support the proposed guidelines based upon which the final artefact i.e. process model was developed. This research followed the process in section 3.4.2 in chapter 3 to build and evaluate the artefact. Design guidelines directed the design of the final artefact, and indicate a fundamental role of practitioners in the development of the proposed solution. Three design guideline themes were derived based on the examination of the literature review and collaboration with practitioners. These themes are: 1) Citizens' involvement 2) Service improvement 3) Model features under which 11 design guidelines were identified. Figure 8 represents these guidelines for which a detailed discussion has been provided in the section below.
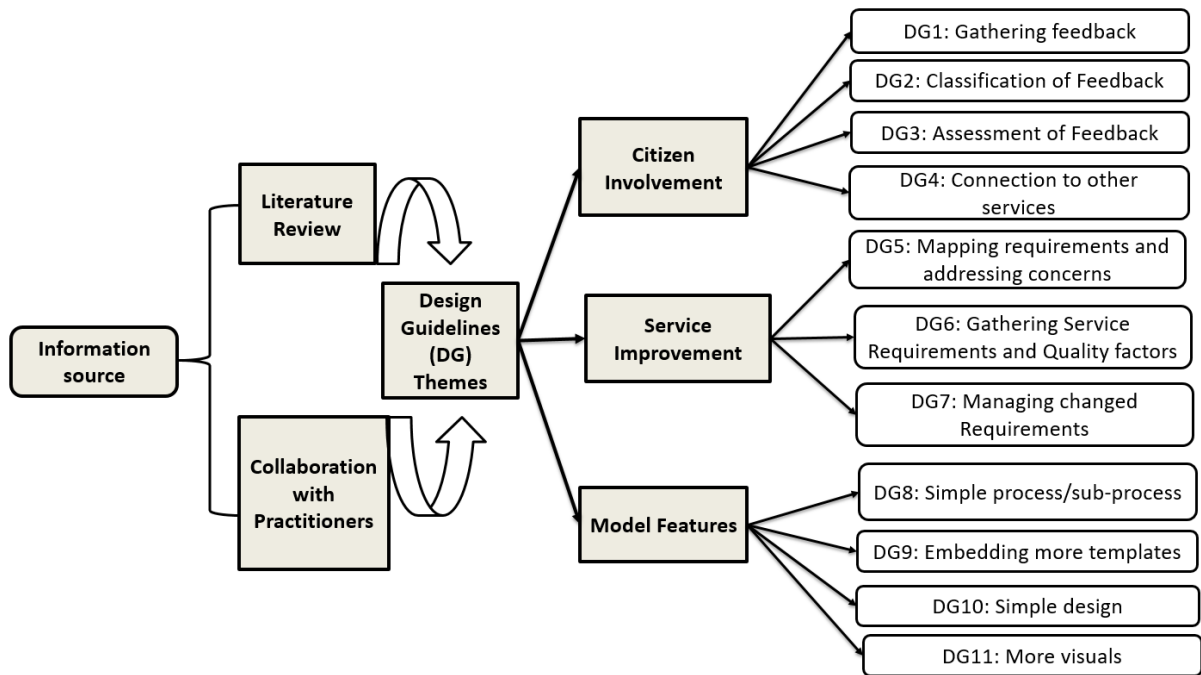
Figure 8: Source of design guidelines

5.2.1 Guideline theme: Citizens' Involvement

The first design guideline theme is associated with the involvement of citizens at two levels where they provide their feedback on multiple platforms such as PPN and Civiq. The detail of these platforms has been provided in chapter 1. The design guideline theme, Citizens' involvement captures components that are associated with the citizens' feedback. Four design guidelines (DG1, DG2, DG3, DG4) were identified for this theme. The detail of these design guidelines has been provided as follows.

DG1: Gathering citizens' feedback- Citizens' feedback should be captured via multiple channels (e.g. online, offline) to improve the services.

It is important to improve the ideology of the public sector, encourage engagement with private organisations, and provide a mechanism of feedback loop for the end users (Ma and Lam, 2019). This will ensure that government know about the true need of citizens, and can improve their decision makings (ibid). A smart sustainable city should not only consist of well-defined infrastructure and energy but at the same time citizens' inputs and feedback (Mueller *et al.*, 2018). Citizens' feedback should be gathered beyond the system design process to ensure that designed systems are appropriate for the end users to achieve sustainability goals (Francisco and Taylor, 2019). Services need to be delivered seamlessly and be easily available so that citizens can provide their feedback to the city authorities (Dimitri Gagliardi et al., 2017). To achieve this, smart cities should focus on finding

answers to various urban problems by adopting advanced technologies that can assist in collecting citizens' feedback (Chong *et al.*, 2018).

Citizens' feedback is positively related to solving urban problems and provides a way for citizens to communicate with city authorities and service providers who may use this feedback to improve their programmes (Allen et al., 2020). Even though online platforms can support in obtaining citizens' feedback, there is no replacement for offline face-to-face engagement when decision-making is required to resolve such large issues in the real world (Horgan and Dimitrijević, 2019). Therefore, it is vital to integrate existing e-participation platforms with traditional offline tools for successful citizen participation initiatives that cannot be guaranteed simply by introducing Information and Communication Technologies (Pina, et al., 2017).

The findings from the above discussion are in line with what the researcher found while conducting the case studies with practitioners in County Council A. It was highlighted that there is a need to capture citizens' feedback not only via offline platforms such as PPN but also via online platforms to have an aggregated perspective of the community's view. *"I think it's really important because it's only by aggregating that you see the impact at the County level. So It's clearly a gap and it is you know if you can aggregate, you can show that impact".* [Community prospect coordinator 1, County Council A]. Furthermore, the coordinator emphasised that they need to capture citizens' feedback via both channels. "*I mean, you're really making me think Priyanka, that community prospect needs to go online…I do think that there is a scope and for us to be thinking about How can you know maintaining the community based approach, but you know, how could the information from this process go online and be much more useful and much more used as well"* [Community prospect coordinator 1, County Council A]. Thus, it is vital that citizens' feedback is captured via both channels instead of focusing on only online platforms.

DG2: Classification of feedback- Citizens' feedback should be classified into different categories to recognize the positive or negative impact of the services on citizens' lives.

Citizens' feedback can be classified as positive, negative, or neutral for various city services, and can assist in understanding citizens' needs and the impact of smart initiatives in their life (Bastidas et al., 2021). A sentimental analysis system can help in predicting such types of positive, negative, or neutral public emotions based on their suggestions (Sharma and Sharma, 2020). User feedback and taking their abilities and motivation into consideration can overcome the possible failures of the provided technical solutions (Van der Graaf and Veeckman, (2014). Therefore, it becomes vital to classify citizens' feedback based on different categories (i.e. positive, negative) to understand their needs and improve the services further. From the practitioners' perspective, it was found that County Council A

also captures citizens' feedback in the form of Top likes and Dislikes which can further be categorised as positive or negative feedback. They do this classification manually using Excel spreadsheets in which they capture citizens' feedback based on the priority of their requirements and rank them accordingly.

DG3: Assessment of feedback- Service performances should be assessed based on the citizens' feedback to identify the satisfaction level towards the services.

The quality of services is related to the citizens' satisfaction and their wellbeing (Bastidas *et al.*, 2021). Service performance should be assessed based on the citizens' satisfaction level which is an important metric in evaluating cities' performances (Nakamura and Managi, 2020). Service performance assessment can be performed based on citizens' subjective evaluation on a 5-level scale (low to high) parameters (ibid). This can also include Quality of Experience (QoE) observed by citizens that would provide indicators about how the quality is being represented, delivered, and perceived by the citizens (Nepal *et al.*, 2019). It will ensure that users can accomplish desired goals with satisfaction, efficiency, and effectiveness in a specified context (Ballesteros, et al., 2015).

During the problem investigation phase in chapter 4, it has been highlighted that the citizens' feedback plays a vital role in the improvement of city services. Consequently, Citizens' feedback should be captured not only during the initial stages of engagement but also after the implementation of the services to identify the satisfaction level of the citizens towards the services. However, this study found that County Council A did not have any parameters to assess the performance of the services. But, they highlighted the need of having an assessment to ensure that services meet the need of citizens. *"So it's assessing service performance. I mean, I think it's crucial. You know if we have citizen feedback on the performance of the different services"* [Community prospect coordinator 1, County Council A].

DG4: Link to the associated services- The feedback should be channelled to associated service departments to address the community's concerns about a specific service.

In the traditional operating model of the cities, the services operate in vertical silos wherein the organisational processes, for instance, accountability, decision-making, and service delivery happen in isolation and do not meet the requirement of citizens (Heaton and Parlikad, 2019a). It is vital to integrate city services from multiple domains which include health, mobility, education, etc. to respond to the objectives and goals of multiple stakeholders such as city authorities, service providers, and citizens (Bastidas, 2021).

Similarly, in light of the conducted case study with County Council A, it was found that practitioners capture citizens' feedback under community development service. However, this service was

operating in silo and the feedback was not being shared with other relevant service departments which were responsible for improving and delivering the services. As a result, there was a need to channel citizens' feedback to the associated service departments for which citizens had provided their feedback. *"we do a progress report each year with the communities to see how they're getting along and have they made any progress with any of the actions and that information at the moment is sitting on a Word document. It's not being channelled through either"* [Community prospect coordinator 2, County Council A].

5.2.2 Guideline theme: Service Improvement

This theme captures the guidelines which are required to align practitioners' action plans based on the citizens' feedback for continuously providing improved services to the citizens. Guidelines five, six, and seven (DG5, DG6, DG7) are associated with it. The detail of these guidelines has been provided below.

DG5: Mapping Requirements- Citizens' requirements should be mapped based on their feedback.

Citizens are considered as crucial stakeholders that can produce valuable ideas and can assist in meeting social requirements (Anthony Simonofski *et al.*, 2019). Cities are required to develop connected services that meet the requirements of citizens who engage with services in silos and try to make a connection themselves (Heaton and Parlikad, 2019a). There has been an ongoing research effort that aims to align the requirements of the local community with technical solutions (ibid). Yet, the translation of smart city initiatives into actual urban implementations often fails to place citizens' experience in the centre at the cost of optimisation of the urban system and processes (Andreani *et al.*, 2019b). Moreover, city services fail to deliver the services as per the requirements of citizens due to the lack of a structured approach to support the strategic planning of the cities (Bastidas *et al.*, 2021). Consequently, there is a need for social, and governmental infrastructures to fulfil the requirements of citizens and to shape the city they want instead of just focusing on technical smart infrastructures (Wolff *et al.*, 2020). However, in some cases, organisations focusing on providing smart city services to the citizens have misunderstood the need of communities (ibid).

There is a possibility that citizens will keep using existing smart city services and be more satisfied if their opinions are considered to improve smart city services (Abella, et al., 2019). Hence, smart cities should make sure that the citizens are included as stakeholders during the requirements engineering phase (Knutas, et al., 2017). On the other hand, practitioners at the County Council A highlighted that they faced challenges while mapping citizens' requirements. For example, the Head of Strategic Capital Projects pointed out: *"like the major block is how do we match their requirements"* [Head of Strategic Capital Projects, County Council A]. A detailed discussion has been provided about this

challenge in section 4.2.1 in chapter 4. It also provides a detailed description of additional factors which could impact the mapping of the requirements. It includes the Council's capacity, stakeholders working on citizens' feedback, constraints, KPIs, and risk associated with the implementation of the services that the community may demand. Therefore, it becomes important to consider these factors while mapping citizens' requirements.

DG6: Service requirements and quality factors- Enable stakeholders in identifying service requirements and associated quality factors to respond to the need of citizens.

Smart public services need to be user-centric and they should be designed to ensure the high performance of the services from the Quality of Service (QoS) viewpoint (Nepal et al., 2019; Floris, Porcu and Atzori, 2018). It should consider citizens' perspectives by providing a high level of Quality of Experience (QoE) to them (Nepal et al., 2019). Additionally, a smart city's goal can be achieved by setting up objectives consistent with the quality factors of the services to ensure citizens' satisfaction (Pourzolfaghar and Helfert, 2017). These quality factors have been defined as Interoperability, Usability, Availability, Security, Recoverability, Maintainability, and Confidentiality (ibid). These quality factors can be used to evaluate service performance. The functional requirements of the smart cities should be supported by these quality factors (Pourzolfaghar, et al., 2019). In addition, smart city system designers should consider functional and non-functional requirements together for meeting citizens' needs (Bastidas, et al., 2018). Citizens anticipate quality-based public services that can be used to develop strategies for improving the services (Sá, Rocha and Cota, 2016). Citizens' feedback can be useful to understand the service requirements and would guide smart city stakeholders in providing better quality of services (Singh, et al., 2021).

DG7: Managing changed requirements- Support in managing the constantly changing requirements of citizens.

It was found during the case studies that practitioners did not have a standard requirement management strategy in place to manage the changed requirements of citizens. They categorise the requirements of the community based on their priority. However, there was a lack of approach to manage the constant changing requirements of the community. Therefore, a requirement management strategy was required to manage their requirements. The requirement engineering process can assist in managing these requirements, and a business scenario technique is an effective way to discover the business requirements (*The Open Group Standard*, 2018; Blevins and Lambert, 2017).

5.2.3 Guideline Theme: Model Features

This study designed the first version of the process model by following the guidelines of the TOGAF ADM framework to address the identified challenges from the literature and preliminary interviews. Subsequently, ex-ante evaluation (cycle 2) was conducted to validate the design specification and requirements of the process model. The detail of this evaluation has been provided in section 5.4.1.1. The design guideline theme (Model features) emerged during this evaluation process. The detail of the guidelines under this theme has been provided as follows.

DG8: The model should have more visual elements

The practitioners did not want to be overwhelmed by too many concepts and textual information within the model. They preferred to have more visual elements within different activities of the proposed process model. *"sometimes it does look better if it's laid out visually or its leader in graphs, and you know, I think in general people who have a much shorter concentration span, they don't tend to read through as much. We have found out now"* [Community Prospect Co-coordinator, County Council A].

DG9: The design of the process model should be simple to understand

The model should have activities and concepts modelled in a way that is simple enough for city authorities to understand as they did not have a relevant technical background in working with process models. *"I'm looking at it not just from my own perspective, but from some of the people that would be for example, in our communities that would look to access it this way and Kind of, you know how easy it would be for them to understand it"* [Community Prospect Co-coordinator, County Council A]. Therefore, the proposed design of the process model should be simple for all the key stakeholders including non-technical ones within the Council. Based on DG9, required changes were made to the model, and the final model (with new changes) was further validated with the practitioners from County Council A.

DG10: Embedding more templates

Artefacts such as templates for requirement management, quality of service attributes, contracts, etc. adapted from the TOGAF toolkit were presented while demonstrating the first version of the model to the practitioners. Practitioners preferred to have those artefacts and suggested including more templates within the model. The head of Strategic Capital Projects confirmed that those templates can be useful to inform management about the feedback of communities. *"…that document you have up on the screen at the moment is really useful for an overview and feedback to management or the elected members…."* [Head of Strategic Capital Projects, County Council A].

DG11: Simple process and sub-process

The proposed model should have simple and clear processes/sub-processes without introducing any technical names for each activity so that it is easy for practitioners to understand the semantic of each activity and follow it. *"It just almost looks like lines of text. that one there is much more interesting, and It draws your eye and everything"* [Community Prospect Co-ordinator, County Council A]. The summary of these guidelines is presented in Table 9.

Table 9: Summary of Design guidelines

Design guidelines	Supporting Evidence
DG1: Gathering citizens' feedback	Practitioners' interviews, Francisco and Taylor, (2019); Ma and Lam, (2019); Lorenzi et al., (2014); Chong et al., (2018); Gagliardi et al., 2017; Allen et al., 2020; Mueller et al., (2018).
DG2: Classification of feedback	Practitioners' interviews, and Bastidas et al., (2021); Sharma and Sharma, (2020); Van der Graaf and Veeckman, (2014).
DG3: Assessment of the services	Nakamura and Managi, (2020). (Pourzolfaghar and Helfert, 2017). (Nepal et al., 2019). (Ballesteros, Alvarez and Markendahl, 2015).
DG4: A connection to the other services	Practitioners' interviews, Bastidas et al., (2021)
DG5: Mapping Requirements and addressing Concerns	Practitioners' interviews, and Bastidas et al., (2021); A. Wolff et al., (2020); Abella, et al., 2019; Andreani et al., 2019; Heaton and Parlikad, 2019b; Simonofski et al., 2019; Cardullo and Kitchin, (2019), 'The Open Group Standard', (2018).
DG6: Gathering Service Requirements and Quality factors	'The Open Group Standard', (2018); Singh, Lynch and Helfert, (2021) ; Bastidas, Helfert and Bezbradica, (2018); Pourzolfaghar, Bastidas and Helfert, (2019); Pourzolfaghar and Helfert, (2017).
DG7: Managing changed Requirements	Practitioners' interviews, supplementary documents provided by practitioners, 'The Open Group Standard', 2018.
Guidelines for the visual representation of the artefact	
DG8: The model should have more visual elements	
DG9: The design should be simple to understand	Practitioners' interviews
DG10: Embedding more templates	
DG11: Simple process and sub-process	

5.3 Process Model Development

This research followed a reference model, as proposed by Ostrowski and Helfert, (2012) for the development of the proposed artefact for which a detailed discussion has been provided in section 3.4.2. The construct layer of the reference model guides the development of the artefact (Ostrowski and Helfert, 2012). The construct layer constitutes three activities that are found crucial for the artefact development. These activities are Activity 1) Literature Review (chapter 1), Activity 2) Collaboration with practitioners (chapter 4), and Activity 3) Modelling. A detailed discussion of these activities has been provided in section 3.4.2 in chapter 3. The next section provides detail about activity 1 and activity 2 in the context of this study. Section 5.3.2 provides detail for activity 3.

5.3.1 Components Derived from Activity 1 and Activity 2

This section outlines the components that have been derived by following Activity 1 and Activity 2. The outcome of these activities resulted in three design guideline themes (Citizens' involvement, Service improvement, and Model feature) as discussed in section 5.2. These design guidelines supported in the identification of the components for developing the process model. The detail of these components has been provided as follows.

5.3.1.1 Guideline theme: Citizens' Involvement

The construct layer for the guideline theme "Citizens' involvement" includes the following components: Feedback gathering, feedback classification, and service domains/departments are derived from both literature review and collaboration sources whereas feedback assessment and satisfaction score are derived from literature review sources. Table 10 provides a summary of the derived components with the corresponding guidelines.

Table 10: Summary of the derived components (DG Theme: Citizen Involvement)

Construct layer (Activity 1 and Activity 2)	Derived Components (concepts and/or activities)	Associated guidelines
Literature review source	Feedback gathering (online, offline), Feedback classification (positive/negative), Feedback assessment, Satisfaction score, Service domains.	DG1, DG2, DG3, DG4
Collaboration source	Feedback gathering (offline), Feedback classification (likes/dislikes), Service department.	

5.3.1.2 Guideline theme: Service Improvement

This theme includes components that deal with the challenges of mapping citizens' requirements, and associated factors with it. The construct layer for this theme has been defined with the components: Managing the changed requirements, mapping community requirements, identifying service requirements, and quality factors. The first two components were identified from the literature review and practitioners. The third and fourth components were identified in the literature review process. Table 11 provides a summary of the derived components with the corresponding guidelines.

Table 11: Summary of the derived components (DG theme: Service improvement)

Construct layer (Activity 1 and Activity 2)	Derived Components (concepts and/or activities)	Associated guidelines
Literature review source	Mapping community requirements, managing the changed requirements, identifying service requirements, and quality factors of the service.	DG5, DG6, DG7
Collaboration source	Mapping community requirements, and managing the changed requirements.	

5.3.1.3 Guideline theme: Model Features

The practitioners from County Council A suggested four components for the design of the artefact. It includes more visuals, a simple design, more templates, and a simple process and sub-process. All these features were considered during the development of the process model and are associated with the design guideline theme "Model Feature" for which the details have been provided in section 5.2.3. The summary of the derived components has been provided in Table 12. The next section provides detail for Activity 3 (Modelling).

Table 12: Summary of the derived components (Guideline theme: Model Features)

Construct Layer (Activity 1 and Activity 2)	Derived Components (concepts and/or activities)	Associated guidelines
Literature review source	NA	DG8, DG9, DG10, DG11
Collaboration source	Providing more visuals, simple design, embedding more templates, adding simple process and sub-process	

5.3.2 Modelling

The third activity of the artefact development is information modelling in which the information gathered as a part of the literature review and collaboration with practitioners is modelled. The previous section 5.3.1 discussed different components derived from these sources. In this section, the activities carried out for the modelling of those components are presented. The first step in this process is to follow an ontological engineering approach in which the knowledge base is structured, and semantic constraints are provided for the same (Ostrowski, 2014). The second step is to model the knowledge base built based on the ontology created in Step 1. The final step is to document the modelling part including details of the activities, their objectives, data, and actors that have been modelled in the process model. It includes different components (i.e. Scope statement, Applicability Matrix, Impact on business, Roles involved, Process activities, Process exception, and Decision matrix) to document the processes. A detailed discussion has been provided in section 5.3.2.2.

To document the process model, the research scope was updated based on the findings from the literature review and collaboration with practitioners. The process model activities needed to be synthesised if there are two or more process models (i.e. one from a literature review and another from collaboration), otherwise this step can be skipped. In the context of this research, this step was skipped as a single process model originated from both sources for addressing the identified problem. The below section provides a detail description of these activities.

5.3.2.1 Construct Ontology

Ontologies are often used to represent complex knowledge relationships and have gained a lot of attention due to their extensions to the World Wide Web (Thomas and Fellmann M.A., 2009). It assists in systematically structuring the gathered information, and in creating a knowledge base in which all the findings are connected logically. Ontology engineering focuses on analysing the information that is being provided by the literature review findings or/and by collaboration with practitioners (Ostrowski, 2014). There are multiple ontology languages available for explicitly and formally representing the ontologies and one of them is Web ontology language which is a widely accepted tool and is standardized by the W3C (ibid). Thus, this study used Web Ontology Language (OWL) to create an ontology for this research.

The first activity in the Construct ontology phase was to determine terms that are associated with the domain. During this stage, the researcher enumerated terms based on the identified components in section 5.3.1. These terms have been discussed across design guideline themes. For instance, for the design guideline theme "Citizens' involvement", the following terms were enumerated: PPN representatives, service providers, citizens, service department representatives, city authorities, feedback, satisfaction score, services, etc. Similarly, for the design guideline theme "Service improvement", the following terms were enumerated: Requirement, quality factor, and community development representatives. The last guideline theme was associated with the representation of the process model. As a result, no terms were enumerated from the ontological viewpoint.

The second activity was to identify the potential meaning and properties of each term. To perform this activity, all the gathered information from the literature review process and collaboration with practitioners for each guideline theme were analysed to identify the potential meaning and properties of each term. For instance, the name and role were assigned to the class service provider. Similarly, an integer property was assigned to the class quality factor that would be used to identify the performance of the services.

Thirdly, classes were defined and arranged in a hierarchical format. Lastly, class properties, their values, constraints, and sub classes were defined. Classes were defined and arranged in a hierarchical

form which include the name of all the stakeholders involved in the process such as service providers, citizens, city authorities, feedback, quality factor, service, various documents, etc. Lastly, class properties were assigned and sub-classes were identified. For instance, the feedback class is subdivided into two categories (positive, negative). Similarly, QoE and QoS were defined as sub-class of quality factors. Finally, the service class was classified into 7 sub-classes which include Housing, Planning, Economic development, Community Development, Environment, Finances, and Others. The sub-class "Others" was added during the later stages of the artefact development based on the feedback that County Council A provided. Similarly, subclass "Finances" was added based on the feedback that County Council B provided. Finally, the relationship between the classes was defined based on the activities identified in section 5.3.1. Figure 9 represents the resulting ontology created for developing the process model. The next section provides detail about constructing the process based on the developed ontology.
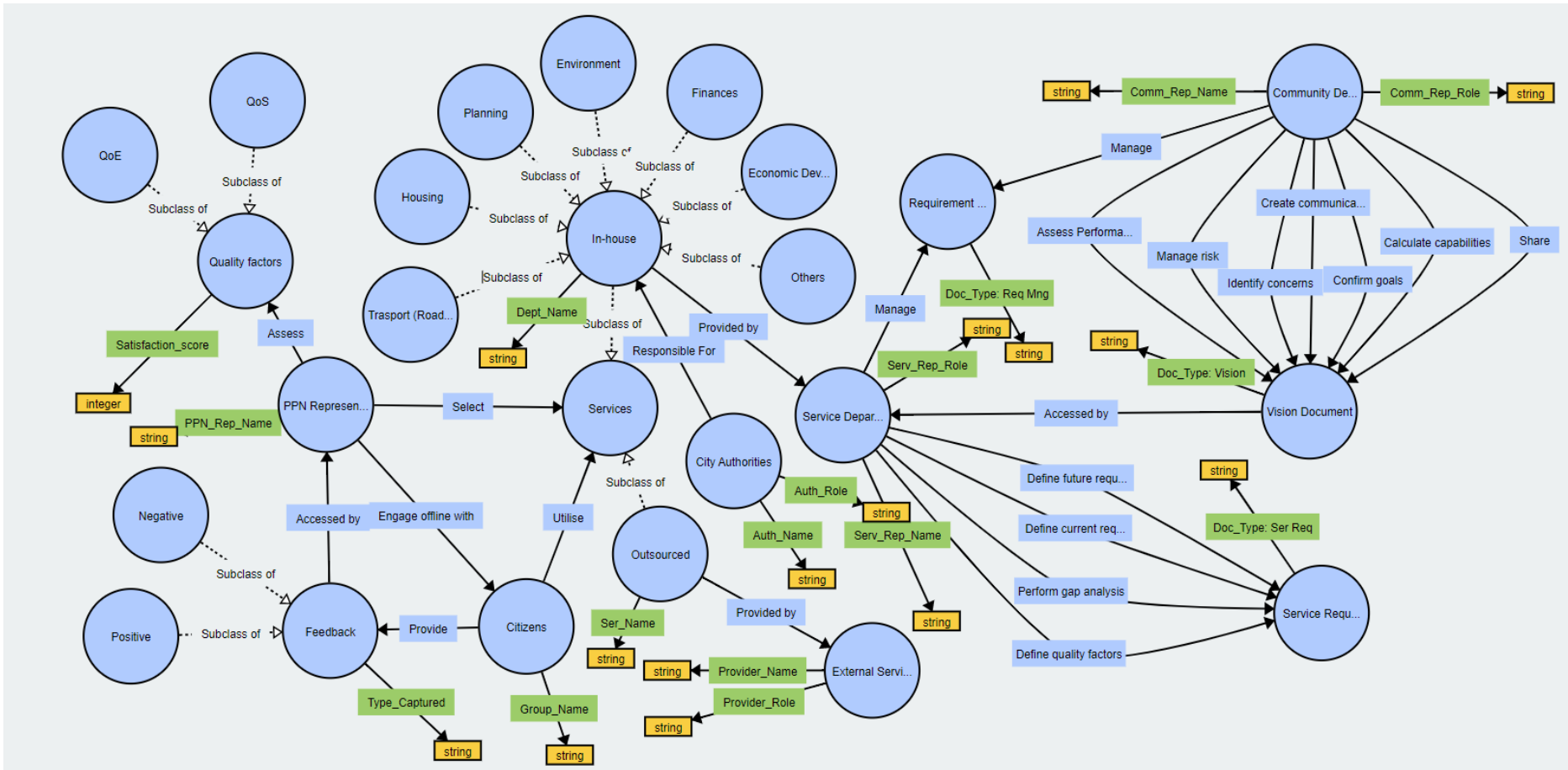
Figure 9: Ontology created based on the derived components

5.3.2.2 Construct a Process

The ontology depicted in Figure 9 served as a basis for the development of the proposed process model. BPMN provides the notation for creating process models. The process model is a representation of the complete process derived from the knowledge base and collaboration with practitioners. The proposed process model consists of different activities and concepts that have been derived based on the identified design guidelines. These design guidelines were co-developed and refined based on the feedback of practitioners. It includes the identification of the challenges they highlighted during the problem investigation phase. In addition, their feedback was captured throughout the build and evaluate cycle of the process model development. The resulting artefact is the result of an ongoing collaboration with practitioners. The process model is divided into three stages. (1) The first stage (Citizens' involvement) of the process model captures engagement channels, citizens' feedback and its classification, activities for service performance assessment, and classification of service (In-house/outsourced). (2) The second stage (Selection of the Service from the catalogue) involves the selection of the service from the service catalogue (Multiple domains) for which citizens had provided their feedback. (3) The third stage (Activities for addressing the community's concerns) is associated with the activities that need to be performed by practitioners at the Council to address the concerns of citizens and to fulfil their needs. The detail of these activities has been provided as follows.

5.3.2.2.1 Stage 1: Citizens' Involvement

Figure 10 represents the first stage of the process model in which the first lane represents the stakeholders from the Council who are involved in the citizen engagement process. The second lane involves the stakeholders such as service providers in case services are outsourced by the Council for implementation. The last lane represents the citizens/community who utilise the services and provide their feedback via various platforms. It is important to highlight that the feedback captured in the first lane is part of an initial consultation. Whereas, the feedback captured in the last lane is gathered after delivering the services to the community. The purpose of capturing the feedback at two levels was to showcase that feedback should not be captured only during the initial stages of engagement but also after the implementation of the services to ensure that the goals set by the initial engagement have been met. The detail of individual lane has been provided as follows.
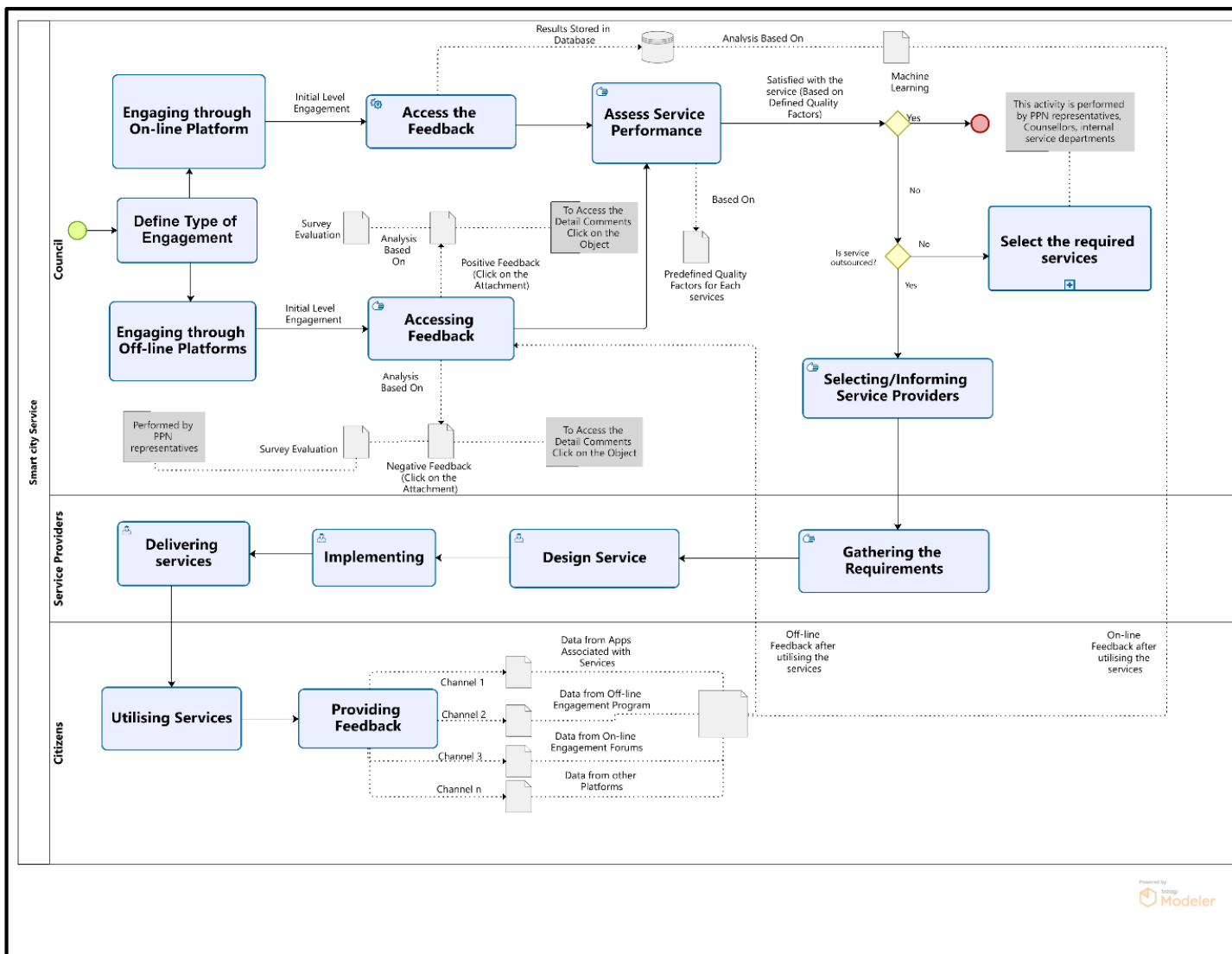
Figure 10: Stage 1- Citizen's Involvement

The first lane (Figure 10) covers the type of engagement that needs to be defined by the Council for capturing the feedback via online and offline platforms to cover a wide range of community views. Practitioners from the Council confirmed that there is a need to have both online and offline platforms for capturing citizens' feedback so that they can capture a wider range of community perspectives. Then, the feedback is further accessed by the council via these platforms. This model represents the sample of community feedback that was obtained via an offline engagement platform (PPN). This feedback is captured by conducting an offline survey with the local community and was organised by Council authorities. The survey evaluation format and process were defined by the Council. This survey highlighted the community's views on different public services which were classified as top likes and dislikes. The rationale behind this classification was to identify what is working well within the community and where Council needs to focus on addressing community's concerns. They have been captured as positive and negative feedback within the model.

Once, this feedback has been captured, the next step in the process was to assess the results against pre-defined quality factors that cover application as well as experience of citizens across different services. It has been captured in a template (Figure 11) and attached to the activity "Assess service performance" in the model. This assessment provides satisfaction factors of the community across various services that are delivered by Council/external service providers. This assessment can be performed by the practitioners who engage with citizens offline. For an on-line platform, this assessment can be automated. After performing the assessment, the next step would be to select the service for which the concerns need to be addressed.

	A	B	C	D	E	F	G
1	ID	Name of Quality Factors	Previous Satisfaction Score (PSS): Extracted from Surveys/other platforms	Current Satisfaction Score(CSS): Extracted from Surveys/other platforms	Comparision Between Scores	Improved	Additonal Detail
2	BA_SVQ_01	Quality of Experince	3	2	{if CSS< PSS, then set Improve=0 (No), else set Improve=1 (Yes)}	No	
3	BA_SVQ_02	Availability	2	4		Yes	
4							
5							
6							
7							
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22							

ROADS,PAVEMENTS,TRAFFIC,PARKING BUILDING,HOUSING & DEVELOPMENT LOCAL ECONOMY COMMUNITY FACILITIES LITTER MANAGEMENT ...

Figure 11: Sample of Assessing Service Quality

During the interviews, it was highlighted that some services are provided by councils (in-house) whereas others are outsourced to external service providers such as e-parking service. Therefore, before performing the activity *"select service for addressing the concern"*, a decision needs to be made by Council whether the service is outsourced to external service providers or is provided by the Council. Based on this decision, if services are outsourced, then service providers need to be informed for addressing new changes. Service providers are selected by the Council on a contract basis. Service providers will be responsible for various stages of the service design process (Requirement gathering, design, implementation, and delivery) as shown in lane 2 (Figure 10). Finally, the services will be delivered by service providers to the citizens. Then, citizens can utilise those services and provide their feedback via multiple platforms as shown in lane 3 (Figure 10). If services are provided by Council, then the activity *"Select required service"* needs to be performed by relevant practitioners in the Council. The detail of this activity has been provided in stage 2.

5.3.2.2.2   Stage 2: Select Required Service

In case, Council is responsible for delivering the service then the sub-process "*select required service*" needs to be selected by the practitioners at the Council; Once the selection has been made, the practitioners will be directed to the service catalogue which provides a catalogue for the various public services provided by local authorities of Ireland. These services can be categorised into different domains such as Transportation, Mobility, Environment, etc. After conducting the Case study with County Council A, it was found that the information (feedback) obtained from the community's end as a part of the community development service was not being channelled to other service departments for which the community provided the feedback. Moreover, instead of linking those feedbacks to the relevant service departments, the community engagement program was working in silo. Therefore, in the second stage of the model, various public services have been represented in the form of a service catalogue, and a required selection need to be made to address the community's concerns for a specific service as depicted in Figure 12. Once the service has been selected from the catalogue by clicking on a specific service, then practitioners will be directed to the third stage of the process model as shown in Figure 13. Next section provides a detailed discussion for all the activities that practitioners need to perform for further improving the services and to address citizens' concerns.
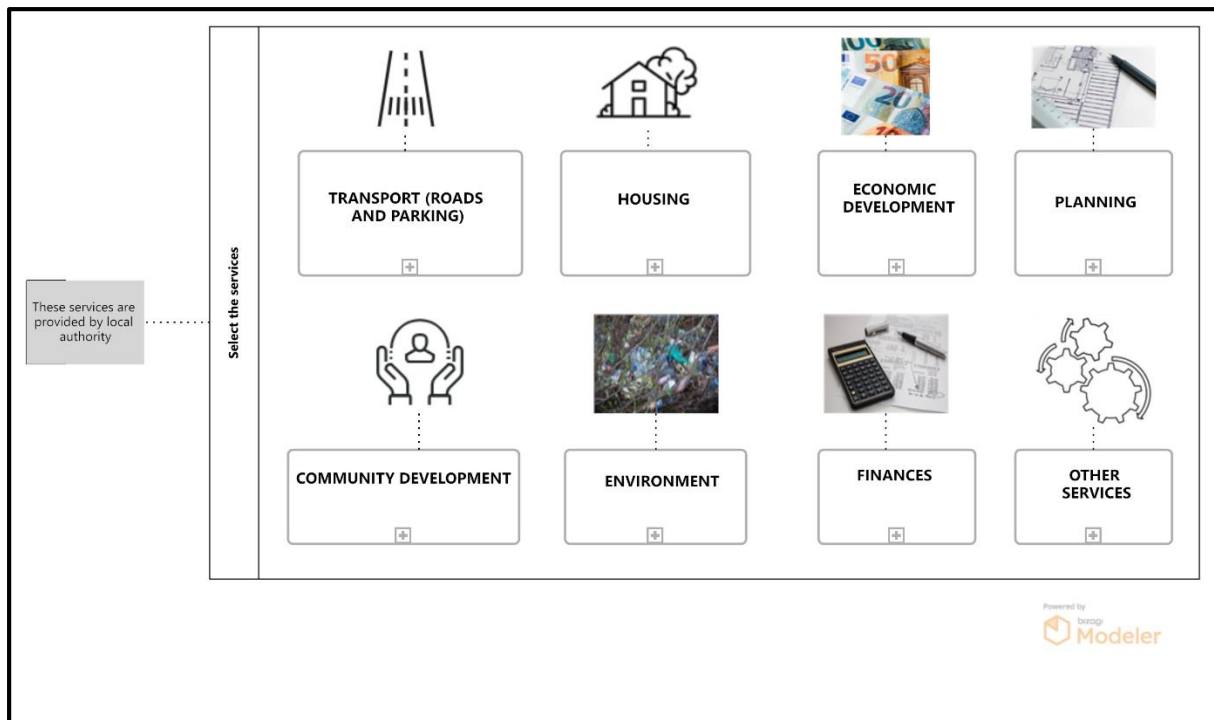
Figure 12: Stage 2- Service Required Service

5.3.2.2.3   Stage 3: Activities for Addressing Community's Concerns

Once the selection has been made from the service catalogue, a set of activities need to be performed by the practitioners to map community requirements and to improve the services. These activities have been captured in the third stage of the process model as show in Figure 13 and are discussed as follows:

This study argued that the adapted guidelines from TOGAF ADM would provide a path in mapping citizens' requirements and addressing their concerns more effectively while considering the challenges arising from city authorities' end. The third stage of the model consists of these guidelines which have been modelled in BPMN using the Bizagi modeller. The naming convention of the activities is given in a way that is not very technical and easy to understand by all stakeholders at the Council. The third stage of the model is subdivided into three lanes as shown in Figure 13. Each lane corresponds to individual ADM phases which are defined as:

(A)   Lane 1 (Citizen engagement team and councillors)

(B)   Lane 2 (Service department)

(C)   Lane 3 (Citizen engagement team and service department)

The detail of individual lane has been discussed in the following sections.
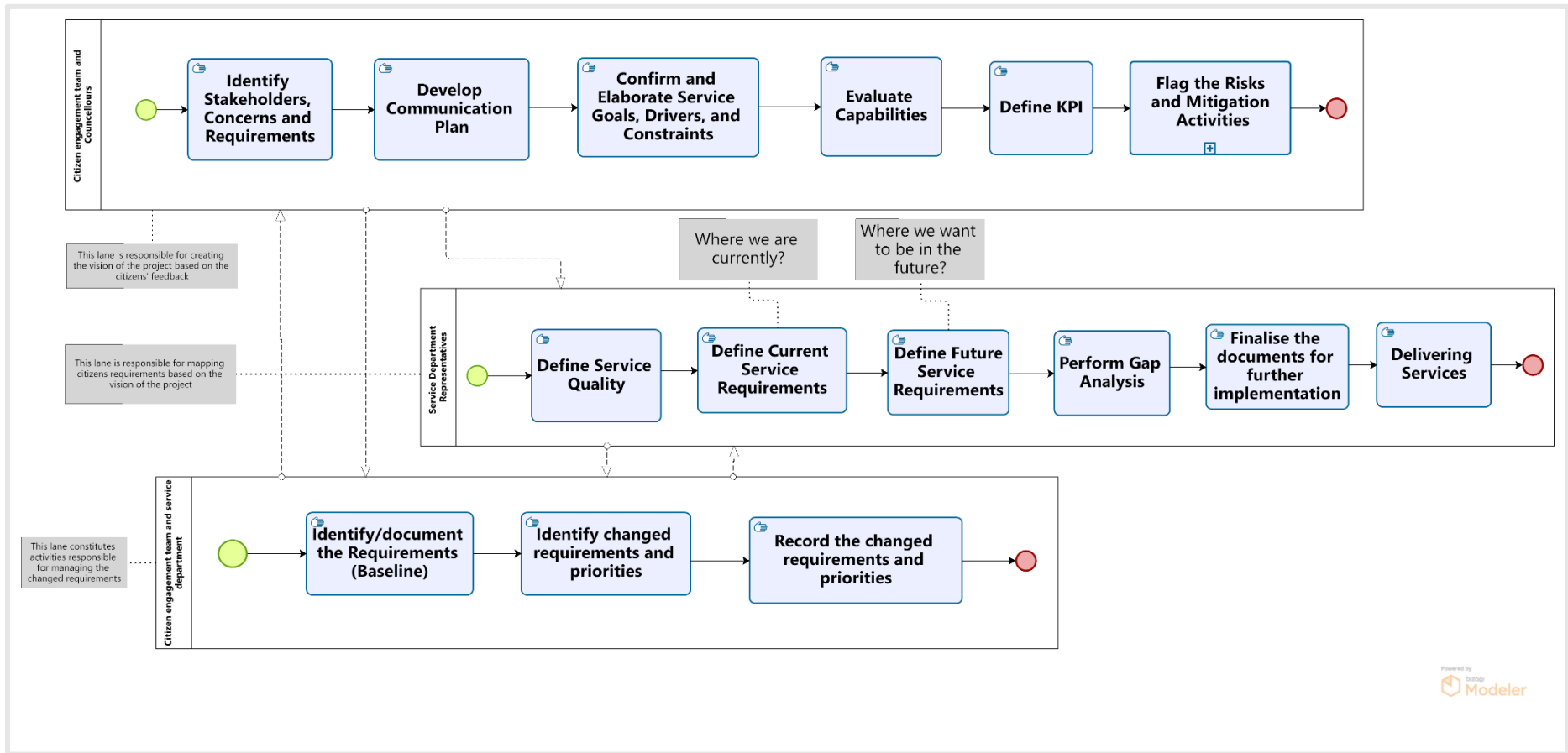
Figure 13: Stage 3- Activities for Addressing Community's Concern

(A) Lane 1 (Citizen engagement team and councillors)

This section provides detail about the key activities of the Architecture Vision phase modelled in lane 1 (Figure 13) based on the guidelines of TOGAF. This research modelled only those activities which were relevant to address the problem domain in the context of this study. The Architecture Vision phase assists in capturing the concerns and requirements of different stakeholders. At this level, the community's and city authorities' requirements and concerns can be captured and the proposed solutions are identified. It also provides business transformation risks and mitigation activities that would guide city authorities in addressing risks associated with the planning and delivery of the services and setting up the realistic expectations for the community.

Another important factor that was identified during the interviews was the Council's capacity to improve services based on the community's feedback. As a result, it becomes essential to keep transparency between the Council and the community in terms of what is achievable. Moreover, Council needs to evaluate its capabilities to ensure that desired goals can be met. It has been covered in the vision of the project as shown in lane 1 (Figure 14). Furthermore, detailed guidelines and examples for each activity have been provided to guide city authorities in performing those activities. The detail of all the associated activities is provided in the following sections.
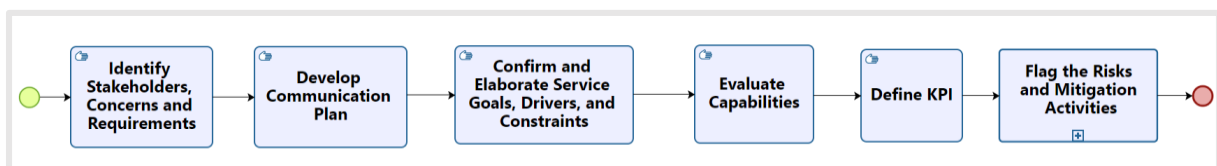
Figure 14: Vision of the Project

Identify stakeholders, their concerns, and requirements: The vision of the project is created early on in the project life cycle and provides a high-level, aspirational view of the end product/services for the community (*The Open Group Standard*, 2018). Table 13 provides an overview and guidelines for performing this activity based on the discussion with practitioners and guidance provided by The Open Group Standard, (2018). Guidelines were adjusted based on the need of practitioners, and examples were provided to demonstrate the application of those guidelines in the context of City/County Councils.

Table 13: Overview and Guidelines for Activity- Identify Stakeholders, Concerns, and Requirements

Overview	• The purpose of the vision is to agree at the outset on what the desired outcome should be for the project so that stakeholders at Council can focus on the critical areas to validate feasibility. • At this stage, stakeholders are identified, and their concerns and requirements are validated. • This would capture the requirements and concerns of City authorities and community's end along with all the other stakeholders who are involved in the process.
Guidelines	**1. Identify the community's concerns:** State a list of issues/problems that should be addressed within the community. For instance, one of the community's concerns was "Better car parking in town is also needed for locals and visitors – it is currently very difficult, for example, for coaches to stop in [name]". **2. Identify opportunities for solutions:** Identify the smart solutions/technologies for implementing the vision of the project which can include solving problems for the community or an opportunity for service improvement. Below sub-guidelines need to be followed to address the community's issues. 2.1 Provide possible solutions to the identified problems. 2.2. Identify other pre-existing solutions in other counties/cities/towns. 2.3 Find networking opportunities for implementing the new solutions. 2.4 Outline the name of stakeholders who will be responsible for taking required action to provide improved services to citizens.
Example	To address the concerns regarding the parking system, the e-parking service could be one of the solutions to solve the problem. A template was also attached within this activity to guide stakeholders at the Council in recording the vision of the project and to add more details for individual services (e.g. Template - Vision of the Project_TRANSPORT_ROADS_AND_PARKING)

Develop a Communication Plan: Effective communication of targeted information to the right stakeholders at the right time is a Critical Success Factor (CSF) for any organisation (*The Open Group Standard*, 2018). Table 14 provides an overview and guidelines for performing this activity based on the discussion with practitioners and guidance provided by The Open Group Standard, (2018). Guidelines were adjusted based on the need of practitioners, and examples were provided to demonstrate the application of those guidelines in the context of City/County Councils.

Table 14: Overview and guidelines for activity- Identify Stakeholders, concerns, and requirements

Overview	• The development of a communications plan allows communication to be carried out within a planned and managed process. As there are multiple departments and stakeholders involved in delivering the services. Consequently, it becomes vital to have effective communication between them. • This would help city authorities to exchange the desired information in the timely manner needed for the successful delivery of the services.
Guidelines	1. Identify stakeholders and group them by communication requirements.
	2. Identify communication needs, key messages about the Vision of the project, communication risks, and CSFs.
	3. Identify mechanisms that will be used to communicate with stakeholders and allow access to project information, such as meetings, newsletters, repositories, etc.
	4. Identify a communications timetable, showing which communications will occur with which stakeholder groups at what time and in what location.
	5. Provide a contact list of stakeholders who will look after the implementation plans.
Example	Figure 15 represents the sample of communication planning with all the details. It includes detail about different stakeholders group and their responsibilities who will be responsible for executing the project for service improvement.

Stakeholders Name/Group	Information Required	Communication Platforms/Location	Time/Frequency	Documentation Required	Responsibilities		
					Project Lead	PPN Representative	Project Manager
ABC	Project status	Mail	Once per week	Project Description	R	A	R
XYZ	Vision of the Project	C Council	Once or twice in upcoming weeks	Proposal	I	I	AC
PQR	Deliverables of the Project	Workshop	Once in a month	Time line of the project	C	C	I

Figure 15: Sample of communication planning

Legends: R-Responsible, I-Informed, C-Consulted, A-Accountable

Confirm and Elaborate service goals, drivers, and constraints: Drivers are defined as external or internal condition that motivates the organization to define its goals (*The Open Group Standard*, 2018). For instance, the external drive is a change in regulation or compliance rules which require changes to the way an organization operates. However, the constraints may not allow the implementation of new changes such as process or budget-associated constraints. As a result, organisations may not achieve the goals that they intend to meet. Table 15 provides an overview and guidelines for performing this activity based on the guidance provided by The Open Group Standard, (2018). Guidelines were adjusted based on the need of practitioners, and examples were provided to demonstrate the application of those guidelines in the context of City/County Councils.

Table 15: Overview and guidelines for the activity- Confirm and Elaborate service goals, drivers, and constraints

Overview	Identify the service goals and strategic drivers for improving the services.
Guidelines	1. Clarify any areas of ambiguity.
	2. Define the constraints that must be dealt with, including Council-wide constraints and project-specific constraints (time, process, resources, etc.).
Example	Citizens' satisfaction with the service (e.g. Lower satisfaction score for e-parking service) could be an example of the external driver for city authorities that would motivate them to provide improved services to the citizens based on their feedback.

Evaluate capabilities: Capabilities define what an organization/Council must be able to do to successfully achieve its strategic goals (*The Open Group Standard*, 2018). The goal could be to transform/improve public services for the community. Thus, existing capabilities should be evaluated and improved to achieve this goal. Table 16 provides an overview and guidelines for performing this activity based on the guidance provided by The Open Group Standard, (2018). Guidelines were adjusted based on the need of practitioners, and examples were provided to demonstrate the application of those guidelines in the context of City/County Councils.

Table 16: Overview and guidelines for the activity- Evaluate capabilities

Overview	Based on the community's feedback, Council needs to evaluate its capabilities for addressing the community's concerns.
Guidelines	1. To achieve the desired goal, an organisation should be able to assess its current capability levels.
	2. These levels can be assessed across different dimensions such as process, resources, technology, etc. as shown in Figure 17. It provides detail of baseline and target maturity levels for Waste Management Capability. The identified gaps or limitations identified in this capability can inform Council for taking desired actions to meet its strategic goals.
Example	• The capability heat map (Dummy) has been shown in Figure 16 based on Council's existing capabilities. These capabilities have been coloured for demonstration purposes only, it does not reflect the real value of the capability in County Council A. • Based on the maturity level of the capabilities, different colour codes have been provided. For instance, above-average capabilities are shown in dark green and below-average capabilities in red.
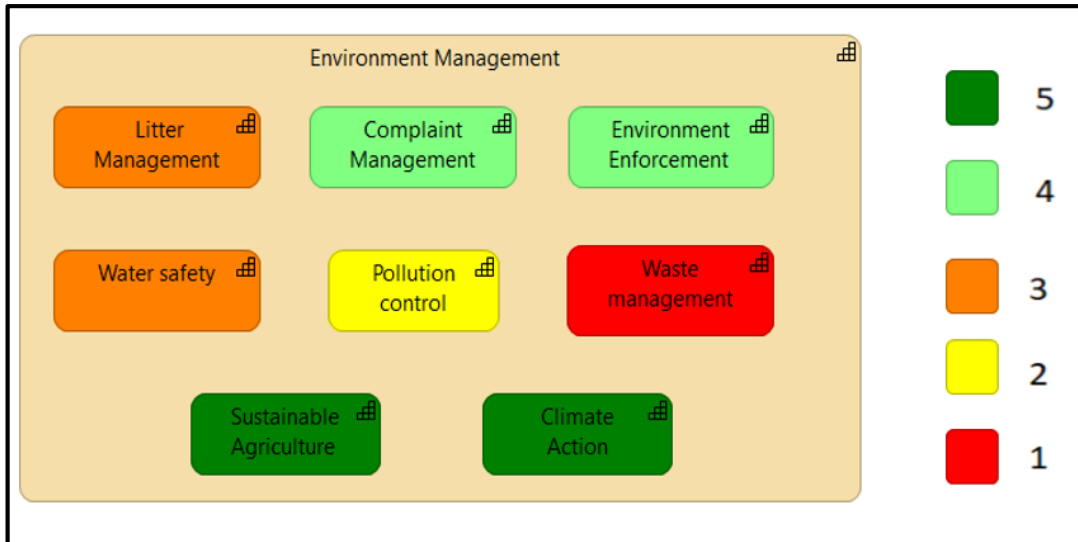
Figure 16: Capability heat map for Waste Management
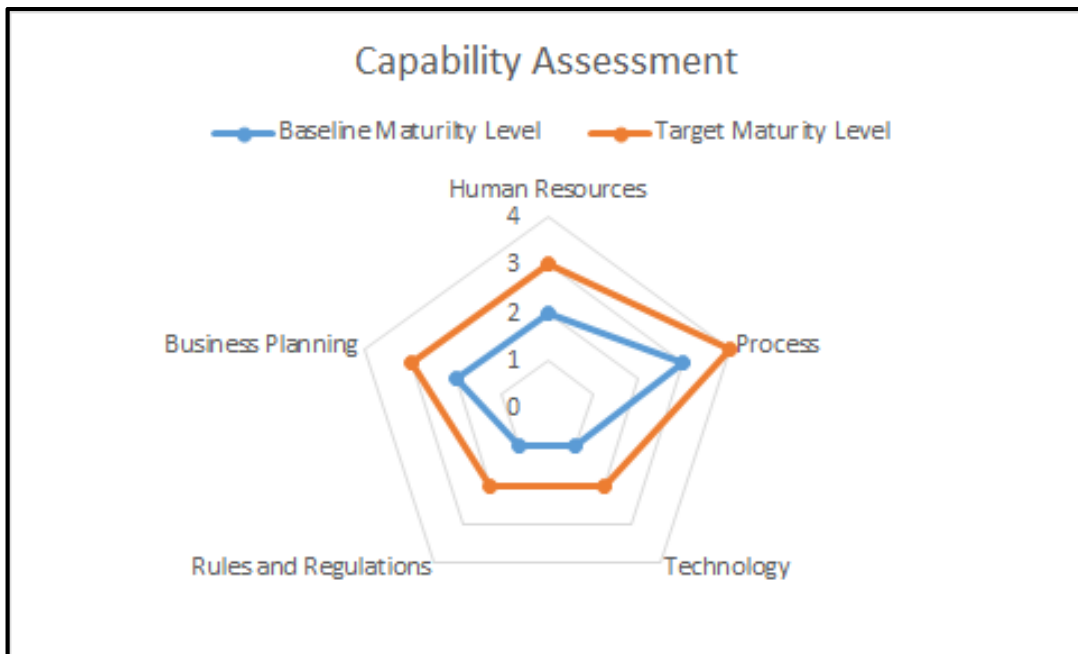
Figure 17: Example of Capability Assessment for Waste Management

Define KPI (Key Performance Indicator): KPIs provide a way to quantify project performance (*The Open Group Standard*, 2018). For example, this can be linked with satisfaction factors towards the service obtained from the Community's side during the citizen engagement process. Table 17 provides an overview and guidelines for performing this activity based on the guidance provided by The Open Group Standard, (2018). Guidelines were adjusted based on the need of practitioners, and examples were provided to demonstrate the application of those guidelines in the context of City/County Councils.

Overview	The project contracts and performance indicators should consider the community's feedback to measure the success of the projects once services have been delivered.
Guidelines	Define the performance metrics and measures to be built into the project to meet community and Council needs.
Example	For instance, KPIs can be linked with satisfaction factors of the service obtained from the Community's side in the form of survey results, online reviews, etc. after the delivery of the services as shown in Figure 18.

Parameters	Method to measure	Expected Outcome to Achieve
e-parking Service Availability	· Survey Results from Community Future · Application Review Comments	**The following service must be available:** 1. e-parking service replaces traditional parking system in next 6 months. 2. The app that support the service should be easy to navigate. 3. The new parking service should fulfils community need. 4. The app should be available 24/7 except during any major outages.

Figure 18: Sample of Expected Outcomes to Define KPIs

Flag the Risks and Mitigation Activities: The risk will be there with any business transformation project (*The Open Group Standard*, 2018). Thus, it is vital to identify and classify risks with mitigate strategies before initiating the projects so that they can be trailed during the transformation. Table 18 provides an overview and guidelines for performing this activity based on the guidance provided by The Open Group Standard, (2018). Guidelines were adjusted based on the need of practitioners, and examples were provided to demonstrate the application of those guidelines in the context of City/County Councils.

Table 18: Overview and guidelines for the activity- Flag the Risks and Mitigation Activities

Overview	• Risk assessment defines a set of activities that need to be performed during the vision of the project before implementing the changes. • This is particularly important in the context of public service transformation due to the complexity of these services. • It would highlight potential risks in the transformation process considering what can be achieved based on the community feedback. The risk assessment guidelines have been outlined below as defined by (The Open Group Standard, 2018).
Guidelines	**1. Assess Readiness Factors:** • It can be assessed using maturity models and should address Readiness factor vision, Readiness factor rating, and Readiness factor risks and actions. • The factor vision is used to determine in which area the enterprise has to change to address factors. • Once, it has been identified, then the importance of each factor is assessed to achieve the target state. Finally, once factors have been rated and assessed, a series of actions need to be identified that will assist factors to change to the desired state.

	2. Classify and Identify Risk: The risk can be classified based on its impact on the organisation. It can be classified as time, cost, technological, environmental, etc. The transformation readiness assessments will assist in identifying the risks and determining a strategy for addressing them.
	3. Perform Initial Risk Assessment: Once the classification has been done, the next step is to classify it based on its effect and frequency within the organisation.
	4. Identify Risk Mitigation Action: The risk mitigation strategy deals with identification, planning, and actions that would decrease risk to a satisfactory level.
Example	• The risk could be associated with the finances. For example, practitioners highlighted that they did not always have enough finances to support the projects. • This can be classified as a financial risk as it will jeopardise the implementation of the project that aims to provide improved services to the citizens. Based on the identified risk, the required risk mitigation action needs to be performed.

(B) Lane 2 (Service Department Representatives)

Business Architecture (BA) describes how the enterprise should operate to accomplish desired business goals, respond to the strategic drivers that are set in the Architecture Vision phase, and addresses stakeholder concerns (The Open Group, 2018). The challenges associated with the implementation of the plans considering monitoring, and delivery of the actions can be addressed by the Business Architecture phase which provides concepts such as Measure, Contract and Service Quality, etc. to take appropriate actions for meeting the vision of the project. The supporting key activities from this phase have been modelled in lane 2 (Figure 19) to support the vision of the project and are outlined as follows.
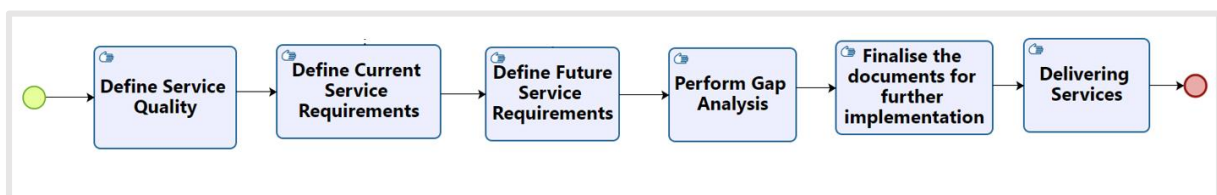
Figure 19: Activities for Service Requirement

Define service quality: Concepts such as Measure, Contract, and Service Quality from the Business Architecture phase can assist in applying the measure to quality factors of the services for achieving desired outcomes and tracking the actions. Table 19 provides an overview and guidelines for performing this activity based on the guidance provided by The Open Group Standard, (2018). Guidelines were adjusted based on the need of practitioners, and examples were provided to demonstrate the application of those guidelines in the context of City/County Councils.

Table 19: Overview and guidelines for the activity- Define service quality

Overview	The first activity in the service requirement lane is to define different quality factors of the services. Community's satisfaction factor for those services can be a part of the contract for the service providers.
Guidelines	The service quality parameters can be defined from two perspectives, one from the user's point of view based on their experiences towards the service, and secondly from a service perspective that can be associated with the technical specification of the service.
Example	For instance, Figure 20 represents a sample of QoS parameters that have been defined for e-parking service. QoS has been classified into two categories i.e. User, and Service for which the corresponding quality criteria are QoE and Availability of the services.

ID	Name of Quality Factors	Description of Quality Factors	Category	Source	Owner
		Service Quality (Governance Extension)			
BA_SVQ_01	Quality of Experince	Can include quality of presentation, delivery, perception, and finally, it can refer to quality of life as defined by citizens.	User	ABC	A
BA_SVQ_02	Availability	It ensures that service is available to its users during the defined timeframe.	Service	XYZ	B
BA_SVQ_03					
BA_SVQ_04					

Measure | Contract | Note for Quality Factors | **Quality of Service** | ⊕

Figure 20: Sample of Service Quality

Define current service requirement: It includes requirements for the services in their current state considering different components such as application, technology, business, etc. (*The Open Group Standard*, 2018). Table 20 provides an overview and guidelines for performing this activity based on the guidance provided by The Open Group Standard, (2018). Guidelines were adjusted based on the need of practitioners, and examples were provided to demonstrate the application of those guidelines in the context of City/County Councils.

Table 20: Overview and guidelines for the activity- Define current service requirement

Overview	A set of different perspectives (viewpoints) are defined according to the need of the stakeholders such as the Council and Community in the current state of the project.
Guidelines	Identify the organization units, business functions, and the linkages between services, applications, and technology components based on the current state of the service.
Example	For example, it can represent the need for replacing the traditional parking system with an e-parking service or to improve the existing e-parking service based on the community's feedback. Therefore, the organization units, business functions, and the linkages between services, applications, and technology components will represent the current state of parking system.

Define future service requirement: It includes requirements for the services in their future state considering different components such as application, technology, business, etc. (*The Open Group Standard*, 2018). Table 21 provides an overview and guidelines for performing this activity based on the guidance provided by The Open Group Standard, (2018). Guidelines were adjusted based on the need of practitioners, and examples were provided to demonstrate the application of those guidelines in the context of City/County Councils.

Table 21: Overview and guidelines for the activity- Define future service requirement

Overview	Identify the organization units, business functions, and the linkages between services, applications, and technology components based on the future state of the service.
Guidelines	Relate all the requirements, processes, services, application components, and technology systems to each other along with the service processes.
	This will allow us to validate whether the proposed changes in the future state of the project/service will fulfil the Community/Council requirements.
	In this phase, IT and Technology components are defined at a high level.
Example	For example, it can include which technology, infrastructure, and other resources are required to replace the traditional parking service with an e-parking service in the future state.

Perform Gap analysis: At this stage, it is important to consider what may have been forgotten or accidentally left out, or not yet defined (*The Open Group Standard*, 2018). Table 22 provides an overview and guidelines for performing this activity based on the guidance provided by The Open Group Standard, (2018). Guidelines were adjusted based on the need of practitioners, and examples were provided to demonstrate the application of those guidelines in the context of City/County Councils.

97

Table 22: Overview and guidelines for the activity- Perform Gap analysis

Overview	The most critical gap that should be considered at this stage is Community/Council concerns that have not been addressed in earlier discussions/projects.
Guidelines	Define the gap between the current (as-is) and target (to-be) state of the service in terms of business, data, application, and technology domains perspective. It can include gaps from a business domain perspective. Such as People gaps (e.g., cross-training requirements), Process gaps (e.g., process inefficiencies), and Tools gaps (e.g., duplicate or missing tool functionality) (The Open Group Standard, 2018).
Example	For example, it can include which technology, infrastructure, and other resources are required to transform the traditional parking service into an e-parking service in the future state for providing improved services to citizens. Figure 21 represents a sample of an identified gap to address one of the concerns regarding e-parking service.

Domain (Business)	Gap
Process	In the future state of the service, people can book parking space in advance using an on-line payment process via App so we don't need another off-line payment system in area XYZ.

Figure 21: Sample of the identified gap

Document the requirement for further implementation: Once all the activities have been performed during earlier stages, the final documents need to be prepared for the implementation of the services. Successively, these documents should be shared with other stakeholders who will look after the actions for further improving and delivering the services.

Delivering the service: The final activity is delivering the services to the citizens. Once all the activities have been performed in the previous stages, then relevant stakeholders from the service department need to deliver services to the citizens. In case there are any changes in the requirements from the community's end or Council's end. Then the activities from the Requirement change management lane need to be performed which have been detailed in the next section.

(C) Lane 3 (Citizen engagement team and service department)

The objective of the Requirement Change Management (RCM) phase is to manage requirements identified during the execution of any ADM cycle or phase (The Open Group, 2018). Figure 22 shows activities that need to be performed for the management of the changed requirements.
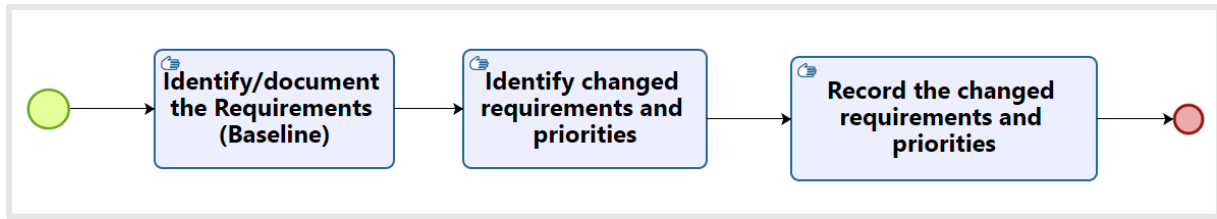
Figure 22: Activities for RCM

The Requirement Change Management (RCM) phase can assist in managing the changed requirements arising from the Community/Council's end. As this research implemented Architecture Vision and Business Architecture phases in the context of this study. Therefore, any requirements originating from either of these phases are managed by the RCM phase and the relevant activities have been captured in lane 3 as depicted in Figure 22. For instance, the community can have an initial requirement (baseline requirements) for a service that might change in the future. It has been highlighted by the Community Engagement Coordinator in County Council B as *"..the problems that I would write down now wouldn't be the same problems I'd write down at six months' time and these things become out of date very quickly*" [Community engagement co-ordinator, County Council B]. Therefore, the requirement change management phase can assist to record any such change and to map citizens' requirements based on their priorities. The detail discussion has been provided below for performing the activities of Requirement change management based on the guidance provided by The Open Group Standard, (2018). Guidelines for the activities were adjusted based on the need of practitioners and an example was provided to demonstrate the application of those guidelines in the context of County/City Councils.

Identify/document the requirements: The first step is to identify the requirements originated from any of the ADM phases modelled in Lane 1 (Architecture Vision), and Lane 2 (Business Architecture) based upon the given business scenario.

Identify the changed requirements and priorities: If the community or any other stakeholders change their requirements in the future, then priorities have to be re-assessed based upon which existing requirements (Baseline) are modified/added.

Record the changed requirements and priorities: Requirements arising from the ADM phase (Derived from the previous step) are prioritized and stored. The initial requirements can be recorded as a baseline requirement by the community engagement coordinators that should further be confirmed by all the stakeholders at the Council. Figure 23 provides a sample template from the TOGAF toolkit to demonstrate how changed requirements can be recorded, and has been attached to this activity.

Requirements Log

ID	Requirement Item	Description	Priority	Action Plan (Year)	Source	Owner/Action By
REQ_C_01	Regulate and develop parking facilities	• Look at ways of developing new parking facilities • Regulate existing car parking	1			
REQ_C_02	Extend the River Walk to Carramore	Work with landowners, RSS etc to develop plans to extend the walk	2	2008-2011	Community Prospect Program	Local: ABC Support Organisation: XYZ
REQ_C_03	Develop the Square	Put more seats, litter bins, information kiosk, encourage visitors to stop and find out what is happening in the area	3			

Requirements | Assumptions | Constraint

Figure 23: Template for recording changed requirement

5.3.2.2.4 The interrelationship between Stage 1, Stage2, and Stage 3

Figure 24 represents the complete process model with all three stages, and the detail of an individual stage has been provided in earlier sections. In this section, the interrelationship between those three stages has been provided. The first stage is associated with the involvement of citizens in which the feedback from citizens' end is firstly captured during early consultation, and later after the delivery of the services. Then based on assessed quality factors of the services, it can be identified whether citizens are satisfied with the service or not. If they are satisfied, then the process ends there else it goes back to the next step where a decision needs to be made between in-house or outsourced services. If service is outsourced, then further activities are performed by external stakeholders as shown in lane 2 (Stage 1, Figure 24). Finally, services are delivered by the providers. If services are provided in-house by the local authorities, then practitioners can select any service from the service catalogue as shown in Stage 2, Figure 24 to address the community's concerns for which the activity "Select service" has been identified. Once the selection has been made, the stakeholders can perform activities in the third stage of the model for further improving the services by identifying the set of requirements for the service and by following the guidelines defined in each activity.

The third stage of the model provides detailed activities that need to be performed by the practitioners of the Council who engage with citizens and work towards the improvement of the services. It includes the identification of the community's concerns and factors that should be considered for addressing those concerns. The community's concerns include the feedback from the community's end that was captured at Stage 1 after the delivery of the services or it can cover any new issue within the community during an initial consultation. Based on those concerns, the next steps are performed and required actions are taken to further improve the services and to fulfil the need of citizens. Once all the activities have been performed in Stage 3, then stakeholders responsible for delivering the services from the service department will deliver the services to the citizens as

shown in lane 2 (stage 2) in Figure 24. The next section provides detail about the documentation of the process model.
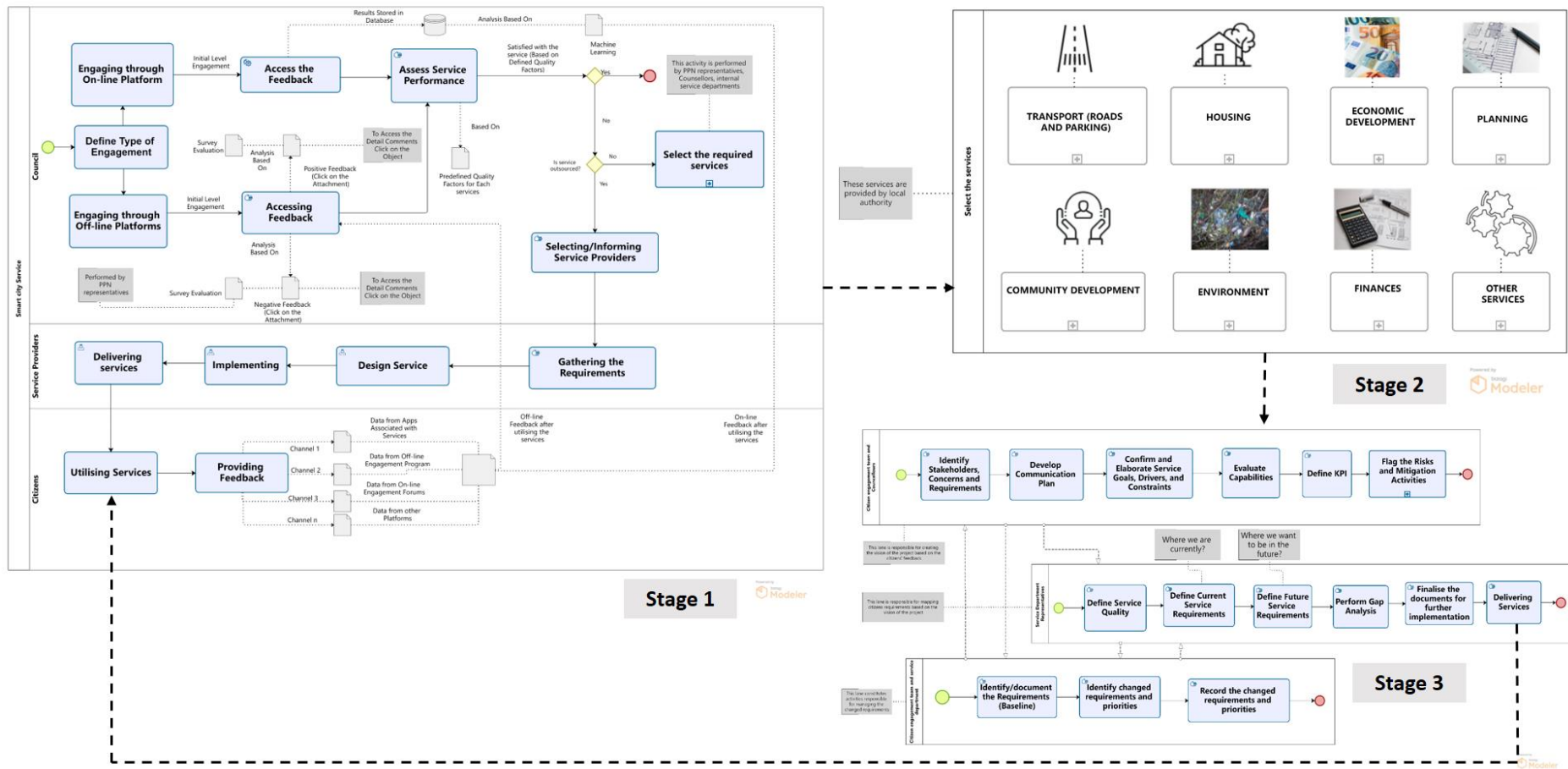
Figure 24: Interrelationship between different stages of the Process Model

5.3.2.3   Document the Process

The final step in the construction of the process model is to document the processes which include different components as discussed in the following section.

5.3.2.3.1   Scope Statement

The scope statement is associated with the initiation of the business process model documentation, stating what the proposed business process model is trying to resolve, why it is needed, and who will be the end users of it (Ostrowski, 2014). In the context of this research, it covers the processes and sub processes to address the challenge of structuring the relationship between citizens'/community's feedback and service improvement for meeting the need of citizens. This research found that existing studies neglected some of the key factors that are important to consider while improving the services. Moreover, practitioners highlighted the challenges in mapping citizens' requirements, and to address their concerns that included unstructured processes, lack of consideration of factors such as risk, constraints, etc. As a result, there was a need to have a structured approach that provides a holistic overview of a complete system that captures citizens' feedback and works upon those feedbacks for improving the existing services. Therefore, this research proposed a structured approach for improving existing services based on the citizens' feedback in the form of a process model.

5.3.2.3.2   An Applicability Matrix

This matrix allows users to understand the scope of the process model as stated in the previous step, and identify the people who will be responsible for the processes (Ostrowski, 2014). This information can be represented either in a matrix diagram or in the form of text. This research represented the information in the form of texts. The activities defined within the process model need to be performed by different practitioners of the Council. However, the key decision makers for conducting these activities are local authorities of the Council. The details have been provided as follows.

The activities associated with citizens' involvement, need to be performed by PPN representatives that gather citizens' feedback via offline engagement platform as shown in stage 1 (lane 1, Figure 24). Similarly, feedback needs to be accessed and assessed by the PPN representatives for evaluating the service performance. Based on this evaluation, further action needs to be taken by local authorities and service departments for addressing citizens' concerns. If services need to be outsourced to external service providers, then a decision must be taken by the local authority otherwise internal service department will be responsible for carrying out the activities. The service catalogue provided in the second stage of the model (Figure 24) is associated with the selection of the services for which the community's concerns need to be addressed. This activity needs to be performed by the PPN representatives and the decision needs to be made by the local authority for assigning particular responsibility to the relevant departments. Lastly, the service improvement stage (stage 3) of the

model (Figure 24) defines a set of activities that need to be performed by multiple stakeholders. PPN representatives will be responsible for creating the vision of the project along with local authorities, then the activities defined in stage 3 lane two (Figure 24) need to be performed by service departments for implementing the services based on the vision of the project. Finally, if there are any changes in the requirements of the community, then the activities defined in stage 3 lane three (Figure 24) need to be performed by PPN representatives and the service department. Based on those changes, the service department can implement new changes for the services.

5.3.2.3.3   Impact on the Business

The objective of this step is to elaborate on how the proposed process will impact the existing business (Ostrowski, 2014). The proposed process model will affect the following:

1. **Action planning for service improvement:** It was validated with the practitioners during the ex-post evaluation of the process model that it will assist city authorities when they do their action plans for service improvement. A detailed discussion has been provided in section 6.3.1.2. The existing process of the Council does not showcase how services are improved based on the citizens' feedback captured via engagement programs. The proposed model addresses this issue and provides a structured approach in the form of a process model for continuously providing improved services to the citizens.

2. **Citizen engagement process:** Existing citizen engagement process did not consider some of the key factors which could impact the improvement of the existing services. The proposed model addresses this challenge by adding new components to their process and would guide city authorities in mapping citizens' requirements.

3. **Public services:** The service catalogue component within the process model provides an opportunity for the city authorities to access the community's feedback on multiple services on a single platform. Based on this, they can work towards individual services by following the proposed activities in the model. This would assist them in providing improved public services to the citizens.

5.3.2.3.4   Roles Involved

It is important to make sure that business processes flow properly and effectively, and that there are no processes without any specified roles for it (Ostrowski, 2014). Practitioners also highlighted during the interviews that they will need someone who could look into this complete process model and report to the local authority about the execution of each activity defined in the model. Therefore, local authorities need to assign this responsibility to the relevant stakeholders who can report back to the Council about the execution of the individual activities within the process model.

5.3.2.3.5   Process Activities

In the section 5.3.2.2 "Construct processes", a detailed description has been provided of each activity of the process model and the logic that has been followed for connecting them. This is underpinned by combining the ontologies and process model diagrams produced in earlier sections using WebVOWL and BPMN.

5.3.2.3.6   Process Exception

The process exception section deal with the components of the process model which can provide an alternate set of activities, and were not considered in the combined business process model (Ostrowski, 2014). However, this step was not performed for the proposed process model as there were no additional sets of activities that were excluded as an alternate approach.

5.3.2.3.7   Decision Matrix

This part deals with the representation of the key decision makers for the proposed process model who will have the authority to take the final decisions regarding the processes (Ostrowski, 2014). It was highlighted by the interviewees during the interviews that the key decision makers are the stakeholders from the local authority. The stakeholders involved in driving the engagement process do not have the power to take the final decisions regarding the service improvement process or to work on the community feedback. They only serve as a mediator between the community and local authorities who gather the community feedback and report it back to the local authorities. The final decisions are taken by the local authority to address any concerns of the community or for implementing the services in the County. This section provided detail about the modelling of the process model. The next section provides detail about its evaluation (Ex-ante) performed during the second evaluation cycle.

5.4   Ex-ante Evaluation (Evaluation Cycle 2)

This chapter presented the updated version of the process model to the practitioner for which a detailed discussion has been provided in section 5.3.2.2. The model was evaluated during different stages of the artefact development and evaluation. The ex-ante and ex-post evaluation strategies have been incorporated during this process as discussed in section 3.4.3. Chapter 4 provided details about the first evaluation cycle during the ex-ante evaluation phase that was conducted to validate the research problem. This section describes the second evaluation cycle during the ex-ante evaluation phase. The semi-structured interviews were conducted with practitioners in County Council A to perform this evaluation. The details have been provided as follows.

5.4.1 Semi-structured Interviews

This chapter included the updated version of the proposed model that was modified based on the feedback that practitioners provided during ex-ante evaluation (cycle 1) in chapter 4 and ex-ante evaluation (cycle 2) as discussed in section 5.4.1.1. The updated version has been designed by following the TOGAF EA guidelines, based on the literature review findings, results from the pilot case study as discussed in chapter 4, and the Case study with County Council A.

The first version of the model included artefacts (e.g. templates) from the TOGAF 9.2 toolkit to address some of the challenges highlighted by practitioners during the problem investigation phase as discussed in chapter 4. The practitioners were involved during all the phases of the DSR methodology and multiple interviews were conducted with them to obtain their feedback on the proposed process model. During the design and development phase, three semi-structured interviews were conducted with them to evaluate the design specifications and requirements of the model. The first version of the model served as a basis for designing the final artefact. In this version, different components of the model were demonstrated including templates for requirement management, concepts such as QoS, contracts, etc. A coding-based system was employed that assisted in mapping the data from interviews and documents provided by practitioners in the proposed model. Table 23 provides detail of the interviews, and Table 24 provides detail for evaluation cycle 2 considering different evaluation criteria. The interview questions are provided in Appendix D. The duration of the interviews was between 30-60 minutes and they were conducted online in MS Teams. The interview data were analysed using NVivo software based on the evaluation criteria of Understand-Ability, Clarity, and Usefulness (Sonnenberg and Vom Brocke, 2012).

Table 23: Interview detail for ex-ante evaluation (cycle 2)

Participant numbers	Roles	Time
Participant 1	Community Prospect Co-coordinator	30-60 minutes
Participant 2	Head of Strategic Capital Projects	
Participant 3	Head of Community Prospect Program	

The purpose of this evaluation was to assess whether the design specification was understandable and meaningful to all of the stakeholders (Sonnenberg and Vom Brocke, 2012). The details of the analysed data have been provided in the following section.

Table 24: Detail of evaluation cycle 2 (Ex-ante)

Inputs	Outputs	Evaluation Criteria	Evaluation Method
• Design specification • Design objectives • Stakeholders of the design specification	• Validated design specification • Justified design requirements	• Understand-ability • Clarity • Usefulness	• Demonstration • 3 Semi-structured interviews

5.4.1.1 Data Analysis and Results

Based on the conducted interviews, further design changes were made to improve the artefact in the next iteration of the design cycle. These changes have been reflected in the proposed process model as presented in section 5.3.2.2. These changes included non-technical names for the activities, a simple process and sub-process, and more templates and visuals within the model as discussed in section 5.2.3. Interview data were coded following a pattern-matching method in which common themes and expressions were categorised and the original model was revised based on the data analyses (Creswell 2013; Yin 2018). The interview questions were designed to validate design specifications and the model as a whole unit. Therefore, it confirmed the representation of the domain and increased the reliability for the next iterations of the artefact.

The content and the structure of the model were further validated during the build and evaluate cycle of the artefact. The questions were asked regarding different components of the model. The questions were designed to evaluate the design specification of the model based on the criteria of understandability, clarity, and usefulness. Questions were regarding the understanding of the model as not all the practitioners had technical expertise in this domain. Therefore, it was important to know whether the proposed solution in the form of a process model is easily understandable by them which has been indicated as: *"Yeah, it's very easy to understand, actually"* [Participant 2, Head of Strategic Capital Projects]. The second criterion was about the clarity of the model in terms of the components and the relationship between those components. The participant confirmed that the model was clear enough to understand, and they will be interested in a proposed model as it makes the engagement process clearer. *"there's still a huge amount of community engagement and engagement with elected members. And so I'm interested in anything that makes that clearer"* [Participant 2, Head of Strategic Capital Projects].

It was vital to confirm the proposed design specification of the artefact and its relevance for the practitioners before actually developing it for addressing the identified problem. Therefore, further questions were asked regarding the usefulness and relevance of the model. Participant 3 confirmed

the relevance of the model to action upon community's feedback *"I mean, this is really good, because this is kind of is the next step, which is very important that, you know, it's all fine having lovely plans, but if we don't action, what's in the plans"* [Participant 3, Head of Community Prospect Program]. Similarly, participant 2 confirmed that the proposed model would assist them to address the challenge of putting all the information (regarding citizens' feedback and action plans) together into a single system to provide improved services to the community *"…..I think it would really help. one of our biggest challenges last year in the community was the amount of information that we were being hit with all the time and we're trying to put a system together….this would probably fit quite well ….."* [Participant 2, Head of Strategic Capital Projects]. Participant 2, also confirmed the usefulness of the artefacts that were attached to different activities within the model for instance a template to define the Quality of the Services. The findings from the above evaluation provided validation to the proposed design specification and confirmed the design requirements for the process model. This further informed the design of the model development and was reflected in the process model. Based on the conducted interviews, the design changes were required to further improve the artefact in the next iteration of the design cycle which has been incorporated in the proposed process model as represented in the previous section 5.3.2.2 of this chapter. These changes have been discussed as follows.

One of the participants highlighted the need of having plans to capture the timeline and the actions with steps for capturing the community's feedback. Additionally, they highlighted the requirement of having a mechanism to track the actions *"I think it would be important to have kind of an action plan that there's a time frame on that they can see incremental steps for achieving specific actions. because then you have your wins then you know small steps"* [Participant 3, Head of Community Prospect Program]. In addition, Participant 3 emphasised that there is a requirement to ensure that citizens' feedback is on the agenda items of their monthly meeting so that they can track its progress monthly. *"I think part of this is the requirement that maybe it's an agenda item on their monthly meeting in the communities so that they can track it"* [Participant 3, Head of Community Prospect Program]. The practitioner also wanted to have a component that could showcase the possible solutions for the identified problems of the community. For example, looking out for other networks and opportunities in other counties that might have already dealt with a similar kind of problem. *"You know part of this framework could be, who are the key players in delivering what we need to deliver? Who do we need? Who do we need to be making contact with an, and what networks do we need to be setting up in order to? You know, deliver what we want to deliver so that people are framing their work because in many cases, we're not reinventing the wheel in relation to communities".* [Participant 3, Head of Community Prospect Program].

The results of the ex-ante evaluation confirm the design specification of the model and its relevance from the practitioners' perspective. Based on the feedback obtained by participants during the interviews, this study further improved the model, and the changes were reflected in the model. Three criteria were selected for ex-ante evaluation (i.e. understandably, clarity, usefulness). The first version of the model was demonstrated to the practitioners. It was designed based on the interviews that were conducted with practitioners during the problem investigation phase, the case study conducted for the e-parking service, and the findings from the literature. The key activities of the model were designed by following TOGAF ADM guidelines. During the demonstration phase, different artefacts associated with activities were also presented to the participants. They found those artefacts useful and confirmed to progress with the further development of the model based on the feedback and suggestion they provided during the evaluation. The next section provides a summary of this chapter.

5.5 Chapter Summary

This chapter first presented design guidelines based on the literature findings and collaboration with practitioners. This study followed a rigorous approach to artefact development by following the approach suggested by Ostrowski and Helfert, (2012). The ex-ante evaluation during the conducted case study provides strong evidence to ensure the reliability and validity of the research for the next iteration of the artefact development. The feedback from the practitioners provided inputs to further refine the design of the artefact. It also provided additional components for the model and refinement of the earlier versions. This approach followed an iterative approach of build and evaluate cycle, through a case study approach (Peffers et al. 2007). The resulting process model encapsulates all the changes that were identified during ex-ante evaluations (cycle 1 and cycle 2) as discussed in sections 4.3 and 5.4. The next chapter provides a detailed discussion and evidence for the ex-post evaluation of the process model as a part of the demonstration and evaluation phase of the DSR methodology.

6 DEMONSTRATION AND EVALUATION

6.1   Overview

Demonstration utilises the artefact to resolve one of the problem instances and showcase how the artefact works following a formal evaluation (Prat, et al., 2015). The purpose of the demonstration is to confirm if the artefact works as intended whereas evaluation focuses on whether the artefact works over a range of contextual settings (Hevner, 2014). This chapter provides detail about the ex-post evaluation of the process model with practitioners from two County Councils of Ireland for which the details have been provided in section 6.2. The researcher demonstrated the model and provided a brief overview of the different components of the model. Focus group discussions and semi-structured interviews were conducted in which practitioners from County councils were asked to provide their inputs and feedback on the proposed process model. The feedback from the practitioners was then fed back into the next iterations of the evaluation cycle for further improving the artefact. Multiple case studies were conducted to demonstrate and evaluate the applicability of the proposed process model in a real-world environment as discussed in sections 6.3 and 6.4. For ex-post evaluation, this study conducted 2 Confirmatory Focus Groups (CFG), and 9 Semi-Structured Interviews (SSI) including 6 single, and 3 group interviews with two County Councils of Ireland during the ex-post evaluation phase. The next section provides detail about the evaluation approach and adapted criteria for the evaluation of the process model in the context of this study.

6.2   Evaluation Approach

Chapters 4 and 5 discussed ex-ante evaluations (EVAL1 and EVAL2) based on the criteria adapted from (Sonnenberg and Vom Brocke, 2012). EVAL1 contributed to defining a problem statement and grounding the research gap that further assisted in identifying the design guidelines for the development of the artefact. Furthermore, EVAL2 was conducted to validate the design specification and requirements of the proposed artefact. This chapter provides detail about ex-post evaluations to validate the artefact instance in a natural setting. It includes validation of the artefact based on the assumption that how it would operate in the real environment. The ex-post evaluations allowed the researcher to analyse the usefulness of the proposed artefact in the form of the process model in its application environment. This research followed three levels of evaluation; i.e. Syntactic, Semantic, and Pragmatic (Venkatesh and Davis 2000; Maes and Poels, 2007; Rittgen, 2010; Helfert et al., 2012). Furthermore, the evaluation strategy and criteria were adapted from (Sonnenberg and Vom Brocke, 2012; Venkatesh and Davis 2000). The next sections provide a brief overview of the evaluation criteria.

6.2.1 Syntactic Evaluation

Syntactic components of the model are validated during the whole process of artefact development which could be verified by the researcher without involving the domain experts (Helfert, et al., 2012). Syntactic quality describes how well the artefact corresponds to the rules of grammar (Maes and Poels, 2007). The syntactic structure of a model and its notation, the words and symbols that represent the concepts of the language, are captured descriptively in the Bizagi modeller. BPMN modelling language was used for evaluating the syntactic quality of the model. This was achieved through the in-built validation tool of the Bizagi modeller software. The evidence for this evaluation has been provided in Appendix E. The result confirms that the process model is correct from a syntactic viewpoint in which all the statements of the process model are as per the syntax and vocabulary of the BPMN modelling language.

6.2.2 Semantic Evaluation

Semantic quality defines communication between the information that users think the artefact contains based on their interpretation and the information that users think the artefact should contain based on their knowledge of the problem domain (Maes and Poels, 2007). Semantic quality describes how well the artefact relates to the modelled reality (ibid). The evaluation should broadly contain testing for artefact utility, user satisfaction, or efficiency (Hevner and Chatterjee, 2010; Venable, et al., 2016). This research evaluated this criterion for validating the semantic quality of the artefact by employing multiple case studies to obtain domain experts' feedback. Table 25 provides an overview of the semantic evaluation criteria which have been defined as follows.

Table 25: Overview of Semantic Quality Criteria

Semantic Quality criteria	Statements to be measured
Correctness	The conceptual model represents the business process correctly (Rittgen, 2010). It evaluates if the process model represents the key activities and concepts correctly for service improvement based on citizens' feedback.
Relevance	All the elements in the conceptual model are relevant to the representation of the business process (Rittgen, 2010). It evaluates whether all the components of the process model are relevant to address the problem identified in the context of this study (As discussed in Chapter 1).
Completeness	The representation contains all statements about the domain that are correct and relevant. (Rittgen, 2010). It ensures that all considerations have been taken into account for the improvement of the services while considering practitioners' challenges and citizens' feedback. There are no elements or relationships that need to be added to improve services based on citizens' feedback.
Easy to understand	It is associated with the user's opinion of how easy or difficult it is to comprehend the artefact (Helfert, Donnellan and Ostrowski, 2012; Maes and Poels, 2007). It confirms that the notations and semantics presented in the process model are easy to understand by the domain experts.

6.2.3 Pragmatic Evaluation

Pragmatic quality captures how well the artefact is understood by its intended users (Maes and Poels, 2007). The evaluation criteria are applied to evaluate the perceived usefulness of the process model that addresses the concerns about the pragmatic quality of the model in two real-world scenarios. It evaluates the interpretation of the model from the domain expert's point of view. This research conducted Confirmatory Focus Groups (CFG) and semi-structured interviews for validating the artefact with practitioners. The results of focus group and semi-structured interviews were grouped and reported. This study demonstrates the use and application of the process model in a real-world setting. It measures how well the artefact supports the solution to the problem in multiple cases.

This research conducted two case studies in two County Councils of Ireland (County Council A and County Council B). County Council A was involved during all the stages of the DSR methodology whereas County Council B was involved only during the demonstration and evaluation phase of the methodology. In both case studies, one of the community engagement programs (PPN) was investigated firstly to identify how city authorities capture citizens' feedback, and secondly to understand how they provide improved services to the citizens based on their feedback. This study followed a similar process for demonstration and evaluation purposes in both case studies. In County Council A, this study found that practitioners faced challenges in terms of mapping citizens' requirements. To address this challenge, this study developed a process model and further evaluated it with practitioners. The identified activities and concepts within the proposed process model were required to provide improved services to the citizens while addressing the challenges faced by practitioners. The identified activities and concepts in the form of a process model from County Council A were used to address the similar challenges identified in County Council B by instantiating the developed process model. Two characteristics (job relevance, and output quality) have been evaluated for the pragmatic quality dimensions which are defined as follows.

1. Job (task) Relevance: It has been defined as the point at which an individual's opinion regarding the proposed system applies to their jobs (Venkatesh and Davis, 2000). It can also be deliberated as "a function of the importance within one's job of the set of tasks the system is capable of supporting" (Venkatesh and Davis, 2000, p.191). These are the significant indicators for evaluating the perceived usefulness of the artefact. The ex-post evaluation results demonstrate the usefulness of the model for practitioners and its application in supporting the set of tasks in their context. The resulting views are substantial in the complete evaluation of the artefact.

2. Quality Output: It is an indicator to evaluate how well the proposed solution can deliver on its anticipated purpose. As practitioners could not test the model in the real environment, therefore,

their feedback was obtained based on the assumption that how it would operate in the real environment. Then questions were asked regarding the expected outcome of the process model. The objective of conducting the ex-post evaluation was to evaluate the participants' understanding of the model, its relevance in their context, and how the model can be useful for providing improved services to the citizens. Table 26 provides a list of components that were validated with practitioners during the ex-post evaluation of the process model in both County Councils. The detail of these components has been provided in the subsequent sections along with the results for semantic and pragmatic evaluations.

Table 26: Validated components in Confirmatory FGD and SSI

Components of the process model	Associated activities/concepts	Validated
Citizen involvement	A hybrid form of engagement	Yes
	Classification of feedback	Yes
	Assessment of feedback	Yes
	Satisfaction score	Yes
	Feedback loop	Yes
	Activities for the service design process	Yes
Service domains	Service catalogue	Yes
Service improvement	Consideration of multi-stakeholders concerns	Yes
	Communication plans	Yes
	Consideration of multi-stakeholders concerns	Yes
	Capability	Yes
	KPIs/performance indicator	Yes
	Risk assessment	Yes
	QoS/QoE	Yes
	Service requirement and gap analysis	Yes
	Requirement management	Yes

6.3 Case Study A (County Council A)

Chapter 4 provides a profile description for County Council A in section 4.2. During the ex-post evaluation stage, the researcher demonstrated different components of the model, and navigated through all the sub-activities. The researcher asked questions based on the different quality criteria to the participants, and their responses were classified against those criteria. This assisted in evaluating the different element of the model concerning the predefined quality parameters and provided validation to the research findings. The focus group discussion and interview allowed participants to consider the overall purpose of the model and provided further depth to the data. It is relevant to note that the semi-structured interview provides a triangulation of data for the qualitative

text analysis stage. A demonstration of the artefact during the focus group discussions/interviews served as a basis for a discussion on the purpose and construct of the model from the perspective of BPMN modelling specification. The next section provides detail for semantic and pragmatic evaluation results from County Council A.

6.3.1 Semantic and Pragmatic Evaluation - County Council A

This section provides detail about the findings from the focus group discussions and semi-structured interviews for semantic and pragmatic evaluation of the process model in County Council A. This research firstly conducted focus group discussions with practitioners. The duration of the focus group discussion was between 60 minutes to 90 minutes. Subsequently, a group interview was conducted to clarify some of the key points highlighted during the focus group discussions. The duration of the group interview was between 30 minutes to 60 minutes. Additionally, detailed inputs were obtained to measure the quality of the model for semantic and pragmatic parameters. These meetings were recorded and transcribed in Microsoft Teams. Transcriptions were imported and coded in NVivo for pattern matching of the transcribed data against the quality parameters. Content analysis was performed following a structured and systematic approach to code text based on patterns and regularities to demonstrate the meaning of that text within a prescribed context (Alhassan et al. 2018). The contents of the discussion are examined and coded with predefined codes and provide guidance for the analysis (Hevner and Chatterjee 2010). Table 27 and Table 28 provide detail about the conducted interviews and focus group discussion. Focus group and interview questions have been provided in Appendix E. The next section provides evaluation results for semantic quality criteria.

Table 27: Focus Group Discussion (FGD) details for the ex-post evaluation

Participant numbers	Roles	Time
Participant 1	Community Prospect Co-coordinator 1	60-90 minutes
Participant 2	Community Prospect Co-coordinator 2	
Participant 3	Head of Community Prospect Program	
Participant 4	Head of Strategic Capital Projects	
Participant 5	Head of Information Systems & Innovation	
Participant 6	IT service support	

Table 28: Semi-Structured Interview (SSI) details for the ex-post evaluation

Participant numbers	Roles	Time
Participant 1	Community Prospect Co-ordinator 1	30-60 minutes
Participant 2	Community Prospect Co-ordinator 2	

6.3.1.1 Semantic Quality of the Process Model- County Council A

The below sections provide a detailed discussion of results obtained for the semantic evaluation of the process model from County Council A. The below criteria were selected to evaluate the components of the process model. An overview of these criteria has been provided in section 6.2.2.

6.3.1.1.1 Relevance of the Components

The community prospect co-ordinator confirmed that the components of the model are revenant for their work as they were required for their future action plans but were missing in their existing process. For instance, the component "Assessing service performance" will allow them to measure the performance of the services based on the citizens' feedback. This assessment takes the satisfaction score for the services and compares it with the initial satisfaction score. This assessment shows whether services have been improved or not based on the feedback that is provided by the citizens. *"The way you have included feedback and assessing service performance. I think that's really helpful and that's you know, the way to go for the future. But at the moment it doesn't represent it's going further than we currently are"* [FGD, Community Prospect Co-coordinator 1]. It was found as a crucial element of the model as some of the services are provided by Council whereas others are subcontracted to third parties. Therefore, it was essential to evaluate service performance based on this parameter. *"I think it's crucial. I mean it just makes the process even wider process"* [FGD, Community Prospect Co-coordinator 1]. Additionally, it will provide concrete data to the Council for measuring service performances as there are five years of the period between their initial plan and the renewal plans. So, this assessment will assist Council during its annual progress review with the community. Consequently, it will make the community's feedback wider for the Council. *"This assessment would make the feedback wider to the Council"* [FGD, Community Prospect Co-coordinator 1].

Once the citizens had provided their feedback on multiple services, the practitioners at the Council can select specific services for addressing the community's concerns. This selection is made by selecting the service from the service catalogue which contains a list of services that are provided by local authorities. This component was found relevant by the practitioners as it connects the community's feedback to the relevant service departments. Initially, the community engagement program was working in silos, and the feedback was not shared/channelled at the municipal district level which is responsible for all the services. After the demonstration of the model, the practitioners realised that there was a missing link between the community development service and other service departments. They also understood the potential of sharing/channelling the community's feedback with the relevant service departments. *"the information isn't being fed through, so this is good that there would be a way of channelling that into, say, the roads department or whatever department.*

115

And right now that isn't happening. So this is good. At least they would be aware. Then there be a way of cross-checking. What does their work shows versus what's coming in from a community? So I could see that that would work" [FGD, Community Prospect Co-coordinator 2].

The practitioners highlighted that It was important to share the feedback with local authorities at the municipal district level so that the services can be prioritized at the local level. As soon as funding comes in, they would have an opportunity to use the community's feedback for further service improvement. Nevertheless, that was not happening in their existing community engagement program. "*That's not always happening. That's the problem here, and I know that not everything that comes through the Community prospect plan is maybe all Council, but a lot at the stepping stones or the start do relate to the Council or partly relate to the Council side of things so the information we're gathering is lots of information, but it's not getting fed through to the various People that would be able to make use of that information*" [FGD, Community prospect co-ordinator 2]. Thus, it also confirmed the relevance of providing a connection between an engagement platform that collects citizens' feedback and the departments which provide services at the municipal district level. It ensures that bottom-up citizen engagement is being aligned from a strategic point of view (top-down) based on the priorities of organisations and communities. *"We're seeing really bottom up citizen engagement, but aligning that then from a strategic perspective, you know from a top down and what are the priorities for the organization"* [FGD, Head of Information Systems & Innovation].

Finally, the components defined for mapping citizens' requirements, defining quality factors of the services, and managing service requirements were considered relevant for improving the services by the Head of Information Systems & Innovation. *"I think what you have here is all very relevant. You know the quality is important. What are the requirements, etc. So I think that's good"* [FGD, Head of Information Systems & Innovation]. A summary of the findings has been provided in Table 29.

Table 29: Summary of the results for quality criterion Relevance

Quality Criteria	Role	Comments	Summary of findings/Action taken
Relevance	FGD, Community Prospect Co-coordinator 1	"The way that you have included feedback and assessing service performance. I think that's really helpful and that's you know, the way to go for the future. But at the moment it doesn't represent it's going further than we currently are" "I think it's crucial. I mean it just makes the process even wider process"	1. The component assist in measuring the performance of services based on feedback. 2. Crucial in making the engagement process wider as a result of breaking the silos.
		"This assessment would make the feedback wider to the Council"	3. Able to map citizens' feedback with associated service departments.
	FGD, Community Prospect Co-coordinator 2	"the information isn't being fed through, so this is good that there would be a way of channelling that into, say, the roads department or whatever department. And right now that isn't happening. So this is good. At least they would be aware. Then there be a way of cross checking. What their work shows versus what's coming in from a community? So I could see that that would work"	4. The practitioners found service catalogue relevant as they would be able to channel community's feedback to relevant service departments.
	FGD, Head of Information Systems & Innovation	"We're seeing really bottom-up citizen engagement, but aligning that then from a strategic perspective, you know from a top-down and what are the priorities for the organization"	5. The connection between the community's feedback and other service departments was found relevant for the alignment.
		"I think what you have here is all very relevant. You know the quality is important. What are the requirements, etc. So I think that's good"	6. Components associated with service improvement were found relevant by the participant.

6.3.1.1.2 Correctness

There were some changes suggested by the practitioners while evaluating this criterion. The practitioners wanted to align the service catalogue as much as possible with many services that were originating from the community in their County. *"we might suggest if there might be eight categories coming from the community, I think those categories need to be aligned as much as possible"* [FGD, Community Prospect Co-coordinator 1]. As a result of the discussion with them, the researcher explained to the practitioners that the categories of the services were selected based on the common services that are provided by most of the Counties of Ireland. In addition, this list also considered the priority of the community's needs in two County Councils that were involved during the case studies. Therefore, the list contains those public services which are common among them while considering

the priority of the community. Practitioners confirmed this change and required changes were made to reflect the same.

Another change was suggested by the head of the IT service department. It was regarding the classification of the services in which services were categorised based on the stakeholders who provide the services. Consequently, a decision making condition was introduced in the final version of the model to define whether services are provided in house by Council or contracted to external service providers. *"when you talked about the service providers you know there could be an in house or an outsourced or an external you know there may be some services that are provided like I say by different parties you …but there may be some services that we support from an in House perspective."* [FGD, Head of Information Systems & Innovation].

Similarly, the Participant 6 from IT service department pointed out that the community should be aware about whether services are contracted to external service providers or provided by council. This would provide clarity to the community that it is not only the Council which is responsible for all the delivered services but also service providers. This further confirmed the relevance of the component "classification of the services" i.e. in house and outsourced services within the model. *"Yeah, can I just ask when you're doing these surveys and interacting with the public, are they aware of who is providing the service so to them it's a service provided by the Council, but are they aware that we are actually dependent on third party then as well?"* [FGD, IT service support]. The summary of the results has been provided in Table 30.

Table 30: Summary of results for quality criterion Correctness

Quality Criteria	Role	Comments	Analysis/Action taken
Correctness	FGD, Community Prospect Co-coordinator 1	"we might suggest if there might be eight categories coming from the community, I think those categories need to be aligned as much as possible"	Required changes were made to align the service categories based on the priority of the community's need.
	FGD, Head of Information Systems & Innovation	"when you talked about the service providers you know there could be an in house or an outsourced or an external you know there may be some services that are provided like I say by different parties you …but there may be some services that we support from an in House perspective"	Action was taken to make a clear distinction between in-house and outsourced services within the model.
	FGD, IT service support	"Yeah, can I just ask when you're doing these surveys and interacting with the public, are they aware of who is providing the service so to them it's a service provided by the Council, but are they aware that we are actually dependent on third party then as well?"	

6.3.1.1.3 Completeness

There were some changes required based on the feedback that participants provided about the completeness of the model. Community Prospect co-ordinator suggested to mention the names of the stakeholders within the activity *"Identify stakeholder concerns and requirements"* in the Service Improvement stage of the process model. These stakeholders will be responsible for looking after the services. "*I, think it's a brilliant idea to put in the you know who are, the stakeholders or who are taking things forward, who's responsible for the services or whatever"* [FGD, Community Prospect Co-coordinator 1]. Initially, there were no names provided within this activity but participants wanted to have a step which explicitly state the names of the stakeholder. Thus, additional step was added within the guidelines of the activity.

Head of Community Prospect program also highlighted that there is a need of having a contact list for stakeholders who will be responsible for implementing the action plans. *"I suppose it's just contact list that could be a part of that communications plan so that you know who are the key people"* [FGD, Head of Community Futures Program]. Accordingly, a guideline for adding a contact list was added within the activity "*Develop communication plan*". This list will also contain names of stakeholders within or outside the Council who could assist in addressing the community's problems. The summary of the evaluation result has been provided in Table 31.

Table 31: Summary of results for quality criterion Completeness

Quality Criteria	Role	Comments	Analysis/Action taken
Completeness	FGD, Community Prospect Co-coordinator 1	"I, think it's a brilliant idea to put in the you know who are, the stakeholders or who are taking things forward, who's responsible for the services or whatever".	The practitioners wanted to mention the name of the stakeholders who will be responsible for improving the services further. Thus, a guideline was added within the associated activity "Identify stakeholders concern and requirements".
	FGD, Head of Community Futures Program	"I suppose it's just contact list that could be a part of that communications plan so that you know who are the key people".	Similarly, Head of Community Futures Program wanted to have a contact list for the key people who will be responsible for services so that it is clear who to contact for communication purposes. Therefore, an associated guideline was added in activity "Develop communication plan".

6.3.1.1.4 Easy to Understand

To evaluate this criterion, questions were asked regarding the understanding of the model and about its components to know whether it is easy for the practitioners to understand the model or not. The community prospect co-ordinators highlighted that they were able to understand the model but an orientation was required. *"When you went through it with us it was possible to understand this. So I would think that people would definitely need orientation on understanding it, you know, but I thought it was well structured and the explanations were good"* [SSI, Community Prospect Co-ordinator 1].

Additionally, the components for instance KPIs, quality assessment, and the approach that was used for improving the services were easy to understand. *"And that it made sense, the particular you know you used certain business models or approaches KPIs and an analysis tools and they seem to make sense to me, yeah"* [SSI, Community Prospect Co-ordinator 1]. They also confirmed that the steps provided within the model were easy to follow, although initially they looked complex to them. *"It did look complex, but the steps were easy to follow once you step through them"* [SSI, Community Prospect Co-ordinator 2]. The summary of the evaluation results has been provided in Table 32.

Table 32: Summary of findings for quality criterion Easy to understand

Quality Criteria	Role	Comments	Analysis/Action taken
Easy to understand	SSI, Community Prospect Co-ordinator 1	"When you went through it with us it was possible to understand this. So I would think that people would definitely need orientation on understanding it, you know, but I thought it was well structured and the explanations were good." "And that it made sense, the particular you know you used certain business models or approaches KPIs and an analysis tools and they seem to make sense to me, yeah."	1. Participants suggested to have an orientation before using it. 2. They found that the model was well structured, and they were able to understand it after providing orientation.
	SSI, Community Prospect Co-ordinator 2	"It did look complex, but the steps were easy to follow once you step through them."	

The next section provides evaluation results for pragmatic quality criteria. It includes results for quality criteria Job relevance and Quality output of the process model.

6.3.1.2 Pragmatic Quality of the Process Model- County Council A

Pragmatic quality is associated with the perceived usefulness of the process model. The below section discusses evaluation results for the usefulness of the process model from a job relevance and quality output viewpoint. An overview of these criteria has been provided in section 6.2.3. A detailed discussion has been provided as follows.

6.3.1.2.1 Job (Task) Relevance

The participant confirmed that with the proposed process model they are able to measure the before and after effect of citizens' feedback on various services. *"I think you could probably find before and after effect if we did, introduce that"* [FGD, Community Prospect Co-coordinator 2]. Once communities provide their concerns regarding different services during the initial stages of engagement, practitioners could verify if the relevant work has been done based on the feedback that community provided. It allows them to measure the impact of their engagement program as it will assist them to measure the development progress towards the services. *"it allows a way of measuring impact and that's something that we always wanted to do"* [FGD, Community Prospect Co-coordinator 1]. By doing so, they would know if the work is going well or not, and can recognise if anything needs to be changed for achieving the goals that are set for improving the services further.

Furthermore, process model provides flexibility and interrelationships between the different stakeholders such as people from community engagement department and people from service departments for providing improved services to the citizens. *"…I just think it's brilliant…it's kind of indicates how positive it could be if there was a bit more flexibility and interrelationships within the Council staff and between Council staff and services"* [FGD, Community Prospect Co-coordinator 1]. As a result, practitioners were able to analyse the impact of their existing engagement program at service level. They also confirmed that the process model reflects the priority of the community. *"it's lovely to see that it is based on the community's priorities"* [FGD, Community Prospect Co-coordinator 1].

The community engagement program starts with an initial plan with communities where they capture community's feedback on various aspects of the services. Then, they do further plans with community, and discuss progress of their work that has been done to address community's concerns. However, they didn't' have any parameter to assess this progress. The process model firstly helps them to analyse the change in terms of the achievement of the actions. Besides, they can compare the quality factors of the services to assess whether they achieved what they intended to achieve during the first plans. It will allow them to evaluate whether there was any shift in terms of the development of the projects for improving the services over the period of time. *"…. then you're seeing is there a shift in where the community is at based on what has been achieved?"* [FGD, Head of Community Prospect

Program]. *"And it would be very good data there in that context, so it's keeping this live over the life of the first plan going into the renewal plan."* [FGD, Head of Community Prospect Program].

Moreover, County Council A gathers a lot of information as a part of their engagement program. However, they didn't have a visibility about how to channel this information to different service departments. It was also highlighted that there has to be a link between their various plans and the work they do for addressing the community concerns. The process model was found useful as it provided that link and would assist them in doing their action plans. It captures the key activities that demonstrates how action plans can be aligned based on the feedback of community. *"What I see your model is helping us with is when we do our action plans"* [FGD, Community prospect Co-coordinator 1]. Furthermore, the model would also assist them in assessing their capabilities for fulfilling the need of citizens. *"I just have to compliment you. You've done a tremendous amount of work and it's a very deep level process model with bottom up things like capability. You know from IT, but also beyond that from a general capability perspective, I see you have that covered in the model So I think that's very good"* [FGD, Head of Information Systems & Innovation].

The Head of Community Prospect Program also found the process model valuable in terms of improving the existing services. Moreover, they wanted to exploit the full potential of all the information that was gathered within the process model. *"You know there's huge value in what you're presenting here and we want to maximize the potential of all the information that's gathered"* [FGD, Head of Community Prospect Program]. Similarly, community prospect co-ordinator found the process model valuable and wanted to use it as an information tool that can further be utilised for sharing the information with other service departments. *"your model could be converted into a useful information tool to distribute to other departments and just to add to that, I think that a huge value that comes with"* [SSI, Community prospect Co-coordinator 1]. They found the process model relevant for their current work. *"yeah, process model is relevant for our current work…I think that's what you're proposing is very smooth and is a much more useful way of making sure that the information gets to the services and is used to respond to the needs you know"* [SSI, Community prospect Co-coordinator 1].

Likewise, Head of Strategic Capital Projects from community engagement process found the process model as a useful tool not only for their existing engagement process and the plans around it, but also from the future development point of view around the services. It provides them a platform to track the progress of their work regarding the improvement of the existing services over the period of next five years. Additionally, it ensures that citizens needs are met based on the feedback they provide on different services and that the appropriate actions have been taken in that direction. *"what you have*

shown me, is a very useful tool and it looks like a great tool, not just for community engagement around community prospect plans, but also like we're just about to embark on a local, economic and community plan for the county for the next five years. And this looks like a great tool for tracking exactly what is going on" [FGD, Head of Strategic Capital Projects].

Finally, the proposed model provides a structured approach to practitioners that align community's feedback with associated service departments based on which city authorities can take appropriate actions for improving the services. This would provide them a better perspective on what their engagement program is achieving in terms of fulfilling the need of citizens. *"probably we haven't had that oversight before or not in the way we would have it with your model and therefore it would give a better perspective on what community prospect is doing or is achieving?"* [SSI, Community prospect Co-coordinator 1].

6.3.1.2.2 Quality Output

The community engagement co-ordinators confirmed that they will have a better outcome from the proposed process model as compared to what they already have in place for engaging with community and to improve the services based on their feedback. *"I have to say yes; it should have a better outcome. The fact that we can distribute it to other departments this is already targeting measure of the people that are responsible for the various projects that communities want to advance. so. Yes, the answer is yes."* [SSI, Community prospect Co-coordinator 2].

Furthermore, the process model assisted them in understanding what is missing in their existing engagement program. The community engagement co-ordinators realised that there was a need to integrate two isolated side of the system. One that captures citizens' feedback which is more around community development, and the other which is responsible for improving and delivering the services. Consequently, there was a need to understand this gap and provide a connection between them, and the process model provides this link and closes the gap. *"I suppose your model is helping me to realize what is missing…. there is more integration needed, that's for sure, but maybe community prospect is speaking one language around community development and the services are maybe just more service oriented. More, you know, responding to service users, but somehow there's a gap that needs to be understood and some connection needs to be made"* [SSI, Community prospect Co-coordinator 1]. The summary of the evaluation result has been provided in Table 33. The next section provides conclusion derived from sematic and pragmatic evaluation of the process model in the context of County Council A.

Table 33: Summary of evaluation result for Pragmatic quality- County Council A

Quality Criteria	Role	Comments	Analysis/Action taken
Job (task) Relevance	FGD, Community Prospect Co-coordinator 2	"I think you could probably find before and after effect if we did, introduce that"	1. Able to measure the before and after effect of citizens' feedback.
	FGD, Community Prospect Co-coordinator 1	"it allows a way of measuring impact and that's something that we always want to do." "it's lovely to see that it is based on the community's priorities." "…I just think it's brilliant…it's kind of indicates how positive it could be if there was a bit more flexibility and interrelationships within the Council staff and between Council staff and services."	2. Able to measure the impact of their community engagement process and reflects the priority of the community. 3. Able to see the positive impact of citizens' feedback by capturing the relationship between the feedback and its influence on service improvement.
	FGD, Head of Community Prospect Program	"…. then you're seeing is there a shift in where the community is at based on what has been achieved?" "And it would be very good data there in that context, so it's keeping this live over the life of the first plan going into the renewal plan."	4. Able to measure the continuous service improvement by having an assessment between their initial plans and renewal plans over the period of time
	FGD, Community prospect Co-coordinator 1	"What I see your model is helping us with is when we do our action plans."	5. Assisting in doing their action plans based on the community feedback.
	FGD, Head of Information Systems & Innovation	"I just have to compliment you. You've done a tremendous amount of work and it's a very deep level process model with bottom up things like capability. You know from IT, but also beyond that from a general capability perspective, I see you have that covered in the modal So I think that's very good."	6. Would assist in assessing the capability of the Council to meet the need of citizens.
	FGD, Head of Community Prospect Program	"You know there's huge value in what you're presenting here and we want to maximize the potential of all the information that's gathered."	7. They found the model valuable and wanted to utilise it for their existing engagement process.
	SSI, Community prospect Co-	"your model could be converted into a useful information tool to distribute to other departments and just to add to that, I think that a huge value that	8. The model could be converted into the useful information tool to distribute to other service

124

Quality Criteria	Role	Comments	Analysis/Action taken
	coordinator 1	comes with. yeah, process model is relevant for our current work" "…..I think that's what you're proposing is very smooth and is a much more useful way of making sure that the information gets to the services and is used to respond to the needs you know."	departments responsible for improving the services further. 9. They found the proposed model useful for their citizen engagement process as it ensures that citizens' need is met based on the feedback they provide.
	SSI, Community prospect Co-coordinator 1	"probably we haven't had that oversight before or not in the way we would have it with your model and therefore it would give better perspective on what community prospect is doing or is achieving?"	10. The model provides a structured overview of how citizens' feedback can be linked with the service improvement for achieving the goals set by their existing citizen engagement process.
	FGD, Head of Strategic Capital Projects	"what you shown me, is a very useful tool and it looks like a great tool, not just for community engagement around community futures plans, but also like we're just about to embark on a local, economic and community plan for the county the next one for the next five years. And this looks like a great tool for tracking exactly what is going on."	11. Model serves as a useful information tool not only to lay out their future plans based on citizens' feedback, but also to track the progress for next five years.
Quality output	SSI, Community prospect Co-coordinator 2	"I have to say yes; it should have a better outcome. The fact that we can distribute it to other departments this is already targeting measure of the people that are responsible for the various projects that communities want to advance. so. Yes, the answer is yes."	12. The community engagement co-ordinators confirms that the proposed model should have a better outcome in terms of providing improved services to the community based on the feedback they provide.
	SSI, Community prospect Co-coordinator 1	"I suppose your model is helping me to realize what is missing…. there is more integration needed, that's for sure, but maybe community prospect is speaking one language around community development and the services are maybe just more service oriented. More, you know, responding to service users, but somehow there's a gap that needs to be understood and some connection needs to be made."	13. The model shows what is missing in their existing engagement process and connects two isolated side of the systems, one which capture citizens' feedback, and other that is responsible for delivering the services to continuously provide effective services to the citizens.
	FGD, Head of Community prospect program	"I suppose from our perspective, I think having it, you know, uh, process. and having all work together in relation to discussion is incompetent and this is really useful and absolutely all the work that you've done is mighty honoured"	14. The model was found useful from the community engagement viewpoint.

6.3.1.3 Conclusion

This study conducted Case Study A with County Council A to explore the activities and concepts that would support in structuring the relationship between citizens' feedback and the continuous service improvement. This assisted in validating the findings in parallel to the literature review. It also presented the problems and challenges of aligning action plans based on citizens' feedback for continuous service improvement in real world cities. The application of modelling different concepts and activities in the form of a process model assisted this research in representing a holistic overview of two sides of the system. One that captures citizens' feedback and other that work on service improvement. TOGAF ADM facilitated in identifying the concepts that are applicable to align action plans according to the citizens' feedback. The Architecture Vision phase from TOGAF ADM provides a high-level view of the end product which is created initially during the lifecycle of the project (The Open Group, 2018).

Practitioners confirmed that the concepts from Architecture vision phase would provide guidance in creating the vision of the project. It will assist them in addressing the challenges associated with risks, monitoring, constraints, capacity etc. Moreover, it would assist them in capturing the concerns and requirements of different stakeholders that are required for planning and delivery of the services and to set realistic expectations for the community. Business Architecture (BA) from TOGAF ADM describes how the enterprise should operate to accomplish desired business goals (The Open Group, 2018). It provides concepts such as Measure, Contract and Service Quality etc. to take appropriate actions for meeting the vision of the project. This assisted in addressing the challenges associated with the implementation of the plans considering monitoring, and delivery of the actions. Finally, The Requirement Change Management (RCM) phase from TOGAF ADM will assist in managing the constantly changing requirements of multi stakeholders such citizens, city authorities, etc. Table 34 provides the application of concepts and activities identified in Chapter 5 for County Council A. Row cell filled with a ✓ indicates the need for the activity/concept in County Council A. These activities/concepts were used in the process model for structuring the relationship between citizens' feedback and service improvement.

Table 34: Activities/ Concepts Required for County Council A

Activities/ Concepts	Required in Case study B
Hybrid form of engagement	✓
Classification of feedback	✓
Assessment of feedback	✓
Satisfaction score	✓
Feedback loop	✓
Service catalogue	✓
Consideration of multi-stakeholders concerns	✓
Communication plans	✓
Goals, drivers, constraints	✓
Capability	✓
KPIs/performance indicator	✓
Risk assessment	✓
QoS/QoE	✓
Service requirement and gap analysis	✓
Requirement management	✓

Legend: ✓-Required in County Council A

This study observed in County Council A that the citizen engagement program that captures citizens' feedback was working in silo without sharing community's feedback to relevant service department. Additionally, practitioners faced challenges (e.g. capacity, risk, resources, etc.) in mapping citizens' requirements that resulted in not meeting the need of citizens. Also, there was a lack of structure to showcase how citizens' requirements are mapped based on the feedback they provide. This case study demonstrated how proposed process model can assist city authorities in mapping citizens' requirements and to align their action plans based on citizens' feedback. This will provide a structured approach to city authorities in continuously provide improved services to the citizens. In addition, it also provides a flexibility and interrelationships between community feedback and multiple service departments responsible for the implementation of the services. Currently, the information obtained from the community end in the form of feedback is not progressing further in terms of the implementation. The proposed model shows how citizens' feedback can be implemented to transform the public services. Consequently, making community feedback wider for the Council.

This study firstly identified the challenges from practitioners' viewpoint in County Council A and proposed a solution to address them. County Council A uses PPN program as an engagement platform for capturing citizens' feedback on multiple public services. PPN program is commonly used by most

of the Counties in Ireland. The researcher wanted to examine if any other County Council in Ireland which engage with citizens via PPN program also faced the similar challenges. Thus, this study further selected another Case Study B with County Council B to examine the challenges from practitioner's viewpoint in another context and to validate whether proposed solution would assist them in addressing those challenges. The ex-post evaluation results from Case Study B confirmed that the process model could be applied to the another context as well if similar challenges are faced by practitioners during engagement and service improvement process as discussed in Case Study A in section 4.2.1 which further validated the generalisability of this process model in another County Council. The next section provides detail of the findings from Case Study B.

6.4 Case Study B (County Council B)

County Council B is located in the south east of Ireland (Republic of Ireland) with a population of approximately around 140,000 residents. Similar to County Council A, County Council B provides various public services to the community, some of them include Housing, Planning, Roads and Parking, Environment, etc. County Council B engage with local community via offline engagement program PPN. It is a framework for public participation and engagement which includes wider range of inputs into policymaking at local government level in County B. It is a main link by which local authority connects with community. The community participate in numerous processes of the County/City, and contribute their inputs for existing services. The goal of conducting this case study was to evaluate the process model in another contextual setting and validate the findings. The next section provides evaluation results for County Council B.

6.4.1 Semantic and Pragmatic Evaluation - County Council B

This section provides detail about the findings from the semi-structured interviews for semantic and pragmatic evaluation of the process model in County Council B. 8 semi-structured interviews were conducted with three practitioners to investigate the challenges from their viewpoint, and to obtain their feedback on proposed solution. Initially, three single interviews were conducted to identify the challenges from practitioners' end. Subsequently, two group interviews, and three more interviews were conducted to evaluate the model. The duration of the interviews was between 30 minutes to 60 minutes. The semi structured interviews were recorded and transcribed online using Microsoft Teams. Then, transcriptions were imported and coded in NVivo for pattern matching. Firstly, this research followed inductive reasoning approach to identify the challenges from practitioners' perspective in County Council B for which the detail has been provided in this section. Secondly, transcribed data was coded against the quality parameters that were adopted for evaluating the different components of the model following a deductive approach. The results from this evaluation has been provided in

the subsequent sections. The detail of interviews has been provided in Table 35 and the interview questions have been provided in Appendix F.

Table 35: Interview details for County Council B

Participant numbers	Roles	Time
Participant 1	PPN Representative 1	
Participant 2	PPN Representative 2	30-60 minutes
Participant 3	PPN Co-ordinator	

Similar to County Council A, County Council B engage with local community via PPN program. Community share their feedback on multiple services, and then PPN representatives and co-ordinators provide a summary of their feedback to local authorities. This section outlines details about the identified challenges faced by practitioners in County Council B.

i. Unclear role and responsibility

One of the challenges found during the discussion was regarding the unclear role and responsibilities of different stakeholders who will be looking after the implementation strategy for service improvement. *"You know, like who could be or who could look after the implementation of the strategy"* [Participant 1, PPN Representative 1].

ii. Building realistic expectation

Another challenge was associated with building a realistic expectation within the community as Council cannot fulfil all the requirements of the community. For instance, for one of the services i.e. transportation, PPN co-ordinator highlighted that it is challenging to change community's mind-set regarding various requirements they may have for services. *"I suppose around the transport challenges is to understand the mind-set changes that are taking place. So everybody wants a bus stop outside our front door, but everybody can't have a bus stop outside the front door"* [Participant 2, PPN Representative 2].

iii. Lack of mechanism for measuring the achievements

The PPN representative underlined that there is a lack of method to measure the achievement of the goals from the community perspectives such as improving climate change condition or fulfilling any other requirements that is coming from the community side. *"the last two years as well been trying to establish a concrete method of you know how active cities become involved…. we do not have an actual mechanism to actually say yes, it's been achieved or know what's not achieved"* [Participant 2, PPN Representative 2].

iv. Lack of accountability

Another issue that was discussed by the PPN co-ordinator was about a lack of accountability from different stakeholders who will be responsible for executing the plans that have been developed to address community's concerns. *"….they should be meeting with me probably quarterly, and they should be saying, right? Where are we? Let's go through the work plan line by line and you tell us where we are and then if that bits not been done then will you make sure it's done"* [Participant 3, PPN Co-ordinator].

v. Lack of clarity around the usage of smart solutions

Another challenge was regarding the usage of the smart solutions for instance, e-parking service was launched with the aim of improving the quality of citizens' lives from a hassle free parking. However, there was no guideline provided in terms of how to use this service. Therefore, only implementing smart solutions will not fulfil the need of citizens. There should be a process to communicate how such solutions would work, and to capture community's experiences once such services have been implemented. It will allow to understand how these services are working in the real environment based on the experience of citizens. Moreover, it will assist in measuring the impact of smart city solutions on citizens' daily lives. *"E parking has been launched here recently in the city I am on the back of the parking being launched. What came to our attention as kind of community people and as a representative of the older Persons Council is that it would have been quite confusing for people to actually use it, they were unclear. It was new and people have been unclear as to the process around it…"* [Participant 3, PPN Co-ordinator].

vi. Lack of structure

It was also pointed out by the participants that there is a need to review the structure of existing community engagement process, and where its place is in the society. Besides, it is important to put the right plan in place in order to fulfil the need of community. *"I think there is probably a whole need to review. The PPN on the structure and where it's place is in society. Yeah, someone needs to take all this, dissect it and put the right plan in place now"* [Participant 2, PPN Representative 2]. Furthermore, the participant 2 highlighted that there is no structure in place for their existing engagement program in which they can consider factors such as achievements of goals, individual roles, responsibilities, etc. *"So I suppose when we get the feedback, one of the things is like there should be and I'm not aware that there is within the structure a template. That actually has got to be signed off to say what's achieved and what's not achieved. We don't know if it's who's, responsibility is, is to do it"* [Participant 2, PPN Representative 2].

Additionally, it was underlined by the PPN Representative 2 that there is a lack of structure to capture the relationship between citizens' feedback and how services are improved based on those feedbacks. This will need involvement of multiple stakeholders who are responsible for taking key decisions and to take required actions for continuous service improvement. *"I feel there's probably a lack of structure at the moment, and we need to say well you know that there is a structure in place, that this is the structure. this is how it works. But it'll only work, if everybody is involved"* [Participant 2, PPN Representative 2]. PPN representative 1 also confirmed that there is a lack of structure due to which they were not able to achieve the goals set by their existing engagement program. *"what I've just said, personally, this was a kind of a lack of structure"* [Participant 1, PPN Representative 1].

vii. Challenges in Service Implementation

Practitioners faced challenges in terms of the implementation of the services for addressing the concerns highlighted by community. On one hand, City Council does accept the issues highlighted by community. On the other hand, they do not know how to work upon them. *"I just feel that the City Council, while they accept those challenges, they struggle to understand how to implement them……..so far it's been like you get the feedback, but after that the implementation is the issue"* [Participant 2, PPN Representative 2].

viii. Lack of clarity about community's need

It was found during the interview that local authorities do not understand the actual need of community. Their assumption is that if they solve one problem then rest of the things will be fine. *"…I don't think the local authority has a great deal of interest here in Community… their view tends to be if we can solve the housing problem and everything else will be fine. So kind of that's a concern for us"* [Participant 3, PPN Co-ordinator]. Consequently, there should a way to highlight different kinds of concerns that community could have about different services.

ix. Lack of early consultation with community

Early consultation with community is required before implementing solutions to understand their actual need. However, it was missing in County Council B. *"If the local authority is genuine in the issues of public consultation, then you consult before. You actually draw up plans as opposed to impose plans on communities. And if you consult to start with, then there's much more likelihood that communities will own the plans"* [Participant 3, PPN Co-ordinator]. As a result, it is essential to consult with community before implementing the plans for service improvement.

x.   Managing the change

The requirements originating from the community's end may change over the period of time based on their priorities. Therefore, it is important to record and manage this change. *"..the problems that I would write down now wouldn't be the same problems I'd write down at six months' time and these things become out of date very quickly"*. However, there was no mechanism in their existing engagement program where they could manage this change and perform actions based on the priority of the community. *"Do I have a strategy? No, not really. Probably should have better than I have at the moment"* [Participant 3, PPN Co-ordinator]. Thus, a requirement management strategy was needed to manage this change.

xi.   Lack of vision

PPN co-ordinator highlighted that there is a lack of vision in their existing engagement program. They do not have a foresight about how to work upon citizens' feedback in order to meet the need of citizens, and what are the next steps to operate in that direction. *"But you also gonna need to have a vision for how you think you should be operating, and I'm not sure the secretariat has that vision so that to me is a bit of a problem"* [Participant 3, PPN Co-ordinator]. Consequently, they needed a vision to act upon citizens' feedback for improving the services.

xii.   Lack of monitoring the action and delivery of the services

Finally, participant confirmed that there is no mechanism by which practitioners could monitor the action and delivery of the services. *"There is nothing there that we can actually measure that"* [Participant 3, PPN Co-ordinator]. Therefore, there was a need to define activities regarding the monitoring of actions and delivery of the services.

Based on the identified challenges from County Council B, this study found that there were some challenges which were common in both County Council A and County Council B. The summary of the identified challenges in County Council B are presented in Table 36. Some of the challenges identified in County Council B were excluded from this study as they needed to be addressed by the local government of the cities. Consequently, they were considered out of the scope of this research. This included challenges associated with lack of early consultation, lack of clarity around the usage of the smart solutions and community's need. The next section provides evaluation results from County Council B for semantic quality criterion.

Table 36: Summary of the Identified challenges in County Council B

Summary of challenges
i.   Unclear role and responsibility
ii.   Building realistic expectation
iii.   Lack of mechanism for measuring the achievements
iv.   Lack of accountability
v.   Lack of clarity around the usage of smart solutions
vi.   Lack of structure
vii.   Challenges during the implementation
viii.   Lack of clarity about community's need
ix.   Lack of early consultation with community
x.   Managing the change
xi.   Lack of vision
xii.   Lack of monitoring the action and delivery of the services

6.4.1.1   Semantic Quality of the Process Model- County Council B

The overview of this evaluation criteria has been provided in section 6.2. This section provides detail about evaluation results from County Council B. The purpose of the evaluation was to validate the process model with practitioners in another Council in which practitioners highlighted the similar challenges as in County Council A. This section outlines the detail of the findings from the evaluation. This assisted in validating the findings parallel to the first case study in County Council A. The researcher demonstrated the model to the practitioners and asked questions regarding the model considering various evaluation criteria. Table 37 provides interview details for three single semi-structured interviews and Table 38 provides detail about group interviews that were conducted for the purpose of ex-post evaluation. The below sections provide a detailed discussion on semantic evaluation of the process model based on the findings from County Council B.

Table 37: Single Structured Interview (SSI) details for ex-post evaluation

Participant numbers	Roles	Time
Participant 1	PPN Representative 1	
Participant 2	PPN Representative 2	30-60 minutes
Participant 3	PPN Co-ordinator	

Table 38: Group Interviews (GI) detail for ex-post evaluation

Participant numbers	Roles	Time
Participant 2	PPN Representative 2	60 minutes
Participant 3	PPN Co-ordinator	

6.4.1.1.1   Relevance of the Components

The participant found the model useful and relevant firstly to comprehend how cities are changed and adjusted based on the needs of citizens. *"So that would be very useful very relevant and of course, that leads to everything else. Then we can see Oh. how. It might affect in the you know how the city of [city name] is changed or adjusted basis on these needs"* [SSI, PPN Representative 1]. Secondly, it will assist city authorities to look into different issues that community has highlighted about various services in different departments (domains) such as transportation, environment, housing, etc. *"I think it's actually a very good and it would really help people when they log in to look at raising an issue…The boxes of the different departments I think is excellent"* [GI, PPN Co-ordinator]. Table 39 provides the summary of the evaluation results.

Table 39: Summary of findings for quality criterion Relevance

Quality Criteria	Role	Comments	Summary of findings/Action taken
Relevance	[Participant 1, PPN Representative 1].	"So that would be very useful very relevant and of course, that leads to everything else. Then we can see Oh. how. It might affect in the you know how the city of [city name] is changed or adjusted basis on these needs"	1. Able to showcase how city is changed or adjusted based on community's need. 2. Assist in logging into issues from community's end.
	[Participant 3, PPN Co-ordinator].	"I think it's actually a very good and it would really help people when they log in to look at raising an issue…The boxes of the different departments I think is excellent"	3. Service catalogue was found relevant for capturing feedback on multiple services.

6.4.1.1.2   Correctness

Participants highlighted changes regarding different roles and responsibilities in the process model. They wanted to make a clear distinction between different stakeholders that will be responsible for performing different activities by highlighting individual roles and their responsibilities using colour coding scheme. *"You could use a bit of colour to say, yeah, well, this is green is City Council's responsibility, and blue is everybody's responsibility. However, the green box is part of City council's project"* [GI, PPN Representative 2]. Thus, colour coding scheme was used to differentiate among different roles and their responsibilities for County Council B. Another change was suggested regarding adding one more stakeholder i.e. Councillors who are also responsible for capturing citizens' feedback other than PPN and elected representatives *"I think the feedback we've got is coming, through the PPN, and that could also be counsellors. That doesn't have to be just the PPN, and it might be PPN and elected representatives"* [GI, PPN Co-ordinator]. Therefore, required changes were made

to include one more stakeholder i.e. Councillors. Table 40 provides the summary of the evaluation results. Based on the participants' feedback, the required changes were made to the third stage of the process model as shown in Appendix G.

Table 40: Summary of evaluation result for quality criterion Correctness

Quality Criteria	Role	Comments	Summary of findings/Action taken
Correctness	Participant 2, PPN Representative 2	"You could use a bit of colour to say, yeah, well, this is green is City Council's responsibility, and blue is everybody's responsibility. However, the green box is part of City council's project"	1. A change was suggested to differentiate different roles using colour coding scheme.
	Participant 3, PPN Co-ordinator	"I think the feedback we've got is coming, through the PPN, and that could also be counsellors. That doesn't have to be just the PPN, and it might be PPN and elected representatives"	2. Another stakeholder (Counsellors) was added in the model who are also responsible for capturing feedback other than PPN and elected representatives.

6.4.1.1.3 Completeness

PPN Representative 1 found the model well-structured and meaningful for their existing engagement program. *"No, it looks really well structured and it makes sense too"* [SSI, PPN Representative 1]. Additionally, all the required changes suggested by participants during earlier meetings were incorporated to ensure nothing is left to address the identified challenges. *"No, I don't think so because we spoke before and anything we've said you've adjusted to put it there".* [Participant 2, PPN Representative 2]. Table 41 provides the summary of the evaluation results.

Table 41: Summary of evaluation result for quality criterion Completeness

Quality Criteria	Role	Comments	Summary of findings/Action taken
Completeness	Participant 1, PPN Representative 1	"No, it looks really well structured and it makes sense too".	1. It was found well-structured and meaningful by the participant.
	Participant 2, PPN Representative 2	"we spoke before and anything we've said you've adjusted to put it there".	2. All the required components were considered for improving the services based on citizens' feedback within the model.

6.4.1.1.4   Easy to Understand

PPN Representative 1 confirmed that the model is understandable and all the required components for services improvement based on the captured feedback has been included. In addition, the participant appreciated the fact that the model can be adjusted based on their requirements and is meaningful as well. *"yes, it's actually not that complicated to understand and I think everything is included and it is understandable…So I think it's important that it can be adjusted,* but it makes sense" [SSI, PPN Representative 1]. Another participant also confirmed that model is simple enough to understand. *"that's looking at that now it's simple enough, yeah"* [GI, PPN Co-ordinator]. Table 42 provides the summary of the evaluation results. Table 42 provides the summary of the evaluation results. The next section provides discussion on results for pragmatic quality evaluation.

<p align="center">Table 42: Summary of findings for quality criterion Easy to understand</p>

Quality Criteria	Role	Comments	Summary of findings/Action taken
Easy to understand	Participant 1, PPN Representative 1	"yes, it's actually not that complicated to understand and I think everything is included and it is understandable…So I think it's important that it can be adjusted, but it makes sense"	Practitioners found the model easy and simple enough to understand which could be adjusted or updated based on the stakeholder's requirements.
	Participant 3, PPN Co-ordinator	"that's looking at that now it's simple enough, yeah"	

6.4.1.2   Pragmatic Quality of the Process Model- County Council B

This section discusses evaluation results for the usefulness of the process model from a job relevance and quality output viewpoint in the context of County Council B. An overview of these criteria has been provided in section 6.2.3. A detailed discussion has been provided as follows.

6.4.1.2.1   Job (Task) Relevance

PPN Representative 1 confirms that the process model provides a holistic representation of a complete process that includes activities associated with capturing citizens' feedback and service improvement. In addition, they highlighted that they can keep track of actions that are taken to address community's concerns. So, the model does not only provide a platform for capturing citizens' feedback, it also shows how those feedbacks are processed and what it leads to at the service level. *"So we could see I think what is more relevant, now it is just the access to the feedback in general to see that you know, from the citizens' level that their voice is really heard and keep track on it and see what they actually say, how they gather this information, how is this information processed and what it leads to at the service level. So I mean at the next level it would definitely be more rewarding"* [SSI, PPN Representative 1]. Furthermore, this study also found that the County Council B didn't have

process in place which can capture the interrelationship between citizens' feedback, and service improvement. The model was found useful not only for stakeholders who engage with community, but also for other stakeholders who are involved in the process, starting from engagement until the service improvement. This will provide a structure to their existing program as currently they have different structures for different service departments. *"Yes, and then just not for me, so it would be useful for anybody involved. To give it the structure and also give visibility because the problem now is that they're different structures for different areas"* [SSI, PPN Representative 1].

Moreover, County Council B receives feedback (information) from community's end from different channels without having any structure in place. The process model would provide a single platform where they can access all the relevant information regarding citizens' feedback and service improvement. This will ensure that right information feeds into the system for continuously providing improved services to citizens. *"So it's very difficult to access us, just not even access any information, it's a different route, but this would be an overall you know platform that's why I like it because it contains everything"* [SSI, PPN Representative 1]. Additionally, PPN Representative 1 confirmed that it provides more structured system not only to access community's feedback, but also provides a platform to process that feedback and communicate it to various stakeholder such as state agencies or local authorities. Whereas, their existing engagement process was only able to capture citizens' feedback on different services without providing any details about how would they work upon those feedbacks for further improving the services. Also, they were not considering other significant factors which impact the service improvement such as accountability, setting up the realistic expectations, managing constant changing requirements of citizens, measuring the impact of feedback, etc.

The process model provides a structured approach considering all those factors to continuously provide improved services to the citizens. *"this model gives a more structured system not just to get access to the feedback from the citizens, but to process the results and communicate it towards the state agencies or the authorities"* [SSI, PPN Representative 1]. It was emphasised that the model is useful for them as they can see how different elements of the Council are structured, and would provide guidance to local authorities in addressing community's issues. *"It's a useful box for people to see how the Council is structured. It's a useful box for people to tap into when they first come into to help them guide them to where they want to log their issue"* [GI, PPN Co-ordinator].

Lastly, the process model was found useful as compared to their existing engagement program as it captures the accountability of local authorities for taking required actions based on the feedback that community provides. *"Something like this would be excellent because it holds the local authority to account for what they're asked to do, what they should be doing, and what they're not doing"* [GI, PPN

Co-ordinator]. Moreover, it will not only work for communities who provide their feedback on multiple services but also for local authorities, counsellors, representatives, and other stakeholders who can check what are the requirements of communities. They can track the progress of the efforts that have been made to address community's concerns. "*So from a Community perspective, something like this that works very good. It's not just for the community, it's also for local representatives. So could be the local councillors to dip in and out to see what the residents group, have been asking for XYZI can check to see whether that's being done. I can report back to them and they'll reflect me. So the potential is great*" [GI, PPN Co-ordinator].

6.4.1.2.2   Quality Output

The proposed model offers a new platform in which they can see a link between citizens' feedback and how services are improved. It will be an enhanced version of their existing engagement program. "*To be honest with you, since Covid there is nothing in place, yeah. So this has got to be a whole new launch……. with a view to saying, well, yeah, what we had before COVID and what we're going to have now is going to be enhanced*" [GI, PPN Representative 2]. Other participants also confirmed the same. "*as I said to you, it gives structure where there's no structure*" [GI, PPN Representative 2]. PPN Co-ordinator pointed out the same with regards to the enhanced version of their existing engagement process. "*Yeah, it can enhance everything but then everybody from council to counsellors to communities, everybody has to be on board*" [GI, PPN Co-ordinator]. The summary of the evaluation result has been provided in Table 43. The next section provides conclusion derived from sematic and pragmatic evaluation of the process model in the context of County Council B.

Table 43: Summary of evaluation result for Pragmatic quality- County Council B

Quality Criteria	Role	Comments	Summary of findings/Action taken
Job (task) Relevance	Participant 1, PPN Representative 1	"So we could see I think what is more relevant, now it is just the access to the feedback in general to see that you know, from the citizens' level that their voice is really heard and keep track on it and see what they actually say, how they gather this information, how is this information processed and what it leads to at the service level. So I mean at the next level it would definitely be more rewarding" "So it's very difficult to access us, just not even access any information, it's a different route, but this would be an overall you know platform that's why I like it because it contains everything" "This model gives a more structured system not just to get access to the feedback from the citizens, but to process the results and communicate it towards the state agencies or the authorities" This will provide a structure to their existing program as currently they have different structures for different service departments. "Yes, and then just not for me, so it would be useful for anybody involved. To give it the structure and also give visibility because the problem now is that they're different structures for different areas"	1. Would assist in keeping a track of their progress and achievements. 2. Provide accessibility to connect with different service departments. 3. Provides a complete structure on a single platform for their existing engagement program as currently they have different structures.
	Participant 3, PPN Co-ordinator	"It's a useful box for people to see how the Council is structured. It's a useful box for people to tap into when they first come into to help them guide them to where they want to log their issue" "Something like this would be excellent because it holds the local authority to account for what they're asked to do, what they should be doing, and what they're not doing" "So from a Community perspective, something like this that works very good. It's not just for the community, it's also for local representatives. So could be the local councillors to dip in and out to see what the residents group, have been asking for XYZI can check to see whether that's being done. I can report back to them and they'll reflect me. So the potential is great"	4. Useful for logging and accessing citizens' feedback and provides a structure to their program. 5. Capturing accountability of different stakeholders who will be responsible for improving and delivering the services.

Quality Criteria	Role	Comments	Summary of findings/Action taken
Quality output	Participant 2, PPN Representative 2	"as I said to you, it gives structure where there's no structure" "To be honest with you, since Covid there is nothing in place, yeah. So this has got to be a whole new launch……. with a view to saying, well, yeah, what we had before COVID and what we're going to have now is going to be enhanced"	6. Provides structure to their existing program as they didn't have any structure in place. This will result in enhanced engagement process.
	Participant 3, PPN Co-ordinator	"Yeah, it can enhance everything but then everybody from council to counsellors to communities, everybody has to be on board"	7. Will enhance the performance of existing engagement process in terms of providing improved services to the citizens.

6.4.1.3 Conclusion

The case study B with County Council B was conducted to demonstrate the applicability of the concepts and activities that support in structuring the relationship between citizens' feedback and service improvement. This assisted in replicating and validating the findings in a different city context by designing a solution for offline engagement process through which citizens' feedback are captured. The application of a BPMN modelling technique followed the guidelines of TOGAF ADM and findings from both case studies. Table 44 provides the application of concepts identified in Chapter 5 for County Council B. Row cell filled with a ✓ indicates the need for the concept in County Council B. These concepts were used in the process model for structuring the relationship between citizens' feedback and service improvement.

Table 44: Concepts Required for Case Study B

Associated activities/Concepts	Required in Case study B
Hybrid form of engagement	✓
Classification of feedback	✓
Assessment of feedback	✓
Satisfaction score	✓
Feedback loop	✓
Service catalogue	✓
Consideration of multi-stakeholders concerns	✓
Communication plans	✓
Goals, drivers, constraints	✓
Capability	✓
KPIs/performance indicator	✓
Risk assessment	
QoS/QoE	✓
Service requirement and gap analysis	
Requirement management	✓

Legend: ✓-Required in County Council B

In case of County Council B, there was a lack of vision about how to improve services based upon citizens' feedback. Moreover, there was no structure in place to execute their plans for further service improvement. Practitioners from County Council B were only using offline platform to capture citizens' feedback. However, they confirmed the need of capturing their feedback via online platforms as well. These feedbacks could be on various city services such as environment, transport and parking, planning, etc. This assisted in understanding the need of different stakeholders and to focus on non-

technical factors such as structure, capacity, vision, etc. as well. The application of proposed concepts and activities in County Council B shows that these concepts and activities are relevant to structure the relationship between citizens' feedback and service improvement. The proposed process model provided a platform to the practitioners that helped them in developing a vision of the project for further service improvement based on citizens' feedback. It would also help them in transforming existing services based on the vision developed during the engagement process. This will also support in achieving the goals set by municipalities for community development program by providing a structured approach to transform the existing public services.

6.5 Cross Case Analysis between Case Studies A and B

Multiple case studies allow researcher to apply a cross case analysis for examining the similarities, differences, and themes across cases (Yin, 2014). This research gathered data focusing on one of the engagement platform that captures citizens' feedback for providing improved services to them and to fulfil their requirements. The design process of individual case study composed of modelling the key activities and concepts associated with engagement and service improvement. The unit of analysis are County Council A and County Council B in Ireland. Data source triangulation was used to compare the findings across data sources for individual case study (Runeson and Höst, 2009). The results were examined across cases for proposed design guidelines, process model, and its implementation. The model was evaluated by asking questions to the key practitioners (e.g. Community engagement co-ordinators, Community engagement representatives, Head of community engagement departments, Head of IT service department, etc.) regarding the applicability and relevance of the process model. The results from cross case analysis have been discussed as follows.

- **Cross Case Analysis - Design guidelines:** The set of design guidelines presented in Chapter 5 was used to contrast the key findings across both case studies. These design guidelines were defined to continuously provide improved services to the citizens based on the citizens' feedback while considering the challenges faced by practitioners during the implementation of the changes at the local level. The design guidelines were grouped into three themes: Citizens' involvement, Service improvement, and Model features. A detailed discussion has been provided in the following section.

DG1 - Gathering citizens' feedback: Support in capturing citizens' feedback via both channels (online and offline), which was further validated in both County Councils of Ireland. *"I do think that there is a scope for us to be thinking about How can you know maintaining the community based approach, but you know, how could the information from this process go online"* [Community Prospect Co-ordinator, County Council A]. Likewise, PPN representative 1 from County Council B highlighted that the feedback should be captured via both channels. Representative pointed out the strength of online and offline

channels. *"it shouldn't only be online. it's good that It offers a lots of things on the website, but I think from my experience it's only my third year with PPN, but they try to bring people together and offer an opportunity to socialize and you build your network with real people and I don't think it should be just be online completely"* [PPN representative 1, County Council B]. Similarly, PPN representative 2 emphasised the same point by highlighting that face-to-face interaction is important for them: *"I think our points can get lost by not having face-to-face interaction"* [PPN representative 2, County Council B].

DG2 - Classification of feedback: Supporting in recognising the negative and positive impact of the services based on citizens' experiences. This design guideline was validated by the County Council A. They classify the citizens' feedback into two categories i.e. Top likes and dislikes which has been captured as positive and negative feedback within the model. *"you know the way that you have included feedback and assessing permit for service performance. I think that's really helpful and that's you know, the way to go for the future but at the moment it doesn't represent it's going further than we currently are"* [Community prospect co-ordinator 1, County Council A]. It was further instantiated in the context of County Council B as currently they generate a summary of the community's feedback and provides a list of concerns that need to be addressed.

DG3 - Assessment of feedback: Assist in identifying the satisfaction level of citizens towards different public services. This assessment can be performed based on the captured feedback from community's side. Both County Councils did not have any assessment parameter to assess the satisfaction level of the citizens. This design guideline was derived based on findings from the literature and was further validated by the Council A. It was found as a most critical component of the model. *"I think it's crucial. I mean it just makes the process even wider process"* [Community Prospect Co-ordinator, County Council A].

DG4 - Link to the associated services: Assist in sharing the community's feedback to the relevant service departments. Both County Councils confirmed that the feedback should be channelled to the associated service departments to address community's concerns for a specific service. *"There is more integration needed, that's for sure, but maybe community prospect is speaking one language around community development and the services are maybe just more service oriented. More, you know, responding to service users."* [Community prospect Co-coordinator 1, County Council A]. Similarly, PPN Co-ordinator from County Council B confirmed that "*It's a useful box for people to tap into when they first come into to help them guide them to where they want to log their issue"* [PPN Co-ordinator, County Council B]. Thus, the proposed relationship to channel citizens' feedback to the associated service departments was validated in both case studies.

While in the first case study (County Council A), the sharing of feedback was missing, in the second case study, practitioners confirmed that the feedback collected as a part of community development service was being shared to the relevant stakeholders within the Council. However, they highlighted that there was a lack of structure and vision for improving the services based on citizens' feedback. Consequently, a connection was required to showcase the inter-relationship between two sides of the system, one which captures citizens' feedback, and another that is responsible for further service improvement, as discussed in the next section.

DG5: Mapping Requirements- This design guideline was defined to support the mapping of the requirements based on the feedback that citizens provided as Head of Strategic Capital Projects highlighted the challenges in terms of mapping citizens' requirements. *"like the major block is how do we match their requirements"* [Head of Strategic Capital Projects, County Council A]. This guideline was validated during the ex-ante evaluation of the process model with County Council A as discussed in section 4.2.1 in chapter 4. Similarly, County Council B underlined that there is a lack of vision to fulfil the need of community. *"But you also gonna need to have a vision for how you think you should be operating, and I'm not sure the secretariat has that vision so that to me is a bit of a problem"* [PPN Co-ordinator, County Council B]. Therefore, there was a need to assist them in creating the vision of the project based on the feedback that citizens provide.

DG6: Service requirements and quality factors- It enable practitioners in identifying service requirements and associated quality factors to respond to the need of citizens. *"I think what you have here is all very relevant. You know the quality is important. What are the requirements, etc. So I think that's good"* [Head of Information Systems & Innovation, County Council A]. Likewise, practitioner from County Council B confirmed that this will provide them a structured approach to map service requirements based on the feedback of citizens. *"this model gives a more structured system not just to get access to the feedback from the citizens, but to process the results and communicate it towards the state agencies or the authorities"* [PPN Representative 1, County Council B].

DG7: Managing changed requirements- This assist in managing the changed requirements of citizens as practitioner from County Council B highlighted that the requirements originating from the community's end may change over the period of time. Therefore, it is important to record and manage this change. *"..the problems that I would write down now wouldn't be the same problems I'd write down at six months' time and these things become out of date very quickly"* [PPN Co-ordinator, County Council B]. The similar issue was observed during the review of the documents provided by County Council A. They did categorise the requirements of the community based on their priority. However, there was a lack of approach to manage it.

DG8: Model should have more visual elements- This ensures that practitioners do not have to go through many activities in the model, and should contain more visual elements. This design guideline was validated with County Council A as discussed in section 5.2.3 in chapter 5. Similarly, County Council B suggested to use colour coding for highlighting different roles. *"You could use a bit of colour to say, yeah, well, this is green is City Council's responsibility, and blue is everybody's responsibility. However, the green box is part of City council's project"* [PPN Representative1, County Council B].

DG9: The design of the process model should be simple to understand- This supports in providing less technical details within the model so that practitioners can understand the elements of the model easily. The practitioners from County Council A wanted to have a simple process model with limited activities that is understandable by all the relevant practitioners in the Council. A detailed discussion has been provided in section 5.2.3 in chapter 5. Similarly, Community Prospect Co-ordinators from County Council B preferred to have less technical names for the activities in the model and emphasised to have more general terms to be used for each activity. *"we need to access and put our point of view across and that has got to be simple. Yeah. To me It looks too technical to the eye"* [Community Prospect Co-ordinator, County Council B].

DG10: Embedding more Templates- This ensures that enough documents are embedded in the model to provide additional information about the activities. This design guideline was validated with County Council A. Practitioners were more inclined towards embedding more templates which has been highlighted as: *"This one here is much more interesting, and it draws you. It draws your eye and everything. Probably more readable, but kind of that kind of template there. Yeah, I think that looks better"* [Participant 1, Community Prospect Co-coordinator 1]. County Council B did not provide any explicit feedback with regards to the design guideline DG10 rather they provided their response about the overall model and found it useful for their job as discussed in section 6.4.1.2.

DG11: Simple process and sub-process- It supports in designing simple processes and sub processes without adding too much textual detail in it. Community prospect co-ordinator from County Council, A, preferred to have simple processes as compared to the ones which had more activities and textual details. Likewise, The PPN Co-ordinator from County Council B pointed out that they would also prefer to have simple activities within the process model. Initially, they found model activities more technical and wanted to have simpler versions of them. *"everything that's in there is part of the overall project, but we may need to make the model simple".* [PPN Co-ordinator, County Council B].

- **Cross Case Analysis – Process model:** The key activities and concepts proposed in the form of a process model were used to compare the main findings across case studies. In both case studies, stakeholders faced challenges in addressing citizens' concerns and to improve services based on their

feedback. This research identified key activities and concepts to assist them in fulfilling the need of citizens and to continuously provide improved services to them.

For instance, an assessment parameter has been introduced within the model to capture satisfaction score towards the services. This would indicate whether services have been improved or not based on the feedback that citizens provide. The head of the community prospect program in County Council A highlighted that with the proposed parameter they could measure their achievements. *"…. then you're seeing is there a shift in where the community is at based on what has been achieved?"* [Head of the community prospect program, County Council A]. Similarly, PPN Representative from County Council B indicated that there should be a way to measure what has been achieved and what not in terms of providing improved services to citizens. *"So I suppose when we get the feedback, one of the things is like there should be and I'm not aware that there is within the structure a template. That actually has got to be signed off to say what's achieved and what's not achieved"* [PPN Representative, County Council B].

However, one of the differences that were found in both cases was associated with the sharing of the feedback with associated service departments. In case of County Council, A, the community engagement program was working in silo without sharing the feedback with other service departments who are responsible for delivering the services. Whereas County Council B shares the feedback with relevant stakeholders in the Council. Nevertheless, they didn't have a vision to work upon those feedbacks due to the lack of structure in place. Hence, the process model provides a structure to capture this relationship along with other relevant factors that would assist in providing improved services to the citizens and to meet their need.

- **Cross Case Analysis- Implementation of the Process model:** Both County Councils highlighted some challenges with regards to the practical implementation of the process model. This section discusses those challenges which include 1) Not considering community's need as an important source of information 2) Lack of resources for the implementation 3) Lack of support, and transparency from higher authorities. 4) Lack of literacy. A detailed discussion about these challenges has been provided as follows.

1. **The Community's need is not considered as a vital source of information**

The practitioners highlighted that the community' feedback captured via their existing engagement process is not seen as an important source of information. *"I think that at the moment the way it is in A County Council that the program is part of you know Community engagement department and perhaps you know It's not seen as a vital source of information on what the communities need"* [Community Prospect Co-ordinator 1, County Council A]. Moreover, they pointed out that in order to

be used as a vital sources of information, higher authorities (Local authorities) of the Council need to take key decisions to address the need of community. "*I think that in order for Community prospect, genuinely to be used as a source of information on what communities need. you need a decision at the top that you know we're going to take this on board. We're going to try Priyanka's model to really, you know, to show that that A County Council is taking on board the requirements of communities and is going to respond to the needs that come up through the Community prospect*" [Community Prospect Co-ordinator 1, County Council A]. It was confirmed by the community engagement co-ordinator that the process model does have a potential to be used for their existing engagement process. However, that would be a big step for the Council to undertake. *"I think it would be quite radical. It would be a big jump, I think for A County Council to make, but I do think that there is potential, but It would be a big undertaking"* [Community Prospect Co-ordinator 1, County Council A].

2. Lack of resources for the implementation

Community engagement co-ordinator underlined that it does appear that County Council A is thinking about the need of community and want to provide better services to them. Nonetheless, in reality there is a lack of human resources to execute their plans and to engage with local community in order to respond to the community's need. "*when I applied for this job I said, wow, you know this is a County Council that is really thinking about what people want underground and taking it on board. and this could be the basis of, you know, the services of the County Council that respond to the communities, and that would be wonderful. But in practice you know it's a very small team and it would need to be resourced very much more than it currently is*" [Community Prospect Co-ordinator 1, County Council A].

3. Lack of support from higher authorities within the local municipalities

Community engagement coordinator also emphasised that there is a need of involvement from the higher authorities in order to address community's concerns based on the information (feedback) they capture via their program. "*so I would see that if we could at least get the heads of each of the municipals to receive the information and delegates that information to reach their department then there's some, you know, feed through but then that directive probably has to come through chief executive officer*" [Community Prospect Co-ordinator 2, County Council A]. Community engagement co-ordinator 1 confirmed the same. *"You know, if you get county councillors on board. That's definitely a possibility in terms of influence"* [Community Prospect Co-ordinator 1, County Council A].

Co-ordinator 1 further highlighted that with the proposed process model, the community's need will become a real project for the implementation and its impact can be measured. Nevertheless, there is a need of agreement from the highest level as well from political level for implementing the

process model. *"what we're saying broadly is that you need to have agreement to bring on board your system to implement an integrated process where community needs become real projects that get implemented and you know the impact gets measured, so you need, you know, the people at a high level of decision making within the organization. Plus, at the political level as well, because you know, that's very much how things work as well"* [Community Prospect Co-ordinator 1, County Council A].

4. Lack of transparency in implementing the plans

Another important factor that was highlighted by the community engagement co-ordinator in County Council A that they do have a responsibility for sharing plans with the local councillors of the Council. These plans highlight the need of community based on the feedback that is captured via their engagement process. But, they would not know about the execution of those plans. *"Well, currently Priyanka when we do a new plan we will mail a copy of the plan to the local county counsellors for that area so they are aware of the plan, but beyond that we don't know what they do. Yeah, I suppose they may or may not familiarize themselves with the what community have said"* [Community Prospect Co-ordinator 2, County Council A].

5. Lack of Literacy

Similar to County Council A, participants from County Council B also confirmed the usefulness of the model on various occasions. However, they also highlighted the issues in terms of the practical implementation of the model. PPN Co-ordinator from County Council B pointed out that there is a lack of literacy in the people to understand the model. Thus, it will be difficult for some of the practitioners to understand it. To address this issue, the model should be much simpler in terms of the activities and representation. *"But I can tell you that however it works out and if we ever go down this route with trying something like this It has to be something simple because all under the people that will be using this will be people who maybe never managed to leaving certificate. don't have any third level education. Won't necessarily be particularly computer literate. I know it could be a wide range of people who would be daunted by that level of detail. I mean, I've been around a long time, and yet for me trying to fill in forms online, I sometimes get very frustrated"* [PPN Co-ordinator, County Council B]. The next section provides summary of this chapter.

6.6 Chapter Summary

This chapter presented the results from ex-post evaluation of the process model. It involved the application of process model in multiple case studies. The evaluation provides assessment regarding the usefulness of the process model in two County Councils of Ireland. It captured the syntactic, sematic and pragmatic evaluations of the artefact. The practitioners from the County Councils

confirmed the usefulness and relevance of the process model in their existing engagement program. Moreover, they confirmed that the process model would assist them in providing improved services to the citizens while addressing the challenges they faced during the engagement process. Finally, practitioners confirmed that it provides a structured approach to practitioners in aligning their action plans based on the feedback they receive from community's end. It would further ensure that citizens' need is met based on the feedback they provide on various services. The next chapter will provide a discussion on the contributions of this research along with the limitations and further direction for future research.

7 Conclusions and Future Thoughts

This chapter outlines conclusion and direction for future work that need to be communicated to a wider range of research community. It is a part of the final phase (Communication) of DSR methodology. This thesis firstly investigates existing literature that provided solutions based on citizens' feedback and their experiences to design and improve smart city services. It identified the limitations of the current literature in fulfilling the need of citizens based on those feedback and experiences as discussed in section 1.1.2 in chapter 1 (e.g. A. Wolff et al., 2020; Abella, et al., 2019; Heaton and Parlikad, 2019; Simonofski et al., 2019, etc.). To address those limitations, this thesis proposed a process model to structure the relationship between citizens' feedback and service improvement to fulfil the need of citizens. The proposed process model includes the components to assist practitioners in addressing citizens' need by implementing their action plans effectively. This thesis followed design science research methodology to conduct this research as discussed in section 3.4 in chapter 3. The aim is to provide evidence that the artefact solves the identified research problem as highlighted in section 1.4 in chapter 1.

The results from this study highlighted that practitioners faced challenges in terms of fulfilling the need of citizens and to provide improved services to them (See sections 4.2.1, 6.4.1). Some of those challenges included unstructured isolated processes of the Council, factors such as risk, constraints, capacity, etc. that impact the improvement of the services. As a result, citizens are not satisfied with delivered services and their need is not fulfilled as discussed in section 2.6 in chapter 2. Therefore, this study proposed a process model as a resulting artefact that would assist practitioners in providing improved services to the citizens. The design of the artefact involves two activities i.e. development and its evaluation (Tremblay, et al., 2010). Consequently, to build the components of the model, practitioners were involved throughout the build and evaluate cycle of the artefact. In addition, the knowledge derived from the literature assisted in ensuring the rigor of the research. The build and evaluate cycle follows frequent iterations between development of the artefact and its evaluation instead of following procedural approach (Kuechler and Vaishnavi, 2008). Ex-ante and ex-post evaluations were performed during different stages of artefact development and evaluation as outlined in section 3.4.3 in chapter 3. To perform those evaluations, this thesis used multiple research techniques and methods such as multiple case studies, interviews, and focus group discussions. The questions were asked to the practitioners based on the different evaluation criteria selected for this research as discussed in section 6.2 in chapter 6. The results from those evaluations confirms that the process model addresses the challenges faced by practitioners and assist them in providing improved services to the citizens.

The remainder of this chapter answers the research questions as outlined in chapter 1. Moreover, it provides details about the contributions, limitations, boundaries, and the direction for the future work.

7.1 Restating the Research Questions

This research addresses the problem of having a lack of structure to support the relationship between citizens' feedback and service improvement at local municipal level. The research questions defined to address this problem are presented in section 1.6 in chapter 1. This section revisits those research questions, and presents their main results which meet the objectives of this research as discussed in section 1.5 in chapter 1.

RQ1: What are the design guidelines that support in structuring the relationship between citizens' feedback and the continuous service improvement?

For RQ.1, Chapter 5 describes how this study derived and identified set of design guidelines to structure the relationship between citizens' feedback and service improvement. A set of 11 design guidelines are proposed in chapter 5 to structure the relationship between citizens' feedback and the continuous service improvement. These design guidelines were derived based on the literature review findings and the collaboration with practitioners. The demonstration of those design guidelines were conducted through the demonstration of the process model. The presented guidelines are the result of build and evaluate cycle of the artefact as discussed in section 3.4 in chapter 3. These were refined and updated during the ex-ante and ex-post evaluations.

Three design guideline themes were derived based on the examination of the literature review and collaboration with practitioners. These themes are: 1) Citizens' involvement 2) Service improvement 3) Model features under which 11 design guidelines were identified. Citizens' involvement theme is associated with the feedback of citizens and associated factors with it. Service improvement theme deals with the activities that contribute towards mapping of the citizens' requirements based on the feedback they provide. Finally, the theme Model feature ensures that process model functionality and visual representations are in accordance with the preference of practitioners so that they can access the model easily. A detailed discussion has been provided in section 5.2 in chapter 5.

The result from RQ1 meet the first research objective of this research: Provided design guidelines that support in structuring the relationship using literature review findings and feedback of practitioners.

RQ2: What are the concepts and activities that support in structuring the relationship between citizens' feedback and the continuous service improvement following the identified design guidelines?

For RQ2, Chapter 5 outlined how this research designed process model to explicitly specify the relationship between citizens' feedback and the continuous service improvement using the design guidelines resulting from RQ1. This study identified components (concepts and activities) as discussed in section 5.3.1 in chapter 5 to structure the relationship between citizens' feedback and the continuous service improvement. These components were defined based on the three identified design guideline themes resulting from RQ1. The identified concepts and activities for design guideline theme "Citizens' involvement" include feedback gathering, classification, and assessment. In addition, it provides factor such as satisfaction score for evaluating the service performances based on citizens' feedback, and multiple service domains (Housing, parking, planning, etc.) for which citizens provide their feedback. The activities and concepts for design guideline theme "Service improvement" include mapping and managing of the requirements, quality factors of the services, and identification of the service requirement based on the concerns that communities highlighted. Finally, the activities derived for the third design guideline theme "Model features" include: providing more visuals, embedding templates, simple design and processes. The process model is developed based on these identified concepts and activities using BPMN modelling language for which a detailed discussion has been provided in section 5.3.1. Subsequently, web version of the model was demonstrated to the practitioners for evaluating different components of the process model.

The result from RQ2 meet the second research objective of this research: Provided key concepts and activities that support in structuring the relationship following the identified guidelines.

RQ3: How the proposed concepts and activities support in structuring the relationship between citizens' feedback and the continuous service improvement for meeting the need of citizens?

For RQ3, Chapter 6 provides detail about how this research applied and evaluated the proposed concepts and activities resulting from RQ2. It provides detail about the ex-post evaluation of the process model with practitioners from two County Councils of Ireland for which the details have been provided in section 6 in chapter 6. The results from the ex-post evaluation provide confirmation that the proposed concepts and activities in the form of a process model support in structuring the relationship between citizens' feedback and the continuous service improvement.

The sample of practitioners' feedback has been provided as an evidence to confirm the same. The detailed discussion on their feedback has been provided in sections 6.3.1.2 and 6.4.1.2. For instance, the Community prospect coordinator from County Council A stated: *"…...I think that's what you're proposing is very smooth and is a much more useful way of making sure that the information gets to the services and is used to respond to the needs"* [Community prospect Co-coordinator 1, County Council A]. Likewise, PPN representative 1 from County Council B confirmed that the process model provides a structured approach not only for accessing citizens' feedback but also to process the results. *"this model gives a more structured system not just to get access to the feedback from the citizens, but to process the results and communicate it towards the state agencies or the authorities"* [PPN Representative 1, County Council B].

Multiple case studies were conducted to demonstrate and evaluate the applicability of the proposed process model in two County Councils as discussed in sections 6.3 and 6.4 in chapter 6. The evaluation results demonstrated the validity and reliability aspects of this research. In addition, it demonstrated the high-quality and practical relevance of the proposed concepts and activities in the form of a process model for cities and municipalities.

The result from RQ3 meet the third research objective of this research: Validated the identified concepts and activities in the form of a process model by following ex-post evaluation strategies as discussed in section 6.2. The next section discusses the contribution of this research from theoretical and practical viewpoints.

7.2   Contribution

The two main features of design science artefacts are relevance and novelty (Hevner *et al.*, 2004). The first feature ensures that an artefact solves an important problem, and thus is being relevant. Second feature requires that design science research address either an unsolved problem in a distinctive and inventive way or solved problem in a more efficient or effective way. This thesis addresses the problem of having a lack of structured approach for the improvement of the services based on the citizens' feedback at the local municipal level. Firstly, this research solved this problem for practitioners who engage with citizens at local level and hence becomes relevant in the problem space. It addresses challenges faced by practitioners at the local municipal level for continuously providing improved services to the citizens. Secondly, this research developed an artefact i.e. a process model to solve this unsolved problem in a unique and innovative way, and therefore confirms the novelty of this research. The identified problem in this study was based on the discussion that the researcher had with practitioners from two County Councils of Ireland. This became the motivation factor for this research

and provided an opportunity to assist local government for providing improved services to the community across different domains.

Design science provided methods and techniques to address the identified problem by considering the knowledge derived from literature and the inputs obtained from the practitioner's side. The application of research methods and the process of following the build and evaluate cycle of DSR methodology resulted in a process model. The proposed process model captures the relationship between citizens' feedback and service improvement. The output resulted from those two activities have novel contribution to theory and practice. The type of theory that forms the knowledge in DSR is known as design theory which provides prescription for design and action, and guides how to do something (Gregor and Hevner, 2013). This type of design theory is considered as prescriptive rather than descriptive which includes other types of theory as well (ibid). This study falls under the prescriptive knowledge contribution space in which the researcher prescribes set of activities and concepts in the form of a process model that would assist city authorities in providing improved services to the citizens. The results derived from practice, existing research and evaluations contributed towards the development of the artefact. These results are further fed back to the knowledge base as a contribution from this research. In this thesis, the resulting artefact can be seen as a model. The results obtained from the evaluation of the model and analysis as presented in chapters 5 and 6 suggest that using design science methods and techniques played a significant role to develop the process model. This will further assist in developing a tool or an online platform following DSR guidelines to assist city authorities in continuously providing improved services to citizens. The next section provides a detailed discussion about the theoretical and practical contribution of the thesis.

7.2.1 Theoretical Contribution

While researchers in Information System and other disciplines have provided ideas and guidelines for design science element, the existing literature does not provide a detailed methodology to implement design science research (Ostrowski, 2014; Alturki et al., 2011; Peffers *et al.*, 2007). Furthermore, it does not provide guidance about how to perform artefact evaluations, more precisely, it is not clear which evaluation methods to use for a specific type of design science outputs (Peffers, et al., 2012). There is a lack of detail about the design and evaluation of the artefact development (Ostrowski, 2014). This study provided an in depth detail on how design science researchers can apply DSR methodology to address the real world wicked problems. This research validated the applicability of a reference model proposed by Ostrowski, (2014) for designing and evaluating the artefact and extended its application in another organisational setting. In addition, this study adapted a combination of evaluation approaches and strategies to evaluate designed artefact during different

stages of DSR methodology. For instance, the evaluation strategy and criteria were adapted from (Sonnenberg and Vom Brocke, 2012; Venkatesh and Davis 2000). In addition, three levels of evaluation; i.e. Syntactic, Semantic, and Pragmatic were carried out during ex-post evaluation process as discussed in 6.2 in chapter 6.

The contribution of this thesis falls into the fourth category (Exaptation) of DSR knowledge contribution framework proposed by Gregor and Hevner, (2013) as shown in Figure 29. In this type of contribution, design knowledge that already exists in one field is advanced or refined and applied to a new application domain (ibid). The researcher needs to demonstrate that the expansion of known design knowledge in new field is interesting and must present some specific challenges that were not present in the field (Gregor and Hevner, 2013). The concepts of Enterprise Architecture have been applied by existing studies in smart city context to define different components of the city services and to provide architectural layers for smart cities. However, the challenges faced by practitioners at municipal level have not yet analysed in the literature in the level of detail which is required for continuously providing improved services to citizens. Consequently, the proposed solution i.e. a process model is a blend of best practices, and the application of known solutions, methods from other fields to address the problem domain. A detailed discussion has been provided in the following section about the theoretical contribution of this thesis in the field of smart cities and enterprise architecture.
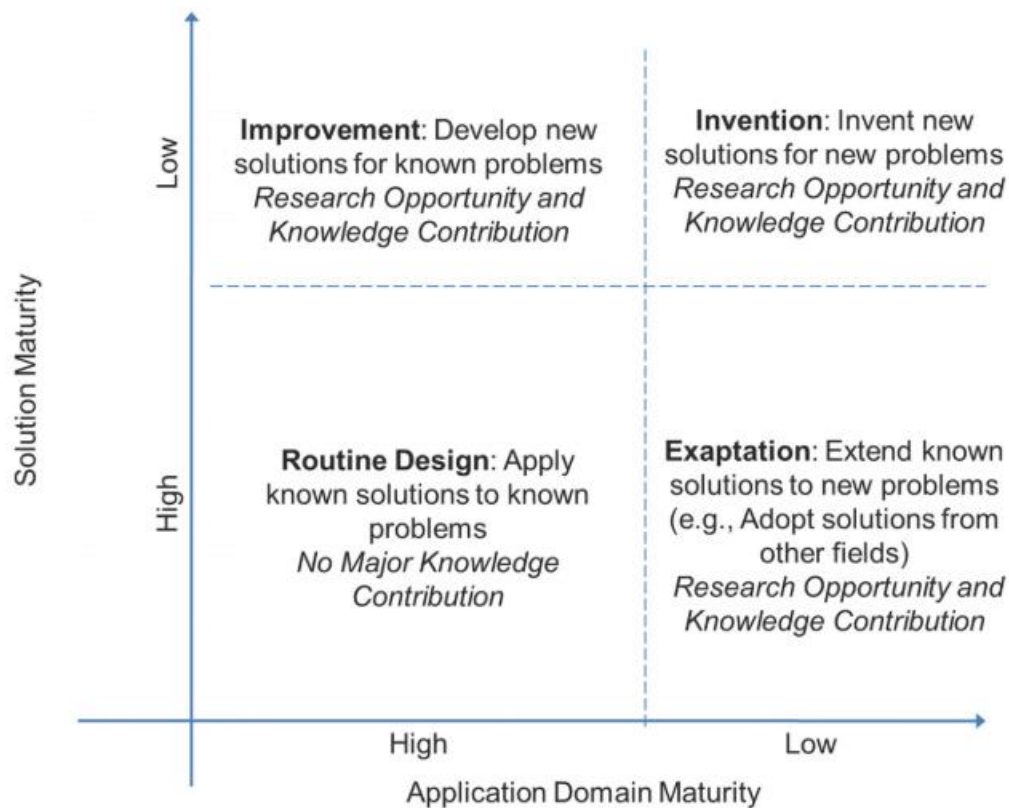
Figure 25: DSR Knowledge Contribution Framework based on (Gregor and Hevner, 2013)

There has been very limited effort firstly to understand how city authorities engage with citizens at local level and work on their feedback. Secondly, to understand the challenges from different practitioners' perspective who obtain their feedback for further service improvement. Thirdly, there is a lack of understanding on how city authorities address citizens' concerns, and what are the factors that can impact the service improvement. Existing research primarily focused on technical side of the citizen engagement and service improvement with little attention on how to achieve the expected outcomes such as meeting citizens' requirements, their expectations, goals set by existing engagement platforms, etc. (Bastidas, 2021; Allen *et al.*, 2020; Yigitcanlar *et al.*, 2019; Heaton and Parlikad, 2019; Abella *et al.*, 2019). Additonally, there was a lack of considerations of challenges faced by local authorities during the incorporation of citizens' feedback for continuous service improvement as discussed in sections 4.2.1 and 6.4.1.

This research provides significant results to enrich the discussion on the existing citizens' engagement platforms, and their implications to provide improved services to the citizens in the field of smart cities (Jnr, 2021; Allen *et al.*, 2020; Rodrigues and Franco, 2018). This study contributed to the adapted citizen participation framework that was developed based on the Artim's citizen participation theory by Simonofski et al., (2019) to structure and evaluate citizen participation in smart cities. This framework classifies citizen' participation in three categories. These categories have been defined as

Citizens as Democratic Participants, Citizens as Co-Creators, and Citizens as ICT Users. The citizen participation considered in this thesis falls under the category of "citizens as democratic participants". While the proposed framework captures the co-relationship between citizens' participation activities and achievement of goals within this category, it does not provide much detail about the impact of their participation activities on the achievement of those goals. For instance, if the goal is to provide improved services to the citizens, then how those participation activities contribute to the improvement of the services is missing in the proposed framework. This study proposes a process model which captures this relationship and also showcase the impact of citizens' feedback from the participation activities at the service level. In addition, this study identified key challenges (mapping requirement, risk, constraints, capacity, etc.) faced by local authorities while they engage with community for providing improved services to the citizens. The proposed concepts and activities in the form of a process model provided a structured approach to the practitioners in continuously providing improved services to the citizens. This research provides a prescriptive view to guide city authorities, community engagement co-ordinators, and representatives in their service improvement action planning. This would assist them in achieving the vision of the project developed during the citizen engagement process. Such a prescriptive view ensures that services are improved based on the goals which reflect the expectations and the need of citizens. The multiple case studies demonstrated the application of this prescriptive view by providing guidance for implementing the solutions based on the citizens' feedback. Moreover, the design oriented research approach and the research findings from multiple case studies in the real world scenarios complements the technology oriented solutions in fulfilling the need of citizens.

This research identified the design guidelines to structure the relationship between citizens' feedback and service improvement. Following the design guidelines, this thesis addresses the problem of having a lack of structured approach to provided improved services to the citizens. Firstly, the design guidelines were collected based on the collaboration with practitioners at Councils and knowledge derived from literature review. Based on the identified design guidelines, the key activities and concepts were defined. Secondly, this research revealed how lack of consideration of non-technical factors such as process and structure can influence the service improvement and do not meet the goals set by existing platforms that capture citizens' feedback. Thirdly, the ex-post evaluation results confirm that the structuring the relationship in the form of a process model can assist practitioners in providing improved services to citizens and meet the objective of this thesis. The identified factors such as risk, capability, goals, constraints, measuring the impact, etc. were considered as critical factors that influence service improvement. The significance of those factors, and difficulty in structuring them have been captured in ex-ante and ex-post evaluation results and the details have

been provided in sections 4.3, 5.4 and 6.2. The practitioners' comments obtained during the focus group discussions and interviews from those evaluations confirmed the same.

The second main contribution of this thesis is in the field of Enterprise Architecture. This research provided significant results to enrich the discussion on the complexity of cities, which currently focused on quantitative results for evaluating the city performances and implementing technical solutions based on citizens' feedback and their inputs (Nicolas, Kim and Chi, 2020; Moustaka *et al.*, 2021; Chen *et al.*, 2019). There have been very limited efforts to capture a comprehensive understanding of two sides of the system. One that gather citizens' feedback and another that work upon improving the services based on those feedbacks. Therefore, this study adapted EA framework as a reference for understanding the relationship between those two sides of the system. This study adapted smart city enterprise architecture framework proposed by Pourzolfaghar et al., (2019) as a lens to analyse the existing literature from different architectural layer's perspective as discussed in section 2.4 in chapter 2. The adapted framework provided an overview of the different components and their interaction in a complex smart city system. The architectural layers assisted in analysing the relationship between citizens' feedback and the other components of the system. However, it did not cover the complex workflow between different stakeholders of the system who are responsible for capturing citizens' feedback and further service improvement. Moreover, it did not capture the relationship for closing the feedback loop from citizens' end. This thesis fills this gap by introducing the components associated with continual service improvement and by capturing the complex workflow between citizens' feedback and service improvement process. Moreover, existing studies highlight the importance of EA in the context of smart cities. However, there are very limited studies that provide detail about how to implement EA artefacts and processes in the real environment for practitioners in public organisations. This research addresses the challenges associated with the application of Enterprise Architecture artefacts and activities (e.g. Templates provided by TOGAF 9.2 for requirement change management, capturing QoS, and functional and non-functional requirements, etc.) and provided great value to the different practitioners of the Council.

This study proposed a process model that demonstrated the application of EA artefacts and activities to bridge the gap between two isolated sides of the Council. This is achieved by combining the knowledge derived from the experience of practitioners and literature review findings and by demonstrating different components of the process model. The existing citizen engagement process within the Councils is unstructured and lack a more detailed vision of providing improved services to the citizens. Moreover, this process works in isolation without having a link with other services that are provided by local authority. As a result, there was a need to provide a connection between these two isolated sides of the Council. One that gather citizens' feedback on multiple services, another that

is responsible for delivering the services to the local community. In this thesis, a process model is developed to provide a structured approach to the practitioners that connect these two sides of the Council.

In addition, the process model provides a vision to the local authorities for addressing the concerns of community based on the feedback they provide. Finally, it incorporates factors that affect the service improvement action planning to fulfil the need of citizens. The structure of the process model is derived from 1) Existing citizen engagement platforms in practice from two County Councils of Ireland. 2) The Architecture Development Method of TOGAF EA framework 3) Factors that impact service improvement action planning to meet the need of citizens. The combination of results from these components leads to a three stage structure: Firstly, citizens' feedback is collected for classification and assessment based upon which the performance of the services is evaluated. After analysing the service performance, in the second stage, the service is selected from the service catalogue for addressing the concerns of citizens for a specific service. Finally, the citizen engagement co-ordinators, representatives, and councillors perform set of activities to outline the vision of the project for improving the existing services. Following the vision of the project, stakeholders from the service departments/external service providers work towards implementing the changes and to provide improved services to the citizens. The next section provides a detailed discussion on managerial contribution of this research.

7.2.2   Managerial Contribution

This research found that the practitioners faced challenges in mapping citizens' requirements and achieving the goals set by the existing engagement process. The results from the case studies highlighted that there are multiple challenges (e.g. constraints, risks, multi-stakeholder's concerns, capability, etc.) faced by practitioners when it comes to improving the services in the real environment based on the feedback that citizens provide. Existing smart city initiatives provide technological platforms for gathering citizens' feedback at different levels. However, most of the solutions focused on quantifying the feedback results, providing tools to gather the feedback, evaluating citizens' experiences, understanding citizens' thoughts, and opinions on urban planning, etc. Furthermore, none of them considered the other side of the system i.e. local authorities who engage with citizens and work on their feedback. This research argues that to achieve the goal (i.e. providing improved services to citizens) of existing citizens' engagement platforms, it is vital to consider both sides of the system, one that gathers the feedback, and the other that is responsible for delivering the services (e.g. city authorities, service providers, Council's internal departments, etc.).

Furthermore, practitioners highlighted the challenge of having a lack of foresight about how to address the community's concerns based on their feedback. It is important to know what happens once community' feedback (e.g. Positive, Negative) is with the city authorities at the Council level. How do they address citizens' concerns? What are the challenges they face in terms of mapping their requirements? Consequently, there was a need for an approach which could consider all these factors together and provide a holistic overview of the complete system. This would ensure that realistic expectations are built within the community and city authorities can align their implementation plans based on the citizens' feedback to meet the goals set by existing citizen engagement platforms. This study proposes a process model to encapsulate both sides of the system and provides a coherent representation for providing improved services to the citizens. The below section provides discussion on the application of the process model for the managerial practice.

- **Tracking project achievement:** The process model will assist city authorities in keeping track of their progress and achievements in service improvement action planning. The process model demonstrates how citizens' feedback is processed and what it leads to at the service level. Moreover, it will not only work for communities who provide their feedback on multiple services but also for local authorities, counsellors, representatives, and other practitioners who can check what are the requirements of communities. They can track the progress of the actions that have been taken to address the community's concerns.

- **Service implementation:** Practitioners didn't have any strategy about how to implement the changes at the service level to provide improved services to the citizens. The proposed model illustrated how changes can be implemented at the service level based on the community's feedback to improve existing public services. The implementation strategy utilises the concepts and activities of EA guidelines and artefacts that focused on multi-stakeholder concerns, evaluation criteria such as QoS and contracts, risk management activities, functional and non-functional requirements of services, requirement management activities, and supporting artefacts. Additionally, it captures the clear role and responsibilities of different stakeholders who will be looking after the implementation strategy for service improvement.

- **Flexibility:** The results from this research suggest that the proposed process model guides the city authorities in providing improved services to the community, and assists in the transformation of public services. It provides flexibility and interrelationships between community feedback and multiple departments responsible for the improvement of the services.

- **Measuring the impact:** The existing engagement program in County Council A was not able to measure the impact of citizens' feedback at the service level. The result from ex-post evaluations highlight the significance of the process model in measuring the impact of their citizen engagement process.

- **Action planning:** The process model would help practitioners in executing their action plans. The results from the case studies confirmed that proposed process model provides a structured approach to facilitate the citizen engagement process, and assist stakeholders in implementing their action plans for improving the existing services.

- **Information tool:** The practitioners gather huge amount of information as a result of the existing engagement process. However, that information was not being channelled properly to the associated service departments. The proposed model provides a link to channel this information to the relevant department. As a result, practitioners found this model as a useful information tool by which relevant information can be distributed to the other departments for taking required actions for service improvement.

- **Structured approach:** The process model fills the gap between two sides of the system, one that interact with citizens and capture their feedback, and another that work towards implementing the changes and to provide improved services to the citizens. So, the model provides a structured way for connecting these two sides of the system for effectively responding to the need of the citizens. The case studies illustrated how proposed model can assist to improve the collaboration between different service departments, and support in providing improved public services to the citizens based on their need. The Council's existing engagement process was only able to capture citizens' feedback on different services without providing any details about how would they work upon those feedbacks for further improving the services. Hence, practitioners found the process model useful as they can see how different elements of the Council are structured, and would provide guidance to local authorities in addressing community's issues.

- **Accountability:** The process model was found useful as compared to their existing engagement program as it captures the accountability of local authorities for taking required actions based on the feedback that community provides. It encapsulates activities for capturing the accountability of different stakeholders who will be responsible for improving and delivering the services. The next section outlines the limitations and boundaries of this research.

7.3 Limitations and Boundaries

This thesis provided a structured approach in the form of a process model that would guide city authorities in improving existing public services in a complex urban context. This section outlines and discusses the limitations and boundaries of this research.

7.3.1 Selection of the engagement platforms

This study selected an offline engagement program (PPN) for multiple case studies in Ireland to apply and validate the model. This program gathers citizens' feedback on multiple public services. The practitioners involved in this program provided access to information about how the citizen engagement process takes place and what are the feedbacks that citizens provided on various services. Moreover, they also provided some additional documents about the engagement process and shared survey results (feedback) that was obtained from the local community. However, this study did not have an opportunity to investigate how local authorities address the community's concerns based on the feedback that is captured via online platforms. Hence, future research is required to validate the findings in another context where online platforms have been employed for gathering feedback.

7.3.2 Limited Number of Services

There are more than ten public services that are provided by local authorities. But, this thesis considered a limited number of services within the process model. This study selected only those services that were considered important for the local community (Based on the priority they highlighted), and are common among different County Councils of Ireland. Consequently, more research is needed to validate the proposed model with more number of services where new concepts and activities can be identified and added into the existing model.

7.3.3 Impact of Covid-19 on this Research

The nature of this research was based on an ongoing collaborative approach with City/County councils of Ireland for investigation of the research problem and to obtain their input on the proposed solution. When the pandemic took place in 2020 with a country-wide lockdown then the schedule for having planned meetings with City/County Councils was interrupted. It took a while to re-arrange the online meetings with practitioners due to the delay in response from their end. This impacted the design and development phase of the proposed solution and delayed the overall completion timeline of the thesis. Lastly, as there were no physical meetings conducted, hence it limited the flexibility in terms of interactions and discussion among participants and the researcher. The next section provides the future work of this research.

7.4 Future work

Future research directions are outlined to guide how other researchers can enrich the findings of this study and have been discussed as follows.

7.4.1 Technical Implementation of the Process Model

The proposed process model provides a structure to capture the relationship between citizens' feedback obtained via online and offline channels, and its influence on continuously providing improved services to the citizens. As a part of future work, an online platform can be implemented based on the structure of the process model. The process model developed in this thesis will serve as a basis for providing conceptual and theoretical background. Furthermore, it represents a structure to provide a relationship between two sides of the system, one that interacts with citizens and captures their feedback, other that is responsible for improving the services and taking key decisions. It serves as an information tool for capturing this relationship and assisting city authorities in providing improved services to the citizens. Some of the benefits of developing an online platform include providing a holistic overview of the complete system with greater flexibility to access the community's feedback on multiple service domains. This will also provide online access to the integrated feedback result from both channels (e.g. online and offline), with qualitative and quantitative feedback assessment results. Following those feedback, city authorities can take appropriate actions, and assign responsibilities to the relevant service departments for providing improved services to the citizens.

7.4.2 Automation of Activities

The results derived from the process model would assist city authorities in implementing their action plans for the services according to the need of citizens. By using the process model, practitioners could measure the impact of their existing citizen engagement process. The activities defined in the model for this measurement can be automated and a report can be generated for sharing it with different stakeholders of the Council. This would ensure that services are improved based on the citizens' feedback, and at the same time, it will showcase the impact of the engagement platform. Moreover, some of the activities for service improvement can be automated as well. For instance, a reminder for sending the communication plans to the relevant stakeholder of the Council. Therefore, future research can continue to investigate which technologies can assist in automating certain activities of the process model to make it more effective for the key stakeholders.

7.4.3 Feedback Analysis

The findings from the case studies showed that online platforms alone cannot capture the feedback of the wider community. Therefore, it is important to capture the feedback via both channels (Online and offline). The proposed process model provides activities for capturing feedback from both

channels. However, this research only analysed feedback from the offline engagement platforms. Thus, future research should consider the feedback from both channels and provide integrated analysis. In addition, by analysing both feedback together, similar issues can be integrated and different ones can be addressed separately based on the need of the community. This will ensure that a wider perspective of the community is considered for taking any further action in the future and will enrich the components of the process model. Lastly, future research work can also explore the technologies that can be adapted for integrating and assessing feedback from multiple channels.

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Appendix A: Systematic Literature Review Process

SLR Based on method (Yigitcanlar *et al.*, 2019,p.352)
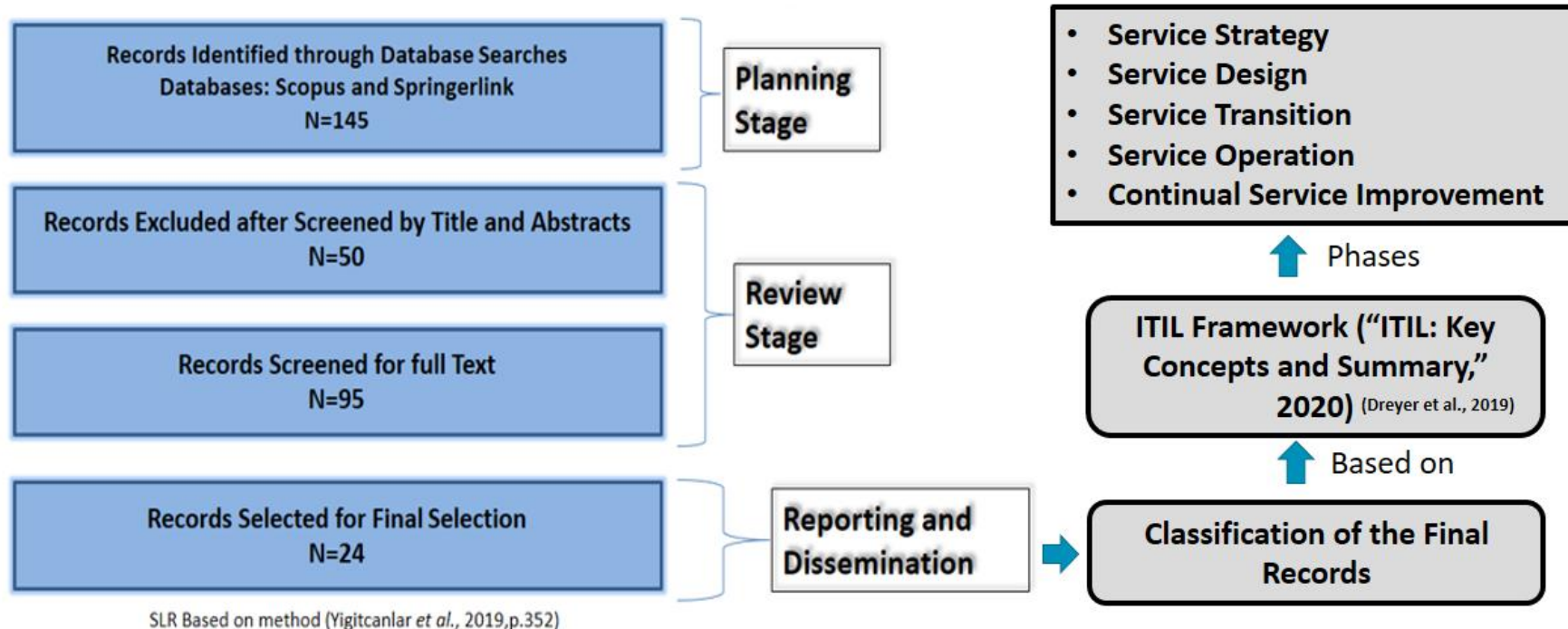
Appendix B: Interview questions for problem investigation phase- Case Study A

1. How the requirement is given to the service providers for designing the new services in the city and does it have any input from the citizens' side?
2. How does Council address the issues faced by people who are using the services?
3. In your opinion, can citizens' feedback be utilised for evaluating the performance of the services?
4. In your opinion, can their feedback help in further improvement of the services in terms of design and quality?
5. Who is responsible for monitoring the service in terms of operation?
6. Issues associated with the service for instance availability, maintainability, or any other service quality-related issues are completely resolved by service providers who provide the services?
7. Do the performance evaluation criteria of the service provider have any element related to the citizens, for instance, any KPI or any other element which is used for the evaluation against the citizens' experience of the service?
8. How does the council know that the service is working as per the initial requirement specification with service providers after the deployment of the services?
9. Do you analyse citizens' feedback after the deployment of the services to ensure that the service is working well in the real environment?
10. Is there any role of citizens in the actual design of the public services in your city?
11. Do you think, after deploying the public services, feedback given by the citizens on service performance can improve the quality of the service further?
12. Is there anything you would like to add?

Appendix C: Interview questions for problem investigation phase-Case Study B

1. Can you explain the process that you go through?
2. Can you explain what is [name of community engagement process] programs in [name] county of Ireland?
3. What are the existing challenges in these programs from your viewpoint?
4. Does the citizens' engagement happen in a standard way?
5. Does this engagement have any implication for the actual design of the public services? and are they both being treated as separate entities?
6. Do you think that the service design process could be benefited from this type of engagement?
7. Name of any service that you can provide that has considered citizens input and feedback as part of the existing process for designing or improving the services in public domain?
8. How the requirement is given to the service providers for designing the new services in the city and does it have any input from the citizens' side?
9. How do they address the issues faced by people who are using the services?
10. Is there any mechanism that they use for evaluating the performance of the services based on citizens' feedback?
11. Does this engagement also consider the feedback after deploying the services?
12. What kind of concerns and ideas do the community usually come up with for the development of their community? /What are these development? Any example?
13. As per the information available online about PPN, can you explain what type of feedback is taken as input for policymaking? Any example that you can provide?
14. What kind of implication those inputs can have in transforming public services or designing the public services?
15. What kind of relationship is there between such engagement and other services, for instance, planning, housing, parking, or any other service?
16. How does Council plan to measure/assess the performance of those projects/services after the deployment? For instance, how do you plan to ensure that citizens' need has been met?
17. Have you considered any quality factors associated with these projects/services? any example that you can provide?
18. From your end, where do you find the challenges in this integrated development?
19. Is there anything you would like to add?

Appendix D: Interview questions during the Design and Development phase

1. How easy the artefact is to understand and comprehend?
2. What do you think about the proposed artefact in terms of its applicability to the problem domain?
3. Is the proposed artefact relevant to the identified problem?
4. Which part of the model (proposed solution) should be improved to make it clearer and easy to understand?
5. What are the additional changes that you would like to include to improve its usability?
6. What do you think about an overall model with respect to its usefulness for the identified challenges?

Appendix E: Interview questions for ex-post evaluation in case study A and case study B

1. Are the components of the model represented correctly?
2. Are all the elements of the model relevant for addressing the challenges?
3. Is it easy to understand the current process model?

> 3.1 Would you be able to navigate the different components of the model?

4. Does the process model provide a complete representation of your existing process?

> 4.1 is there anything missing in the existing model to improve existing services based on the community's feedback?

5. Do you think that entities, relationships, and structural constraints are added adequately to represent the process model?
6. Is the presented process model useful to address the complexity in terms of managing different services and information obtained from the community's end?
7. Does the proposed process model provide a coherent view between citizens' feedback and its relationship with other services?
8. Is the proposed model useful to improve existing services based on citizens' feedback? if yes, then how?

> 8.1 Would this model be useful for managing the community's feedback or addressing their concerns?

9. How and for which purpose you would use the proposed process model?

> 9.1 Do you think the components of the model are relevant to your existing engagement program?

10. Do you think the proposed process model is more effective than your current one? If yes, then why?
11. Would the output of this process model provide a better outcome as compared to what you already have in place?
12. Does it provide you with a structured approach to improve existing public services based on citizens' feedback?
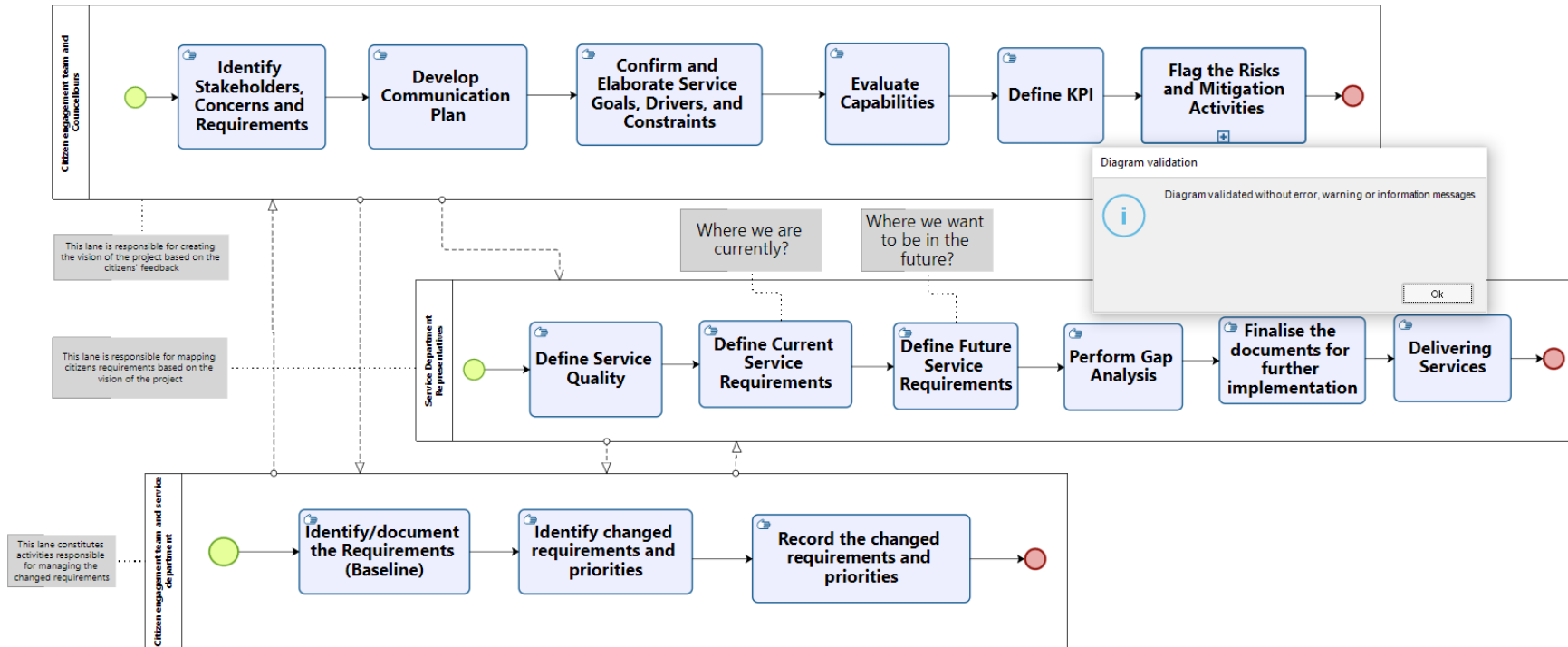
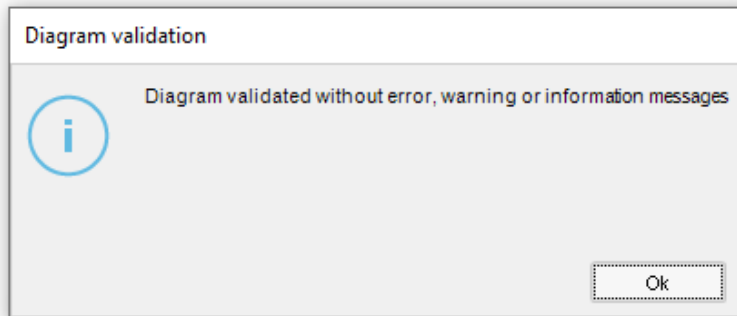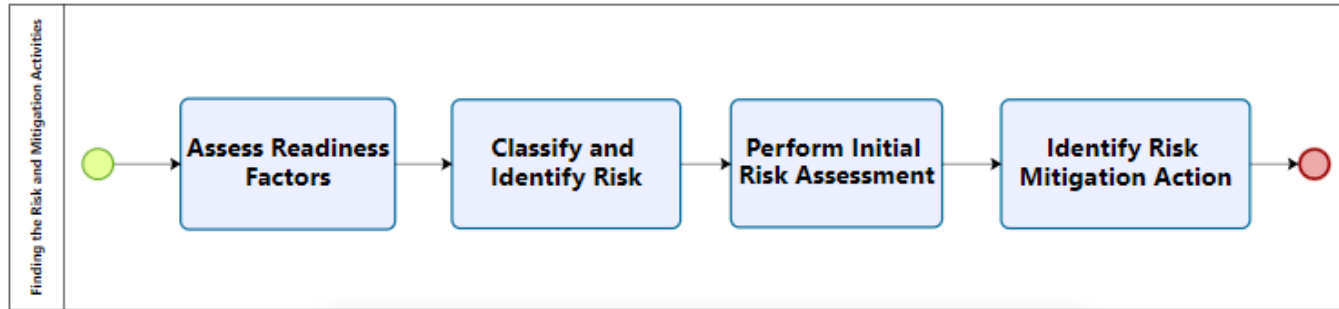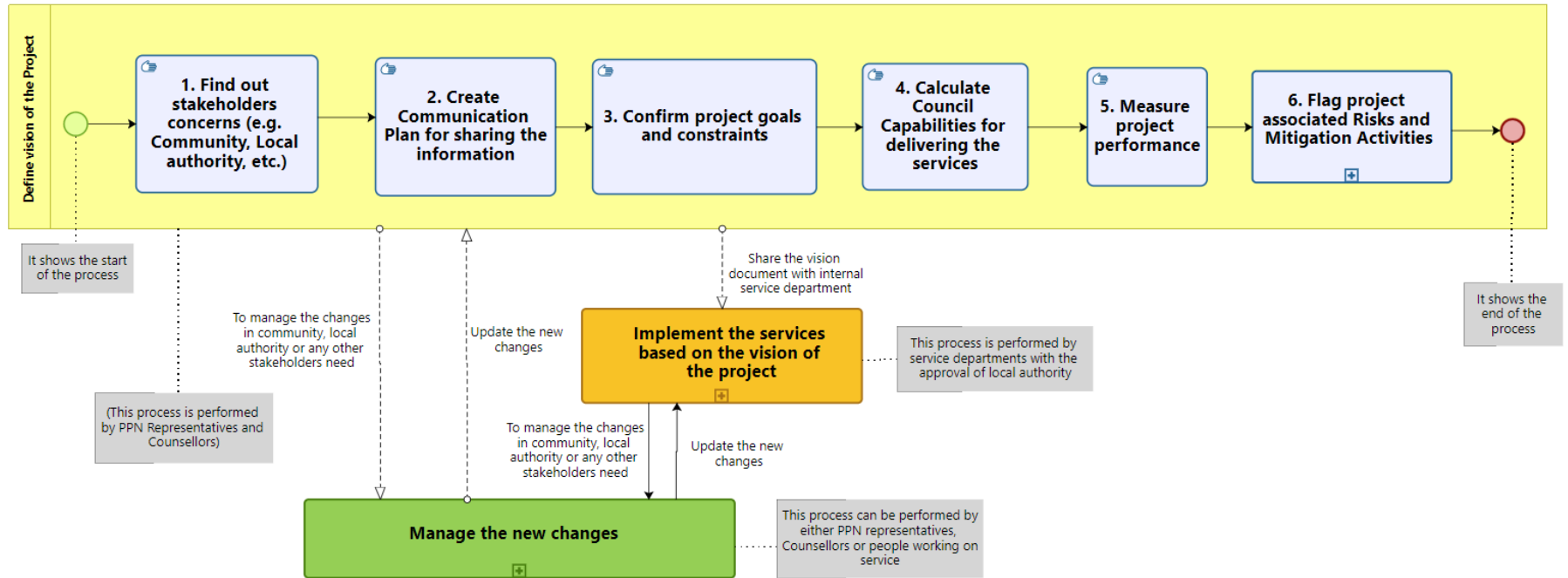## Appendix F: Results for Syntactic Evaluation
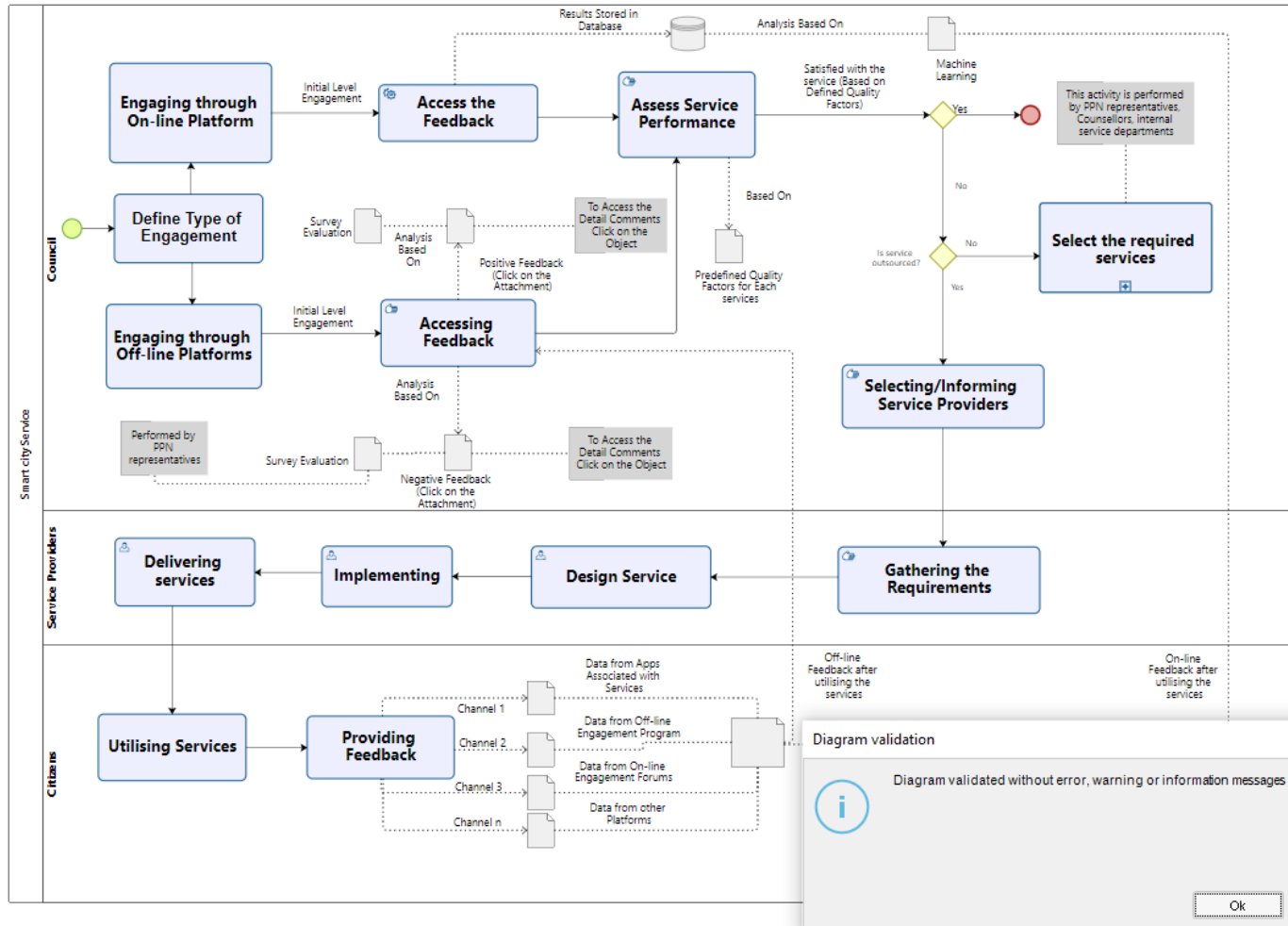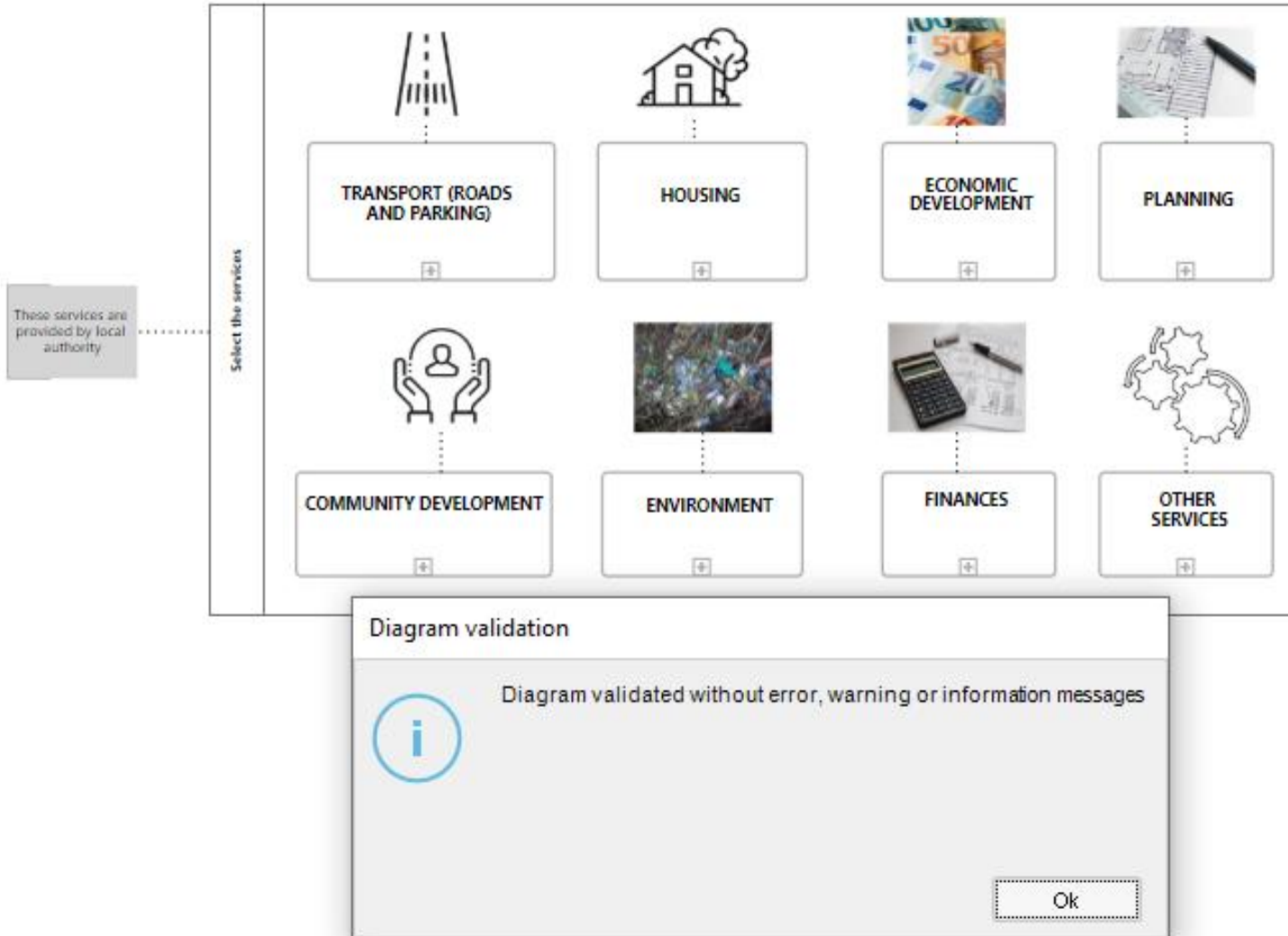
Appendix F: Results for Syntactic Evaluation (Continued)

Appendix F: Results for Syntactic Evaluation (Continued)

Appendix G: Updated version of the third stage of the process model for County Council B

Appendix H: Summary of Findings from systematic literature review

References	Service Lifecycle Phases				
	SS	SD	ST	SO	CSI
(Zhu *et al.*, cc2022)				x	
(Wolff et al., 2020)		x			
(Timeus, Vinaixa and Pardo-Bosch, 2020)	x				
(Abella, Ortiz-De-Urbina-Criado and De-Pablos-Heredero, 2019)		x			x
(Andreani et al., 2019)		x			
(Gupta, Chauhan and Jaiswal, 2019)		x			
(Simonofski et al., 2019)	x				
(Anthony Simonofski *et al.*, 2019)	x	x	x		
(Rana *et al.*, 2019)	x				
(Brandt et al., 2018)	x				
(Javed, Khan, & McClatchey, 2018)	x				
(Cabitza, Locoro and Batini, 2018)			x		
(Abu-Tayeh, Neumann and Stuermer, 2018)				x	
(Okwechime, Duncan and Edgar, 2018)			x		
(Marrone and Hammerle, 2018)	x				
(Weerakkody et al., 2017)	x		x		
(Janssen et al., 2017)			x		
(D. Gagliardi *et al.*, 2017)			X		
(Ludlow *et al.*, 2017)	x				
(van Waart, Mulder and de Bont, 2016)		x			
(Shareef et al., 2016)			x		

References	Service Lifecycle Phases				
	SS	SD	ST	SO	CSI
(Góngora and Bernal, 2015)	x				
(Ojala *et al.*, 2015)		x			
(Solaimani, Bouwman and Itälä, 2015)					X
(Van der Graaf and Veeckman, 2014)			x		
Number of Articles	9	7	8	2	2