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TOWARDS AN E-PARTICIPATION ARCHITECTURE FRAMEWORK (EPART-Framework)

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To my mother.

Abstract

The provision of electronic participation services (e-participation) is a complex socio-technical undertaking that needs comprehensive design and implementation strategies. E-participation service providers, in the most cases administrations and governments, struggle with changing requirements that demand more transparency, better connectivity and increased collaboration among different actors. At the same time, less staff are available. As a result, recent research assesses only a minority of e-participation services as successful. The challenge is that the e-participation domain lacks comprehensive approaches to design and implement (e-)participation services. Enterprise Architecture (EA) frameworks have evolved in information systems research as an approach to guide the development of complex socio-technical systems. This approach can guide the design and implementation services, if the collection of organisations with the commonly held goal to provide participation services is understood as an E-Participation Enterprise (EE). However, research & practice in the e-participation domain has not yet exploited EA frameworks. Consequently, the problem scope that motivates this dissertation is the existing gap in research to deploy EA frameworks in e-participation design and implementation. The research question that drives this research is: *What methodical and technical guides do architecture frameworks provide that can be used to design and implement better and successful e-participation?*

This dissertation presents a literature study showing that existing approaches have not covered yet the challenges of comprehensive e-participation design and implementation. Accordingly, the research moves on to investigate established EA frameworks such as the Zachman Framework, TOGAF, the DoDAF, the FEA, the ARIS, and the ArchiMate for their use. While the application of these frameworks in e-participation design and implementation is possible, an integrated approach is lacking so far. The synthesis of literature review and practical insights in design and implementation of e-participation services from four projects show the challenges of adapting architecture frameworks for this domain. However, the research shows also the potential of a combination of the different approaches. Consequently, the research moves on to develop the E-Participation Architecture Framework (EPART-Framework). Therefore, the dissertation applies design science research including literature review and action research. Two independent settings test an initial EPART-Framework version. The results yield into the EPART-Framework presented in this dissertation.

The EPART-Framework comprises of the EPART-Metamodel with six EPART-Viewpoints, which frame the stakeholder concerns: the Participation Scope, the Participant Viewpoint, the Participation Viewpoint, the Data & Information Viewpoint, the E-participation Viewpoint, and Implementation & Governance Viewpoint. The EPART-Method supports the stakeholders to design the EE and implement e-participation and stores its output in an architecture description and a solution repository. It consists of five consecutive phases accompanied by requirements management: Initiation, Design, Implementation and Preparation, Participation, and Evaluation. The EPART-Framework fills the gap between the e-participation domain and the enterprise architecture framework domain. The evaluation gives reasonable evidence that the framework is a valuable addition in academia and in practice to improve e-participation design and implementation. The same time, it shows opportunities for future research to extend and advance the framework.

Zusammenfassung

Die Bereitstellung elektronischer Beteiligungsverfahren (E-Partizipation) ist ein komplexes sozio-technisches Unterfangen, das eine sorgfältige Vorgehensweise erfordert. Die Herausforderung ist, dass Regierungen oder Kommunalverwaltungen, als häufigste Anbieter, bei der ganzheitlichen Planung und Umsetzung nur unzureichend unterstützt werden. Infolgedessen beschreibt die Literatur nur wenige E-Partizipationsangebote als erfolgreich. Die Wirtschaftsinformatik entwickelte das Konzept der Enterprise Architectures um die Entwicklung komplexer sozio-technischer Systeme zu unterstützen. Versteht man die Gruppe an Organisationen, die E-Partizipationsverfahren bereitstellt nun als Enterprise, so können die Prinzipien von Enterprise Architectures angewendet werden. Nichtsdestotrotz wurde dieser Ansatz in der E-Partizipationspraxis und –Forschung bisher kaum beachtet.

Motiviert durch diese Forschungslücke, untersucht die Dissertation bestehende Ansätze aus der E-Partizipationspraxis und –Forschung auf Besonderheiten und Schwachstellen, um anschließend den Nutzen bestehender Rahmenwerke für Enterprise Architectures im Kontext von E-Partizipation zu analysieren. Die Literaturstudie überprüft sowohl konzeptionelle als auch prozedurale Ansätze aus Praxis und Wissenschaft auf ihre Ganzheitlichkeit und identifiziert die Herausforderungen. Im Rahmen von vier Projekten wird das Vorgehen beim Entwurf und der Umsetzung von elektronisch unterstützten Beteiligungsverfahren dokumentiert und ausgewertet sowie Verbesserungspotenziale aufgezeigt. Enterprise Architecture Frameworks (Zachman Framework, TOGAF, DoDAF, FEA, ARIS, und ArchiMate) werden auf Anforderungen und Nützlichkeit für E-Partizipation untersucht. Die Ergebnisse zeigen die Herausforderungen bei der Übernahme existierender Enterprise Architecture Frameworks, aber auch das Potential einer Kombination aus speziellen Ansätzen für E-Partizipation mit Enterprise Architectures auf. Folglich ist das Ziel der weiteren Forschung die Entwicklung eines Architekturrahmenwerks für E-Partizipation.

Die vorliegende Dissertation führt die Ergebnisse der Literaturstudien und Aktionsforschung zusammen und wendet dementsprechend Konstruktionsforschung (Design Science Research) bei der Entwicklung des *E-Participation Architecture Framework* (*EPART-Framework*) an. Die initiale Version dieses Rahmenwerks wird in zwei unterschiedlichen Umgebungen angewandt und getestet. Die Erkenntnisse führen zu dem EPART-Framework, das in dieser Dissertation vorgestellt wird. Es besteht aus dem EPART-Metamodel, das E-Partizipation aus sechs verschiedenen Perspektiven unterschiedlicher Akteure (den sog. EPART-Viewpoints) betrachtet. Die EPART-Method unterstützt den Entwurf und die Umsetzung von E-Partizipation mit Hilfe des EPART-Frameworks. Sie beschreibt fünf, durch Anforderungsmanagement begleitete, Phasen: Initiierung, Entwurf, Umsetzung, Partizipation und Evaluation. Die Ergebnisse während diesen Phasen werden in der Architekturbeschreibung (Architecture Description) und dem Solution Repository gespeichert. Das finale EPART-Framework wird im Rahmen der Arbeit evaluiert, um Empfehlungen für die Anwendung sowie weiteren Forschungsbedarf aufzuzeigen. Die Ergebnisse geben Grund zur Annahme, dass das EPART-Framework die Lücke zwischen E-Partizipation und Enterprise Architectures füllt und Forschung und Praxis in dem Feld wertvoll ergänzt.

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List of Abbreviations

ADM	Architecture Development Method
ARIS	Architecture of Integrated Information Systems
BPMN	Business Process Modelling Notation
CEAA	Canadian Environmental Assessment Agency
CMS	Content Management System
CSO	Civil Society Organisation
DEMO-net	Network of excellence for e-participation (EU funded project)
DODAF	Department of Defence Architecture Framework
DSR	Design Science Research
EA	Enterprise architecture
EAF	Enterprise architecture framework
EC	European Commission
EE	E-Participation Enterprise
EEA	E-Participation Enterprise Architecture
EPA	US Environmental Protection Agency
EPART	E-Participation Architecture
EPC	Event-driven process chain
EU	European Union
FEAF	Federal enterprise architecture framework
GoM	Guidelines of Modelling
HOBE	House Of Business Engineering
IAP2	International association for public participation
ICT	Information and communication technology
IEEE	Institute of Electrical and Electronics Engineers
IS	Information systems
KoMePol	Research Focus *Communication, Media and Politics*, in German: Forschungsschwerpunkt *Kommunikation – Medien – Politik* (project by the state Rhineland-Palatinate)
LEX-IS	Enabling participation of the youth in the public debate of legislation among parliaments, citizens and businesses in EU (EU funded project)
MEP	Member of the European Parliament
MS	Microsoft
NGO	Non-governmental organisation
OCOPOMO	Open Collaboration for Policy Modelling (EU funded project)
OECD	Organisation for Economic Co-operation and Development
PRINCE2	PRojects IN Controlled Environments 2
SMART	Specific, Measurable, Achievable, Realistic, and Time-bound
TOGAF	The Open Group Architecture Framework
UML	Unified Modelling Language
VoicE	Giving citizens a voice in EU policy-making (EU funded project)
VoiceS	Integrating semantics, social software and serious games into e-participation (EU funded project)
WCMS	Web Content Management System
WYSIWYG	What You See Is What You Get

Part I. INTRODUCTION AND FOUNDATIONS

1. Introduction

This dissertation is situated in the field of electronic participation research, often called e-participation. The field encompasses the investigation of the use of information and communication technologies[1] (ICTs) to enable individuals and groups to engage in policy making and democratic decision making (Macintosh, 2004a; Sæbø, Rose, & Flak, 2008). E-participation is understood as an interdisciplinary research field (Macintosh, Coleman, & Scheeberger, 2009; Medaglia, 2012, p. 346; Panopoulou, Tambouris, & Tarabanis, 2014, p. 196; Sæbø et al., 2008, p. 401; Sanford & Rose, 2007; Wimmer, Schneider, & Shaddock, 2007). It combines concepts from communications research, computer science, information systems research, social and political philosophy, political science, public administration, and sociology (Sanford & Rose, 2007, p. 411). Some authors see e-participation as a subdiscipline of e-government[2]. This research is positioned within the IS and e-government disciplines.

E-participation postulates that the path to better informed political decision making runs through enabling citizens and citizen groups to participate in democratic decision making and provide appropriate ICT support. Thus, e-participation aims to enable more acceptance of political decisions and more trust in policy making (Macintosh, 2004a). Thereby, modern ICTs can play a crucial role in the engagement and collaboration processes (Macintosh, 2004a; Sæbø et al., 2008). With this background, the European Commission started a number of e-participation experiments in 2006 under the eParticipation Preparatory Action. Starting from 2008, I was involved in three of these pilot projects while working in the research group E-government at the University Koblenz-Landau[3]. They triggered my interest to investigate how architecture frameworks can support e-participation design and implementation and how e-participation best practices can be framed to facilitate future developments. This initial chapter describes the motivation behind and the objectives of this dissertation.

The remainder of this chapter is structured as follows. First, it motivates the research and defines the research scope. Afterwards, it presents the research aims, objective and questions tackled in this dissertation in Section 1.2. The chapter furthermore gives an overview of the research design in Section 1.3 before presenting the main contributions to research and practice in Section 1.4. Section 1.5 outlines the dissertation's structure.

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[1] As Neubauer, Vuga, and Ilc (2012, p. 224) outline, the literature uses various terms like "new media, the net, Internet, network of networks, and cyberspace" interchangeably for the same kinds of "tools, applications, gadgets, and platforms" when referring to ICTs. This dissertation uses the term ICT as "an umbrella term that includes any communication device or application, encompassing radio, television, cellular phones, computer, and network hardware and software, (…) and various services and applications associated with them, such as video-conferencing and distance learning" (Pagani, 2005, p. 453).

[2] E-government itself is, according to Wimmer (2007a, 2007c), understood as an applied multidisciplinary research field based on social and human sciences, political sciences and jurisprudence, public management sciences, organisational sciences, information and knowledge research sciences, computer sciences, and economics. With e-government, this research focusses on governmental usage of ICT to "support government operations, engage citizens, and provide government services" according to the definition by Scholl (2003, p. 2).

[3] The projects were LEX-IS, VoicE, VoiceS; later followed OCOPOMO (more information is available in Section 5.2).

1.1 Motivation and Scope

Citizen participation, i.e. the engagement of individuals and groups in policy making (Macintosh, 2004a), is a key element of a healthy democracy (Barber, 1984; Habermas, 1992; Roberts, 2004; Verba, Schlozman, & Brady, 2002) and a governmental duty (United Nations (UN), 2014, p. 61). ICT has been used to facilitate citizen participation for several decades (Harth, 1999; Kubicek, 2016, p. 307). The potential for using electronic media to reach many people increased with the spread of the internet in the 1990s (Harth, 1999) and with the Web 2.0 technologies again in the 2000s (Kubicek, 2014, p. 265; Maier, 2007; Organisation for Economic Co-operation and Development (OECD), 2004, p. 33; UN, 2014, p. 62). Different participation visions and objectives drive e-participation. E-participation can enhance statutory citizen participation, such as the online petitioning platform of the German Bundestag[4]. Petitioning, a right granted in the German Basic Law[5], was paper-based before the launch of the platform in 2005[6]. This platform allows citizens to submit petitions and to sign public petitions via online web forms. Operated by the German government, the platform is accepted as legally binding, in contrast to petitioning platforms offered by non-governmental organisations (NGOs)[7], e.g. *OpenPetition*[8]. An example of citizen participation not granted by law (in most cases (Scherer & Wimmer, 2012b)) but offered by the government is participatory budgeting[9], which allows citizens to have a say in communal budgeting during a given period. A best-practice case in Germany is the *Bürgerhaushalt Köln*[10], which uses an online platform as the main participation channel in a multi-channel approach[11]. The *Bürgerhaushalt Köln* asks citizens for proposals on specific budgetary fields, whereby the final decision stays in the hands of the city council. The online platform allows citizens to submit, discuss, and vote on proposals. At the same time, citizens can submit proposals in written form or via a call centre. The city of Bonn launched in 2014 the *BONN MACHT MIT!* platform, which bundles information on planned, ongoing and past participation procedures in the city[12] and offers different participation services[13]. Furthermore, e-participation does not only aim to enhance *traditional* participation services; it also creates new ones. One example is *liquid democracy*, which enables the individual citizens to vote on each particular issue of a policy – either by doing it themselves or by delegating it to an authority (Litvinenko, 2012). ICT plays a major role to enable the traceability of delegations and decision making.

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[4] https://epetitionen.bundestag.de/ (access 2016-05-14)

[5] Article 17 and Article 45 c of th German Basic Law (see https://epetitionen.bundestag.de/epet/service.$$$.rubrik.rechtlichegrundlagen.html, access 2016-05-14)

[6] https://epetitionen.bundestag.de/epet/service.html (access 2016-05-14)

[7] https://epetitionen.bundestag.de/epet/purubrik.$$$.rubrik.LeserBrief.html (access 2016-05-14)

[8] https://www.openpetition.de/ (access 2016-05-14)

[9] Legal regulations for municipal budgets in Germany define only the formal procedures within the public administration and the municipal council (Scherer & Wimmer, 2012b).

[10] https://buergerhaushalt.stadt-koeln.de/ (access 2016-05-14)

[11] http://www.buergerhaushalt.org/de/best_practice#n139 (access 2016-05-14)

[12] *BONN MACHT MIT! Das Portal für Bürgerbeteiligung in Bonn* (https://www.bonn-macht-mit.de/, 2016-05-14)

[13] In general, there should be no differentiation between electronically supported and traditional participation services, because either participation channels need to be supported in today's society. However, if an emphasis is put on the fact that a service is or should be supported electronically, the term *e-participation service* is used in this dissertation.

Even if there are successful e-participation examples, literature states that the possibilities of using ICT in political participation, i.e. e-participation, have not been sufficiently exploited (Smith, Macintosh, & Millard, 2011). The majority of participation services is isolated. As a result, interoperability between such services and related political or administrative services is limited (Scherer, Liotas, Wimmer, Tambouris, & Tarabanis, 2011). E-participation cases with successful results are in the minority as a study in Germany shows (Stock, 2011, p. 12). Public administrations struggle with changing requirements demanding more transparency, better connectivity and collaboration among different actors (DGCONNECT, 2013). Reasons are, for example, organisational barriers in the governments such as financial and personal constraints (DGCONNECT, 2013), socio-technical barriers resulting from ICT acceptance (Macintosh & Whyte, 2008, p. 28) as well as participants' lack of interest and time (Gabriel & Mößner, 2002, p. 21). How ICT can be employed for creating a meaningful and effective participation environment is still described as challenging by governmental organisations (UN, 2014, p. 62). Consequently, an e-participation enterprise (EE), understood as a collection of organisations with the commonly held goal to provide e-participation services, is a complex socio-technical system[14] (Wimmer, 2007b) that needs careful and comprehensive design and implementation. This is due to the large number of factors as that characterise e-participation such as diverse participation areas, involved stakeholders with often contradictory interests, levels of engagement, and stages in policy-making, social and digital developments (Kalampokis, Tambouris, & Tarabanis, 2008; Macintosh, 2004a; Tambouris, Kalampokis, & Tarabanis, 2008; Wimmer, 2007b). We experienced a lack of approaches guiding the design and implementation of such a complex system (Scherer et al., 2011). Similar experiences were made recently by other researchers (e.g. Kubicek, 2016; Millard, 2009; Panopoulou et al., 2014).

Enterprise Architecture (EA) frameworks evolved in IS research as an approach to guide the development of complex socio-technical systems in e-business and e-government (Janssen, 2012; Janssen, Flak, & Sæbø, 2013; Janssen & Hjort-Madsen, 2007). Understood as an instrument that advices the architect in the development, implementation, and sustainment of a range of different architectures (derived from Perroud & Inversini, 2013; ISO/IEC/IEEE 42010:2011; The Open Group (TOG), 2011a, p. 7), such frameworks can provide a means to manage the complexity of e-participation. If we understand the collection of organisations, who have the common goal of providing e-participation services as an *E-participation Enterprise (EE)*, we can apply the methods and techniques of EA frameworks. They can guide the design of EE Architectures (EEAs) to support the comprehensive design and implementation of participation services. Since e-participation is a relatively new research area, its architecture strategy has not been widely discussed in the literature. The questions are (1) if such an application addresses the challenges of e-participation design and implementation, (2) if adaptions are necessary to facilitate the application of EA frameworks, and (3) what these adaptions are. Therefore, the driving research question is: *What methodical and technical guides do architecture frameworks provide that can be used to design and implement better and successful participation services?* In particular, to link the participation vision with the ICT developments, participation services, pro-

[14] The term *socio-technical system,* according to Cherns (1976, p. 784), refers to the circumstance that a productive system needs a social system. The social system integrates the people who are responsible for operating, maintaining, renewing, and accounting for it.

cesses, and participation results. Consequently, the problem scope that motivates this dissertation is the existing gap in research to deploy EA frameworks in the design and implementation of participation services. From these considerations, the following section presents the research aims, research objective and corresponding research questions.

1.2 Research Aims, Objective and Questions

The aims of this dissertation are twofold: (1) to contribute to designing and operating an EE, and (2) to contribute to improving the design and implementation of e-participation services. To achieve these aims, the following research objective is defined:

Research Objective: Develop an E-Participation Architecture Framework (EPART-Framework) as an instrument that provides a coherent whole of principles, templates, and methods, and models to guide participation service providers the comprehensive design of and implementation of e-participation services.

The purpose is to enable the success of the EE with optimised participation services, processes and ICT, and a lower total cost of ownership. Therefore, this instrument aims to guide the design and description of an EEA including its organisational structure, participation services, processes, information systems, and ICT infrastructure. The design and implementation of such services comprises their planning, preparation, supply, maintenance, and evaluation. The following research questions guide the work towards this research objective:

Research Question 1. What are the challenges in designing and implementing e-participation services?

This research question aims to provide insights into the significant issues surrounding the design and implementation of e-participation services (short: e-participation design and implementation). While investigating the challenges, the goal is to analyse the state-of-the-art in e-participation design and implementation in scientific and practitioner literature. These findings help to refine the problem scope of the dissertation identified in Section 1.1 and to lay the foundation for the subsequent research.

Research Question 2. What are the commonalities and variations around architecture frameworks and e-participation design and implementation?

This research question targets the problem of consolidating existing design and implementation approaches from the e-participation body of knowledge with those of the architecture framework body of knowledge. The goal is to derive insights into the use of architecture framework techniques in e-participation design and implementation including the potential and limitations. This research question aims to analyse to what extent existing architecture frameworks support an EE in developing its architecture description and how this can contribute to the design and implementation of e-participation services. It furthermore aims to investigate what challenges hinder the usage of these frameworks and what gaps exist.

Research Question 3. What should the EPART-Framework look like and what components should it include?

The key objective is to select the relevant components of the approaches studied in Research Question 1 and Research Question 2 and synthesise the results to design the EPART-Framework. Answering this research question provides insights into the main requirements for the EPART-Framework to meet its defined aims as well as recommendations and limitations regarding the designed framework. The research questions are answered and the EPART-Framework is designed by applying literature review, action research and design science research as presented in the following.

1.3 Overview of the Research Design

E-participation research tries not only to answer questions of technical efficiency, but also of economic, social and democratic feasibility (Wimmer, 2002, p. 150). As a consequence researchers are often confronted with a high fragmentation of the research field (Sæbø et al., 2008, p. 401). Interdisciplinary research areas such as e-participation are relatively young, emergent research areas and still lacking a theoretical foundation (Sæbø et al., 2008, p. 415). The result is the demand for more conceptual research and the development of appropriate conceptual and methodological models. Therefore, a largely constructive and explorative approach was chosen.

In applied research fields such as IS research and E-government research (Wimmer, 2007c, p. 85), an approach referred to as *Design Science Research* (DSR) has been established (Hevner, March, Park, & Ram, 2004; Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007; Vaishnavi & Kuechler, 2004). The researchers first structure a problem, jointly defined by practice and research, in order to develop solutions. They should base these solutions on a theoretical background plus practical experience, which suggest ways to shape the future (Hevner et al., 2004). By implementing these solutions in practice, they can be reviewed and then the underlying theory can be refined and adapted. An iterative multimethod approach is applied in this dissertation to answer the three research questions and design the EPART-Framework. Figure 1 illustrates the respective research design of this dissertation with the research questions, research methods and the main results.

Each research question is addressed by one or more research methods. The flow of research is from Research Question 1 to Research Question 3. Outcomes of one research method are used by the consecutive methods. However, iterations are given through iterations in the DSR applied. The research applies a multi-method approach to design the EPART-Framework and to answer the research questions as follows:

Research Question 1 is addressed through the review of e-participation literature studying the characteristics of e-participation design and implementation, and the benefits and limitations of existing approaches guiding it. The outcome serves as the foundation of this study, arguing the need to develop an e-participation architecture framework.

Research Question 2 is addressed by using the results from investigating Research Question 1 while focussing on the review of the e-participation literature on conceptual models, procedure models, and guidelines for e-participation. Furthermore, it is addressed through the review of literature on architecture frameworks with the ensuing integration of the results into the e-participation domain. In action research, four ethnographic studies

accompany the design and implementation of e-participation. These studies result in insights into e-participation practice. The synthesis of results brings further insights into use of architecture frameworks techniques in e-participation design and implementation.

Research Question 3 is addressed through a multitude of research methods driven by an iterative design approach. Literature review and action research serve to identify a rigorous and relevant research objective, study existing approaches used, and derive requirements for the EPART-Framework. These results of a first design stage are synthesised to an initial version of the EPART-Framework. Its application in the design and implementation of e-participation and a second round of literature review result in refinements and revisions of the framework in the second design stage. The resulting EPART-Framework is evaluated against the EPART-Framework requirements. Following the evaluation, the results of the dissertation are synthesised to derive recommendations and limitations, thus concluding the research.

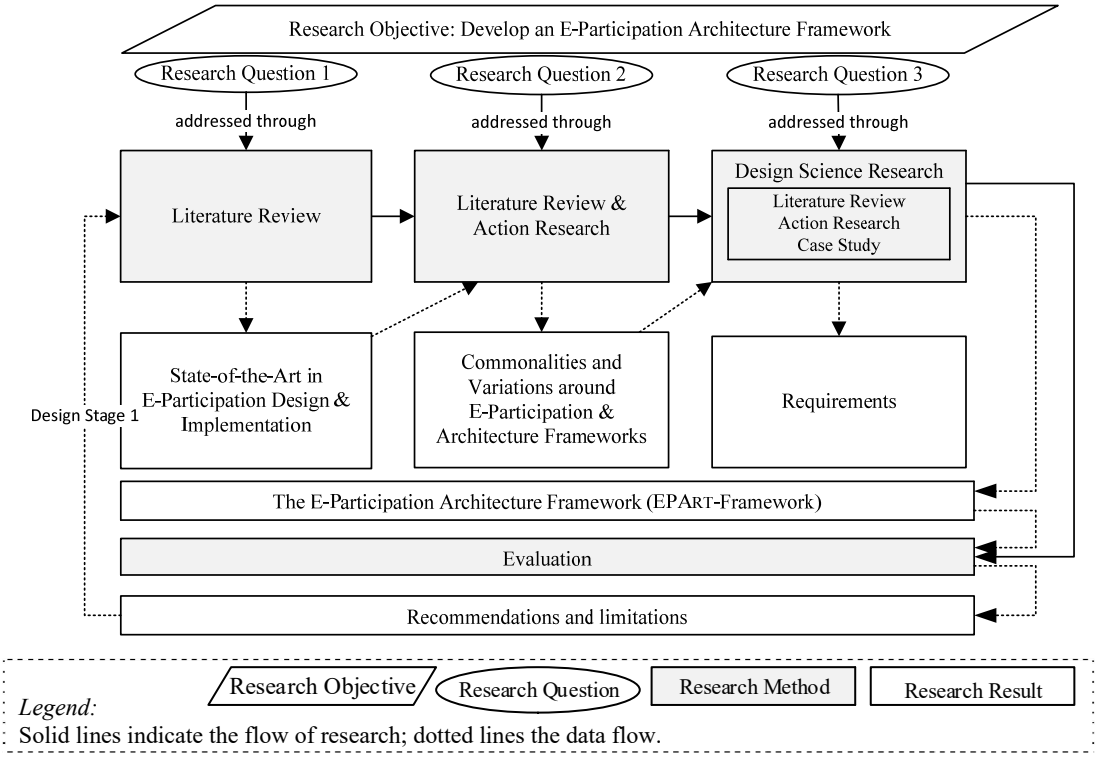


Figure 1. Overview of research design and main research results

A detailed discussion of the research design follows in Chapter 3.The next section elaborates the contributions in addressing the research questions.

1.4 Contributions of this Dissertation

The objective of this dissertation is to contribute to the knowledge base regarding the design and implementation of e-participation supported by enterprise architecture methods. Therefore, an e-participation architecture framework (*EPART-Framework*) is developed. The main conceptual contributions of the dissertation are

– the *EPART-Metamodel* that semantically defines the terms relevant in the EPART-Framework and supports conceptualisation of an EE,

- the *EPART-Viewpoints* that describe e-participation stakeholders and their concerns and propose relevant kinds of architecture models,
- the *EPART-Reference Models* that present best practice architecture models describing an EE,
- the *EPART-Method* that describes phases and activities guiding the design and implementation of e-participation through applying the EPART-Framework, and finally
- the EPART-Framework that frames these four components and their relationships.

The *EPART-Metamodel* specifies the syntax and conceptual structure of an EE by enabling a unified description of EE entities. It describes entities such as participation vision, impact, outcome, output, participation service, actor, role, process, activity, application and technology component in order to conceptualise an EE. The interrelationships between these entities enable to link technological developments with the participation vision (i.e. the mission for enabling e-participation). UML class models present graphically the entities and their relationships. The EPART-Metamodel furthermore provides a glossary describing the semantics of the entities.

The *EPART-Viewpoints* guide the development of views on the EPART-Metamodel by considering different stakeholders and their concerns. Each viewpoint proposes a selection of architecture model types, which are proven successful for designing and describing an EE. The *Participation Scope Viewpoint* is concerned with the definition of the participation vision, objectives and principles. The *Implementation & Governance Viewpoint* is concerned with operations, administration and management of the EE. The *Participant Viewpoint* is concerned with engagement and management of the stakeholders in the EE. The *Participation Viewpoint* is concerned with the definition of participation services and the participation processes and their meaningful integration into policy making and political decisions. The *Data & Information Viewpoint* is concerned with the definition and conceptualisation of the data and information available and needed. The *E-Participation Viewpoint* is concerned with the electronic support of the participation services and engineering of the ICT landscape that supports the Participation Vision.

The *EPART-Reference Models* include proven best practice architecture models supposed to be usable for an EE to develop its own architecture models. It includes amongst others a *Reference Requirement Catalogue*, a *Reference Principle Catalogue*, and *Reference Participation Process Models*, which were employed successfully in past e-participation experiments.

The *EPART-Method* establishes a framing process to support the stakeholders responsible for carrying out e-participation to develop its architecture and implement it. It specifies a procedure for when to do which activity and to employ which *EPART-Viewpoint*. The main steps are organised in a collection of five consecutive phases. In *Phase I. Initiation*, the EE constitutes itself and elaborates the participation vision and objectives. This phase ends with the decision if the EE will provide the participation services. A positive decision initiates the *Phase II. Design*, which aims at developing the integrative architecture of the EE. The following *Phase III. Implementation and Preparation* combines the implementation of ICT with the preparation of marketing and editorial content. The *Phase IV. Participation* combines the activities from different responsibilities to provide and maintain the participation services. The final *Phase V. Evaluation* aims to estimate the success of e-participation.

Finally, the *EPART-Framework* frames all these components and their relationships. In addition to the components described above, it describes an A*rchitecture Description* to store architectural outputs and a *Solution Repository* to store the solutions of the EPART-Method. Both are structured according to the EPART-Viewpoints.

This research is practice-oriented in the sense that it produces knowledge needed by practitioners (Dul & Hak, 2008, p. 31), i.e. those who provide or offer e-participation. However, researchers can use the contributions of the dissertation as well[15]. From a theoretical stance, this research contributes to the e-participation body of knowledge in the following ways: First, it identifies the research gap for architecture frameworks in e-participation and fills it with the EPART-Framework. Second, it consolidates existing knowledge by providing a literature review including

- a comparative analysis of models structuring e-participation and procedure models for e-participation and description of challenges in e-participation design & implementation (Chapter 4), and
- a comparative analysis of models structuring e-participation and procedure models for e-participation and architecture frameworks to study commonalities and variations (Chapter 5).

Moreover, this research contributes to a more business services and business processes based thinking in the e-participation domain. This is done by introducing a participation services and processes into e-participation design and implementation.

In the action research undertaken, I took a participating and observing role in four different ethnographic studies. Consequently, this dissertation addresses the research gap identified by Panopoulou, Tambouris, and Tarabanis (2014) by including practitioner insights:

> "Although more and better eParticipation offerings that exploit current good practice seem to be in evidence, *practitioners' experience in eParticipation is still poorly addressed* in current publications and research efforts across Europe, *including efforts to produce* tangible success factors and *practical guidelines for designing an eParticipation initiative*." (Panopoulou et al., 2014, p. 197, accentuation by the author)

The documentation of insights into e-participation design & implementation from four ethnographic studies (Chapter 5) is another contribution to the e-participation body of knowledge. Finally, this dissertation defines a set of requirements for (e-participation) architecture frameworks (see Appendix A) and provides a vocabulary of relevant terms and structures the e-participation domain with the EPART-Metamodel.

Next, the structure of the dissertation presenting these contributions is outlined.

1.5 Structure of this Dissertation

Part I. Introduction and Foundations introduces the reader to the topic, defines relevant terminology and sets the methodical foundations. Chapter 2 develops an understanding of *e-participation* and *architecture frameworks* and ends with defining the *e-participation en-*

[15] See Appendix E. Communications of this Dissertation.

terprise and *e-participation architecture framework*. Chapter 3 describes the research strategy to argue that results are meaningful. It details the research design introduced in Section 1.3 and argues the selection of research methods. Furthermore, it discusses design considerations to guide the subsequent EPART-Framework development,

Part II. Literature Review and Action Research scientifically grounds the overall research and documents the design of the EPArt-Framework to fulfil the research objective. Chapter 4 seeks to answer Research Question 1. It studies the state of the art in e-participation and identifies the challenges of e-participation design and implementation. In addition, it defines relevant requirements from the perspective of e-participation. Chapter 5 consolidates the literature reviews with insights from practice to answer Research Question 2. It presents related work, identifies the components of the EPART-Framework and documents insights from the action research.

Part III. Design of the E-Participation Architecture Framework presents the developed EPART-Framework. Chapter 5 provides an overview of the framework and presents the EPART-Viewpoints, the EPART-Metamodel and the EPART-Reference Models. Chapter 7 gives an overview of the EPART-Method and describes its five phases in detail. Accordingly, Chapter 5 and Chapter 7 seek to answer Research Question 3.

Part IV. Evaluation and Conclusions presents the evaluation approach and evaluation results of the developed EPART-Framework and concludes this dissertation. Chapter 8 describes the observational evaluation of the initial version of the EPART-Framework as part of the iterative design approach and the final analytical evaluation compares the results with the requirements. Chapter 8 synthesises the dissertation with summarising the research results and answering the research questions. It argues the rigour of the overall methodical approach, critically analyses the outcomes and the limitations of the study, and gives an outlook on future work.

2. Definitions

This chapter introduces terms relevant to this dissertation. Based on the research objective, two conceptual clarifications are necessary: On the one hand, an understanding of *e-participation* is developed (Section 2.1). On the other hand, the meaning of the term *architecture framework* and its purpose are clarified (Section 2.2). The chapter concludes with a summary of the two conceptual clarifications to develop an understanding of the term *e-participation architecture framework* (Section 2.3).

2.1 E-Participation

E-participation is a relatively new research discipline in comparison to many other disciplines, even if activities in this field are not new per se as Sæbø et al. (2008, p. 401) argue. The suggestion that e-participation should become an independent research area appeared, according to Sæbø et al., with a number of e-participation experiments started or initiated by governments (see Scherer, Schneider, Wimmer, & Shaddock, 2008 for an overview).

The *e* for *electronic* or *electronically supported* emerged from the tradition of other *e*-disciplines such as *e-business*, *e-governmen*t or *e-democracy* (Peristeras, Mentzas, Tarabanis, & Abecker, 2009, p. 15; Sæbø et al., 2008, p. 402; Sanford & Rose, 2007, p. 909). The term refers to the use of ICT and its ability to change or transform the participation processes (Sanford & Rose, 2007, p. 909). *Participation* in general can be defined as the process in which individuals or groups take possession of a part of a whole (Scheu & Autrata, 2013, p. 10, all translations from German are my own). Based on this general understanding, many research disciplines with different orientations address *participation* and *e-participation* (Gabriel & Mößner, 2002, p. 215; Sæbø et al., 2008, p. 402; Scheu & Autrata, 2013; Voss, 2014, p. 9). So the interdisciplinary research area e-participation (Macintosh et al., 2009; Medaglia, 2012, p. 346; Sæbø et al., 2008, p. 401; Wimmer et al., 2007) lacks a generally accepted definition of *e-participation* (Sæbø et al., 2008, p. 400). As this dissertation focuses on citizen participation in democratic decision making, it is necessary to define the term *citizen participation* before a working definition of e-participation in the context of citizen participation is proposed.

2.1.1 Citizen Participation

> „Citizen Participation is at the heart of democracy. Indeed, democracy is unthinkable without the ability of citizens to participate freely in the governing process.” (Verba et al., 2002, p. 1).

In principle, this dissertation sees *(citizen) participation* as *engagement of citizens in democratic decision making and policy making.* This is the key aspect of every democracy (Barber, 1984, p. 151; Habermas, 1992, p. 435; Roberts, 2004, p. 315; Verba et al., 2002, p. 1). Though, participation includes direct attempts to influence the policy-making process (such as activism and opinion forming) within and outside the formal political system (as

Sanford & Rose, 2007, p. 409 propose). Buse and Nelles (1975, p. 41) describe such form of political participation as a specific form of social action that is not defined by the type of activity but through the field in which it takes place. The authors furthermore state that each action could be political as it may have unconscious and unexpected effects on the political process (see also Scheu & Autrata, 2013, p. 12). Scheu and Autrata grasp the complexity of the concept participation as follows: If (political) participation is understood as the common forms around parliamentary elections only, many other forms, which have been enforced thoroughly, remain excluded (Scheu & Autrata, 2013, p. 15). If participation research focuses on the participation form debate, it is shredded into many detailed questions: What participation is exactly remains unclear (Scheu & Autrata, 2013, p. 15). Surely, you just know that participation can take many different forms (Scheu & Autrata, 2013, p. 15).

A specific goal or purpose of participation might help to develop a clearer understanding (Buse & Nelles, 1975, p. 42; Scheu & Autrata, 2013, p. 16). Without such a goal, Scheu and Autrata (2013, p. 17) describe e.g. political participation as political apathy; a specific form of political participation. Nevertheless, Scheu and Autrata (2013, p. 18) also see a difficulty in the definition of an appropriate goal or purpose. They propose that attempting to influence political decisions or policy-making can be a specific goal of political participation.

Definition 1. Policy making: The general procedure that results in public decisions by political actors and groups to reach certain goals (Howlett, Ramesh, Perl, & Ramesh, 1995, pp. 4–6).

A definition of the term ‘political participation’ used in literature (e.g., in Kuhn, 2006, p. 26; Westle, 1992, p. 140) is “all voluntary activities by individual citizens intended to influence either directly or indirectly political choices at various levels of the political system” (Kaase & Marsh, 1979, p. 42). Gabriel and Mößner (2002, p. 215) consider this definition as to differentiate political from other participation forms such as social participation (e.g. a club membership), which does not have the purpose of political influence. Furthermore, Gabriel and Mößner (2002, p. 215) maintain that the definition excludes activities such as reading political magazines or activities of politicians and, hence, can be used to define citizen participation.

Nevertheless, citizen or public participation is not restricted to *individual* citizens. Rather *intermediaries* such as political parties, citizen groups, lobby groups, or NGOs are active (Macintosh, 2004a; Sæbø et al., 2008). Accordingly, Rowe and Frewer (2005, p. 251) define *public participation* as “involvement of the public in the affairs and decisions of policy-setting bodies”, not specifying the public. Cunningham (1972) supports the status of citizens as a group of non-experts. The author defines citizen participation as a “process wherein the common amateurs of a community exercise power over decisions related to the general affairs of the community” (Cunningham, 1972, p. 595). Scheu and Autrata (2013, p. 18) criticise that many definitions build an understanding ‘for the structures of parliamentary democracy’ and thus overlook many political activities outside the parliaments. This dissertation relies on the definition of Roberts (2004, p. 320), which is not restricted to individual citizens or democratic systems.

Definition 2. Citizen participation: The "process by which members of a society (those not holding office or administrative positions in government) share power with public officials in making substantive decisions and in taking actions related to the community" (Roberts, 2004, p. 320).

With *citizen participation*, the dissertation refers to engagement of citizens in any processes and activities related to *public officials in making substantive decisions and in taking actions related to the community.* Citizen participation does not focus on simple yes or no decisions, but on the informed deliberation with citizens (Märker & Wehner, 2014, p. 60). Citizen participation has a thematic focus and is linked with a democratic process or event. So far, this chapter has focussed on citizen participation. The following section discusses its electronic support.

2.1.2 Electronic Participation

Gabriel and Mößner (2002, p. 215) outline that in contrast to other forms of political/governmental ICT usage, e-participation aims at influencing decision makers or means direct involvement into policy-making via internet. However, an internet presence of a municipality or administration is not enough to offer e-participation[16]. Kuhn (2006, p. 30) states that the term e-participation is used synonymously with political participation with reference to technical aspects. Kuhn defines e-participation as including all activities 'in which individuals use ICT with the objective to participate in or at least influence personnel and pertinent questions at different levels of the political system'. This definition excludes the participation of intermediaries (see Section 2.1.1, Macintosh, 2004a, p. 4; Sæbø et al., 2008, p. 406; Wimmer, 2007b, p. 91). The definition in Macintosh (2006, p. 364) sees e-participation as "the use of information and communication technologies to broaden and deepen political participation by enabling citizens to connect with one another and with their elected representatives" (2006, p. 364). Sometimes, e-participation is defined as a part of e-democracy without e-voting (Macintosh, 2004a, p. 2). E-voting and e-participation both focus on the associated media usage: e-voting directly through technology-assisted voting and e-participation by the support of citizens in the involvement in deliberations and policy-making processes (e.g., Albrecht et al., 2008, p. 13; Macintosh, 2004a, p. 2). Kies, Mendez, Schmitter, and Trechsel define e-democracy as follows:

> "E-democracy consists of all electronic means of communication that enable/empower citizens in their efforts to hold rulers/politicians accountable for their actions in the public realm. Depending on the aspect of democracy being promoted, e-democracy can employ different techniques: (1) for increasing the transparency of the political process; (2) for enhancing the direct involvement and participation of citizens; and, (3) improving the quality of opinion formation by opening new spaces of information and deliberation." (Kies et al., 2003, p. 3)

E-democracy often deals with normative values such as how democracy may/should develop in relation to the technological developments or viewing structural democratic relations in society (Sæbø et al., 2008, p. 403; Schaal, 2016, p. 279). Therefore, they favour the following definition for 'e-participation' that is independent of e-democracy:

[16] Nevertheless, e-participation literature sees provision and use of information as a necessary 'pre-stage of e-participation' (Organisation for Economic Co-operation and Development (OECD), 2001, p. 15; Macintosh, 2004a; Sæbø, Rose, & Flak, 2008)

> "E-participation defines a set of technology-facilitated participatory processes, both deliberative and decision oriented (which may or may not be democratic, or even in the political arena)" (p. 403).

E-voting focuses on the technical support of the voting activity – a particular participatory activity that is "common to all representative democracies" (Sæbø et al., 2008, p. 403). Based on assumptions in the previous sections, this dissertation uses the following definition. E-voting – electronically supported voting in elections – is excluded from the investigations.

Definition 3. Electronic participation (e-participation): The use of ICT to facilitate citizen participation (Macintosh, 2004b; Sæbø et al., 2008).

Online participation describes a particular form of e-participation, which focuses on enabling citizen participation through the Internet. Both terms are often used synonymously (see e.g. in Andersen, Henriksen, Secher, & Medaglia, 2007; Macintosh, 2004a), which is resulted by the fact that most e-participation is done via simple websites (Bohman, 2014). The ICT, which enables e-participation, is of particular importance for these considerations. In this regard, the dissertation uses the term *e-participation tool*.

Definition 4. E-participation tool: A set up consisting of software, hardware, and data to facilitate participation.

Nowadays, no participation activity is completely independent of ICT. New forms of participation and influence in the democratice processes have emerged through the support of electronic tools. At the same time, only few participatory methods work without the traditional mechanisms; often it is most appropriate to combine both (UN, 2014, pp. 61–62). Hence, the present work does not use the concept of electronic participation to distinguish between traditional and electronic forms. Rather it aims to highlight the change in the traditional paradigms.

Many attempts to offer e-participation– sometimes referred to as *e-participation projects or e-participation initiatives* in literature (see e.g. Macintosh, 2004a; Porwol, Ojo, & Breslin, 2016) – started in the past offering ICT to support citizen participation (see e.g. "best-practices" in Albrecht et al. (2008) or the *eParticipation Preparatory Action* in Wimmer & Bicking, 2013). E-participation can be a one-time endeavour (e.g. a consultation setup for a specific topic), ongoing endeavour (e.g. a petition), or can be continued with different settings at different times. E-participation may have different stakeholders. A *stakeholder* is a person or group directly or indirectly affected by the policy or topic under consideration or by the e-participation itself (Project Management Institute (PMI), 2000, p. 14).

The following section elaborates an understanding of architecture framework and related terms.

2.2 Architecture Framework

An *architecture* refers to a *mental model*. An *architecture description* formulises an *architecture* (i.e. *a model*). An *architecture framework* guides the development of an architecture description. According to this understanding, this subsection starts with discussing definitions of the following terms: model, metamodel, and reference model. Furthermore, the terms architecture and enterprise architecture, architecture description, and architecture framework are defined.

2.2.1 Model, Metamodel and Reference Model

Whenever people try to cope with complex challenges or tasks (be it in thought, with a pen, paper, and other material or with the computer), they rely on something that is commonly referred to as a model (Hesse & Mayr, 2008, p. 377; Winter, 2000, p. 204). People use models all the time (Ludewig, 2003, p. 5). In the broadest sense, a model represents those elements of the topic of interest, which people want to understand, create, or do (Hesse & Mayr, 2008, p. 377). A model can be seen as a pattern or concept (Schütte, 1998, p. 40). Based on such a general attempt to define a model, Stachowiak (1973, pp. 131–133) defines its three characteristics:

a) *Representation*: A model is always an image of something. It represents natural or artificial originals, which themselves can also be models.
b) *Reduction*: A model does not capture all attributes of the original, but only those that seem relevant for the model builder or model user.
c) *Pragmatism*: A model is not associated with an original on its own. It does not only represent something. The modeller models it for a natural or artificial model user. The model user uses it within a specific period and with a specific purpose.

Mahr (2009, p. 232) criticises the general model definition as being methodically useless because it tries to gather everything. Mahr furthermore argues that it is necessary to stay within the boundaries of the discipline in which a common understanding exists to explain the term *model*. In fact, different scientific disciplines offer different definitions and understandings of the term model (Schütte, 1998, p. 40; Winter, 2000, p. 104). In the context of e-participation, disciplines such as political science, computer science, business economics, and IS research are relevant and have a different understanding (Table 1).

Definition 5. Model: A purposeful image of a system, which allows the interpreter to make similar observations and statements as to the original system[17] but reduces the system to relevant aspects with regards to the investigated problem through abstraction (Winter, 2000, p. 104).

Modelling refers to the construction and transformation process that produces a model (Figure 2). The modelling process depends on the modellers, its intended purpose, the time and other influencing factors (cf. the third model characteristic in Stachowiak, 1973, p. 133). The modellers have a subjective perception of the system. Their interpretation and construction process results in a mental model. The modellers then transform the mental model into the model (from abstract to model level).

[17] The term *system* refers to any group of components.

Definition 6. Mental model: An "internal conceptual representation of an external system whose structure maintains the perceived structure of that system" (Doyle & Ford, 1998, pp. 17–21).

Table 1. Overview of model understandings in related research disciplines

Discipline	Examples
Political science	Models are mainly used for describing empirical studies (Morton, 2009, p. 27). *Empirical models* link one dependent variable with independent variables to find relationships between variables and assess their strengths (Martin, 2009, p. 38). *Theoretical models* are used to derive empirically relevant states from relationships between variables (Martin, 2009, p. 38). *Formal* or *non-formal models* can represent both types (Martin, 2009, p. 37; Morton, 2009, p. 27). Morton (2009, p. 27) describes non-formal models as "a set of verbal statements" about the "real" political world. Formal models are "a set of precise assumptions or axioms (...) presented in symbolic terms that are solved to derive predictions about 'real' political world" (Morton, 2009, p. 28). Clarke and Primo (2007, p. 742) sees a model from a semantic view as "kind of system whose characteristics are specified by an explicit (and sometimes elaborate) definition" (p. 742). A set of models could be viewed as a theory.
Computer science	Models are almost always found as linguistic representations in the form of written or spoken text, images or graphics (Hesse & Mayr, 2008, p. 377). Three ways of defining 'model' can be differentiated according to Schütte (1998, p. 5): (1) System models as representation based systems are 'external, touchable replicates of abstract knowledge about the essence of a system' (Schütte, 1998, p. 5). (2) In formal computer science, a model refers to axioms of a theory analysing dependencies between structures: "an interpretation is defined as a model for a specific set of rules if those rules are always true under that interpretation" (cited Elmasri, Navathe (1994) in Schütte, 1998, p. 52). (3) The term model is sometimes a synonym for the term 'language'.
Business economics	Two model terms are used: the representational and the constructive oriented model term (Schmidt, 1999; Schütte, 1998, p. 45; Strahringer, 2013). According to Schütte (1998, p. 47), representational models aim to be replications of the reality. The original could be a real system or a part of a real system[18], a real state or an expected/favoured state and the structure of the reality remains preserved. Schütte (1998, p. 48) and Strahringer (2013) criticise that a replication is always subjectively influenced by the modeller. The constructive oriented model term does not see the model as a replication of the reality (Schütte, 1998, p. 49). Rather it is assumed that the reality can only be perceived as a result of the awareness process of a modeller (Schütte, 1998, p. 49; Strahringer, 2013). The modeller develops the model for "a specific purpose (...) at a given point of time with a specific language" (Schütte & Rotthowe, 1998, p. 243). Hence, the result depends on the purpose, the modellers and their specific point of view.
Information systems research	Information models are the classical model type of *IS research* (Schütte, 1998, p. 63). They focus on information[19] in a socio-technical system and are used for different purposes such as description, simplification, abstraction, clarification, and explication of information concepts (Dresbach, 1999, p. 73). They play a primary role as representational models (Schütte, 1998, p. 63) to support the discourse between users and developers of information and communication systems (Schmidt, 1999). Information models are also built with the purpose to "draw conclusions about the reality" (Schütte & Rotthowe, 1998, p. 242). The aim of information modelling is to simplify the construction process of information systems by reducing complexity of the real world (Fettke & Loos, 2003, p. 38) or in a comprehensive description of a business information system (Schütte, 1998, p. 6).

[18] In this context, Schütte (1998, p. 47) maintains that the term 'an original system' cannot be used straightforwardly: A system is always a theoretical construct resulting from a subject-oriented and system theoretical production process.

[19] In business science, information can be understood as purposeful knowledge on facts or procedures according to Sahlknecht and Hasenkamp (2002).

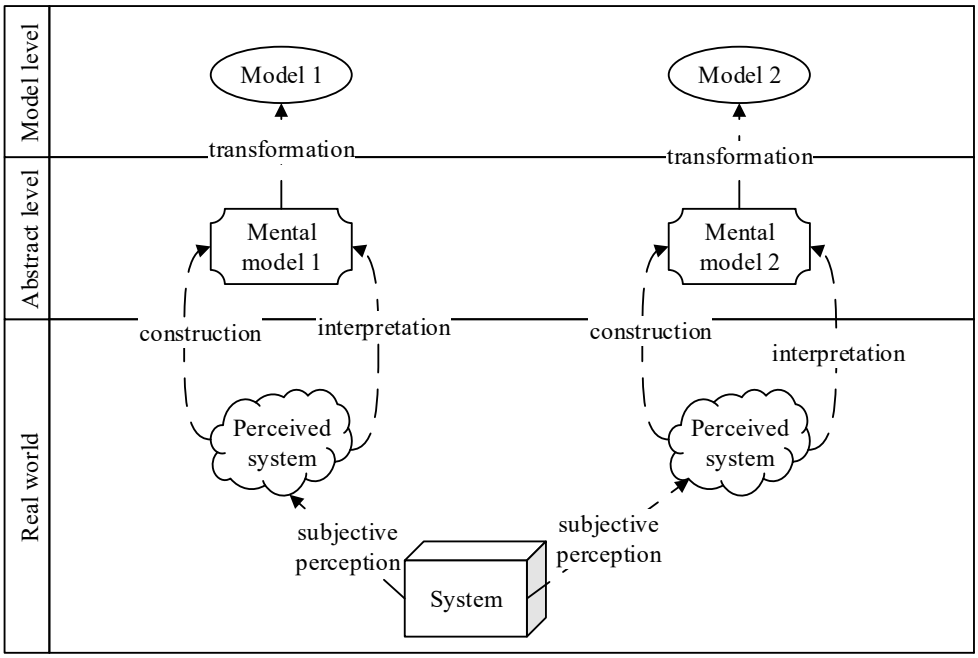


Figure 2. Subjective modelling process (on the basis of Rupprecht, 2002, p. 16; Schütte, 1998, p. 61; Winter, 2000, p. 133)

The purpose of *metamodeling* is to build a model of a (set of) model(s), which describes properties and requirements of the original model(s) (Winter, 2000, p. 116). A "typical metamodel" describes how the elements of a model can be instantiated (Object Management Group (OMG), 2006, p. 17).

Definition 7. Metamodel: A conceptual description of a model, which defines the used modelling concepts as well as their usage (Winter, 2000, p. 116).

This definition considers to describe the procedure for developing or describing a model, and to describe the semantic instruments with an abstract syntax (no concrete notation) (Winter, 2000, p. 117).

Reference models are another relevant concept in this research. Different types of reference models are based on different reference model definitions (see e.g., Becker, Niehaves, & Knackstedt, 2004; Fettke & Loos, 2004, 2007; Thomas, 2006). One general definition from Wilde and Hess (2007, p. 282) states that reference modelling creates an inductive (based on observations) or deductive (e.g. from theories or models), often simplified and optimised (in the sense of ideal concepts) image of the system to deepen existing knowledge and generate templates. This definition does not comment on the quality of the model. It is also not required that a reference model provides recommendations. In this sense, each model can be understood as a reference model (Winter, 2000, p. 106). Another definition says that a specific model that is based on the reference model is needed (Brocke & Buddendick, 2004, p. 341; Winter, 2000, p. 106). Fettke and Loos (2004, p. 5) compare design patterns – meaning a reliable design solution – with reference models in the computer science domain, even if design patterns aim to describe more specific solutions (Fettke & Loos, 2007, p. 5; Winter, 2000, p. 107). According to Fettke and Loos (2007, p. 2), a reference (information) model is understood as a "conceptual framework" (whereby not each conceptual model is a reference model) "representing a class of domains" and

"usable as blueprint for information systems development. Schütte (1998, p. 9) state that reference models include to-be recommendations for a class of enterprises.

Definition 8. Reference model: A designated model, which describes characteristic properties of a class of similar systems and serves as a reference point to develop specific models (Winter, 2000, p. 106).

A model can have one or more metamodels and/or one or more reference models. Within the same level (model, metamodel, meta metamodel), a model can serve as reference model (Winter, 2000, p. 132).

The following sections develop an understanding of architecture frameworks starting with the terms architecture and enterprise architecture.

2.2.2 Architecture and Enterprise Architecture

The term *architecture* can have totally different, context-specific meanings (Schönherr, 2004, p. 7) differentiated by the type of systems and structures it aims to describe (Esswein & Weller, 2008, p. 6; Lankhorst, 2009,). Table 2 presents a review of different architecture definitions in the context of information systems design and development. Architecture definitions focus on different aspects. Nevertheless, the *conceptualisation of a system to define its structure and behaviour* are common to most definitions. Furthermore, the most definitions consider *principles governing the system design and evolution*. A system conceptualisation forms a basis to analyse, optimise, validate, design, implement, and build it (Lankhorst, 2009,). A system refers to any entities whose architectures are of interest (ISO/IEC/IEEE 42010:2011, p. 9).

Definition 9. System: A set of entities, which are interrelated, and can be differentiated from its environment (Krallmann, Frank, & Gronau, 2002, p. 24).

This research is based on the definition of architecture in ISO/IEC/IEEE 42010:2011, which considers the aforementioned aspects. It is used in literature to define enterprise architectures (Minoli, 2008, p. 35). ISO/IEC/IEEE 42010:2011 describes the standard as be able to cover general systems[20].

Definition 10. Architecture: A conceptualisation of a system (that is embodied in an environment) in its fundamental concepts or properties, their relationships to each other and the environment and in design and evolution principles (ISO/IEC/IEEE 42010:2011, no. 3).

An environment means the "context determining the setting and circumstances of all influences upon a system (ISO/IEC/IEEE 42010:2011, no. 4).

[20] http://www.iso-architecture.org/ieee-1471/faq.html#whc (access 2015-03-04)

Table 2. Overview of architecture definitions

Source	Definition
Inmon, Zachman, & Geiger, 1997, p. 30	Starting from "understanding what architecture does", two different meanings are described: (1) a construction plan describing "a proper order in which things should be developed" (2) "a universally recognisable pattern"
ISO/IEC/IEEE 42010:2011, 3[21]	"fundamental concepts or properties of a system in [22]": (1) "its environment embodied in its elements, relationships" (2) "the principles of its design and evolution."
Minoli, 2008, p. 8	"blueprint for the optimal and target-conformant placement of resources in the ICT environment for the ultimate support of the business function"
TOG, 2011a, p. 20	Three different interpretations of the term are seen: (1) a formal system description (2) a plan guiding the implementation of a system (3) a structure of system components, "their inter-relationships" as well as "principles and guidelines governing their design and evolution over time"
Scheer, 1999, p. 1	Referring explicitly to information technology: "type, functional properties and the interrelationship among the individual building blocks of the information system"
Schekkerman, 2008, p. 31	(1) "the structure of components, their interrelationships, and" (2) "the principles and guidelines governing their design and evolution over time"
Perroud & Inversini, 2013, p. 10	"The structure of components, their interrelationships and the principles and guidelines, governing their design and evolution over time."
Rozanski & Woods, 2012, p. 27	Definition of a system's "static structure, its dynamic structure, its externally visible behaviour, its quality properties, and the principles that should guide its design and evolution".
Federal Enterprise Architecture Program Management Office (OMB), 2007, p. 44	"A systematic approach that organizes and guides design, analysis, planning, and documentation activities."

According to ISO/IEC/IEEE 42010:2011 an architecture[23]

- focusses on "fundamental or unifying" aspects determining the systems' "form, function, value, cost, and risk",
- is a conception of a system "in the human mind" (i.e. a *Mental Model*),
- is to be seen in the overall context to give a holistic view on the system – i.e. "how the system relates to, and is situated in, its environment" (so it is to be interpreted what "fundamental" means in the context), and
- is "not merely the overall structure of physical components".

Enterprise architectures (EAs) focus on a specific kind of system – an enterprise. Nevertheless, there is no precise conformity on definitions of EA (Schöenherr, 2009, p. 400). Also a lack of "theoretical foundation, stringent definitions or a common understanding" among scholars publishing EA research is recognised (Schöenherr, 2009, p. 403). An *enterprise* is defined by the *The Open Group*[24] as "any collection of organisations that has a common set of goals (…) encompassing all of its information and technology services,

[21] ISO/IEC/IEEE 42010:2011 replaces both ISO/IEC 42010:2007 and ANSI/IEEE Std 1471:2000, see http://www.iso-architecture.org/42010/index.html (access 2014-05-16)

[22] The term system is used in the standard as a placeholder, referring e.g. to "an enterprise, a system of systems, a product line, a service, a subsystem, or software" (http://www.iso-architecture.org/42010/cm/, access 2015-03-05).

[23] http://www.iso-architecture.org/ieee-1471/faq.html#wharch (access 2015-03-04)

[24] The Open Group® is a registered trademark of The Open Group.

processes, and infrastructure" (TOG, 2011a, p. 5). This includes an enterprise as a whole with all its "information and technology services, processes, and infrastructure" but also a specific domain within an enterprise. Bernard (Bernard, 2012, 481) defines an enterprise as "organisation or sub-activity whose boundary is defined by commonly-held goals, processes, and resources". Both definitions are applicable to e-participation, where different organisations collaborate with the common goal to offer e-participation.

Definition 11. Enterprise: Any collection of organisations that commonly holds goals, processes and resources (Bernard, 2012, 481; TOG, 2011a, p. 5).

Lankhorst (2009, p. 3) defines an *enterprise architecture* as "a coherent whole of principles, methods and models that are used in the design and realisation of an enterprise's organisational structure, business processes, information systems, and infrastructure". Minoli (2008, p. 35) describes it as a plan or blueprint used for business function of mission support. Hanschke (2010, p. 56) defines, in the context of strategic ICT management, that an enterprise architecture describes business and ICT structures and their relationships. Bernard (2012, 481) defines it as the "analysis and documentation of an enterprise in its current and future states from an integrated strategy, business and technology perspective". Even if the focus of EA is often on the usage "as a technical instrument", its objectives are mostly of an organisational nature (Janssen, 2012, p. 29). An enterprise architecture aims to describe a holistic view (Esswein & Weller, 2008, p. 9; Lankhorst, 2009, p. 3). It considers hardware elements, software elements, stakeholders, and information elements and links them to business goals (Eeles & Cripps, 2010, p. 328). All these definitions can be assigned to the *architecture* definition in ISO/IEC/IEEE 42010:2011 by the interpretation of the enterprise as the system. According to the definitions, architectures and enterprise architectures are mental models (Section 2.2.1).

Before proceeding to define architecture frameworks, it will be necessary to introduce a concept to formalise an architecture in the following section.

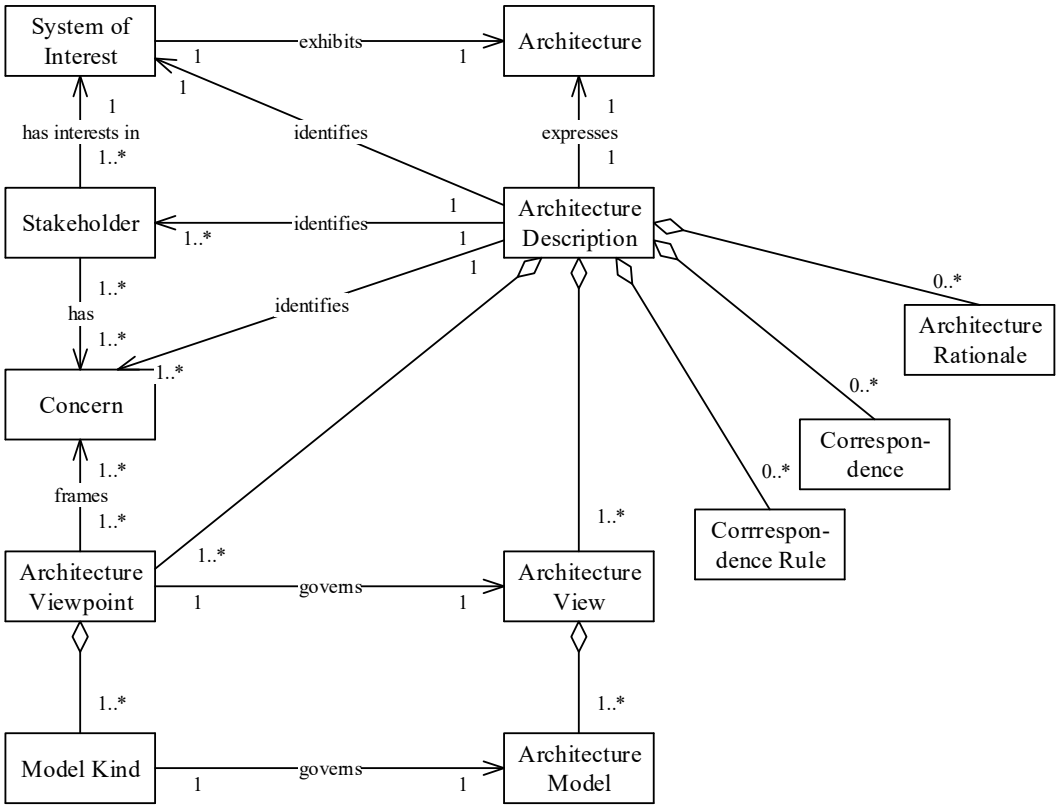
2.2.3 Architecture Description

An architecture needs documentation to be able to prove if a system fulfils its requirements and to maintain it. ISO/IEC/IEEE 42010:2011 defines an *architecture description* as a "work product to express an architecture" (ISO/IEC/IEEE 42010:2011, 3). The standard is the basis for different approaches in the context of software architecture or enterprise architecture research (see for example Callo Arias, America, & Avgeriou, 2011; Eeles & Cripps, 2010, p. 18; Malavolta, 2012, p. 3; Riempp & Gieffers-Ankel, 2007, p. 361; Venkateswara Rao, Govardhan, Chalapati Rao, & K.V., 2012). Rozanski and Woods (2012, p. 28) defines an architecture description as "a set of products [e.g. architectural models, scope, constraints, principles] that documents an architecture in a way its stakeholders can understand and demonstrates that the architecture has met their concerns."

Definition 12. Architecture description: A coherent whole of artefacts or work products to document an architecture (ISO/IEC/IEEE 42010:2011, 3).

An architecture description can describe the architecture of a system at a specific time or its evolution over a time period (ISO/IEC/IEEE 42010:2011, p. 28). Legend*:* UML class diagram.

Figure 2 presents the conceptual model of system terms and concepts, their architecture and architecture description from ISO/IEC/IEEE 42010:2011. An architecture description identifies the system of interest, stakeholders and their architectural concerns. It includes rationales, architectural viewpoints, architecture views and related correspondences and correspondence rules. The terms are defined afterwards.



Legend: UML class diagram.

Figure 2. Conceptual model of an architecture description (ISO/IEC/IEEE 42010:2011, p. 5)

Definition 13. Concern: A consideration that appears during the design, implementation, and operation of a system from its needs and requirements or the choices selected during the life cycle of the system (ISO/IEC/IEEE 42010:2011, p. 6).

A *stakeholder* is understood in this regards as an individual or a group with concerns regarding the system-of-interest "considered in relation to its environment" (ISO/IEC/IEEE 42010:2011, p. 6).

Because of potential huge volume and complexity of enterprise architectures and their different objectives, the literature suggests the *use of different views* (or perspectives, layers, levels) in an architecture description (Eeles & Cripps, 2010, pp. 65–67; Riempp & Strahringer, 2008, p. 116; Schekkerman, 2003, pp. 29–31; Steen, Akehurst, ter Doest, & Lankhorst, 2004; TOG, 2011a, pp. 373–434; Zachman, 1987). A *view* shows parts of the architecture framework from the viewpoint of particular architecture stakeholders. Nevertheless, in EA research and practice no common definitions of views, viewpoints, perspectives, etc. exit. This research differentiates between views and viewpoints in accordance with the ISO/IEC/IEEE 42010:2011 standard. The approaches described in Finkelstein, Kramer, Nuseibeh, Finkelstein, and Goedicke (1992), Rozanski and Woods (2012),

TOGAF (TOG, 2011a) or Eeles and Cripps (2010) are similar to the definition in this standard or are based on it.

Definition 14. View: A work product that describes a part of an architecture description and addresses concerns from the perspective of particular stakeholder groups (ISO/IEC/IEEE 42010:2011).

Definition 15. Viewpoint*:* A description of conventions/principles how to create, interpret or use of a view, i.e. an abstract model of a view (ISO/IEC/IEEE 42010:2011).

Definition 14. View and Definition 15. Viewpoint can be summarised as follows: "the viewpoint is *where one looks from*, the view is *what one sees*" (Maier, Emery, & Hilliard, 2004, p. 262; see also TOG, 2011a, p. 375). Viewpoints are generic and supposed for reuse, while views are specific to an architecture (TOG, 2011a, p. 375). Accordingly, Eeles and Cripps (2010) identify four viewpoint characteristics: (1) it has an identified audience, (2) it serves one or more purposes, (3) it is a pattern or template for a view, and (4) it defines techniques for create, depict, and analyse views. A view consists of one or more architecture models; the viewpoint, which governs this view, of one or more model kinds. A model kind specifies the modelling conventions within a viewpoint (ISO/IEC/IEEE 42010:2011, p. 6). The ISO/IEC/IEEE 42010:2011 standard however does not propose one style for documenting model kinds but proposes some ways for doing so (p. 28). This means for this research that it is necessary to determine the style of model kinds for the framework to be developed. The ISO/IEC/IEEE 42010:2011 standard proposes, e.g. to use a metamodel, templates, languages, or operations (p. 28). An *architecture model* is a work product, which models a part of the architecture addressed by the containing view (ISO/IEC/IEEE 42010:2011, p. 6). An architecture model can be reused by several views thereby reducing redundancies, repetitions and possibilities for inconsistencies (ISO/IEC/IEEE 42010:2011, p. 14). Correspondences and correspondence rules support the architect in analysing and documenting consistency between the elements of an architecture description (ISO/IEC/IEEE 42010:2011, p. 14). A *correspondence* defines a relation between elements of one or more architecture descriptions (ISO/IEC/IEEE 42010:2011, p. 7). A *correspondence rule* governs a correspondence and enforces relations between elements of one or more architecture descriptions (ISO/IEC/IEEE 42010:2011, p. 7). The style of the model kinds and viewpoints define the style of correspondence rules.

Figure 3 provides two examples of viewpoints: *Data viewpoint* for describing the data and information system, and *function viewpoint* for describing processes and activities. Each of both viewpoints includes one or more model kinds. Each model kind establishes the correspondence rules for creating its corresponding architecture models. The data view and function view are architecture views. Data viewpoint and function viewpoint govern them, respectively. An entity-relationship diagram composes the data view. A BPMN models composes the function view. The relation is that the data view describes data elements that emerge during the process in the function view. These kind of relations – called *correspondences* – aim to ensure consistency between views and viewpoints. *Correspondence rules* govern correspondences.

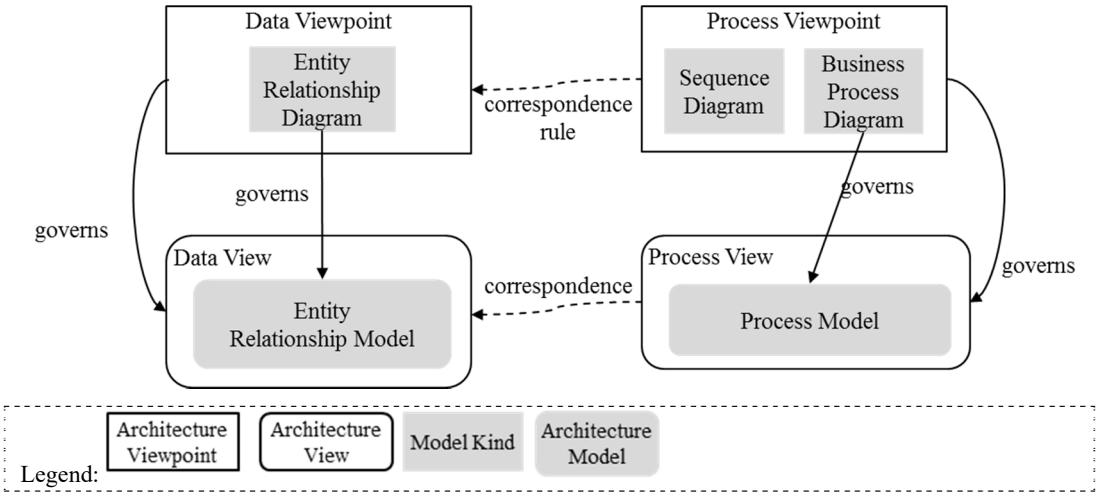


Figure 3. Example of architecture viewpoints and views (Malavolta, 2012, 20)

When architects develop an architecture, they need to make several decisions that affect the architecture (ISO/IEC/IEEE 42010:2011, p. 7). The architecture rationale justifies any decision affecting elements of the architecture description. An *architecture rationale* "records explanation, justification, or reasoning about architecture decisions that have been made", which "can include the basis for a decision, alternatives and trade-offs considered, potential consequences of the decision and citations to sources of additional information" (ISO/IEC/IEEE 42010:2011, p. 7).

The following section argues that architecture frameworks guide the development of an architecture description.

2.2.4 Architecture Framework

To build an architecture and formalise it with an architecture description, the architect needs an "appropriate way" supported by techniques and tools (Lankhorst, 2009,). The purpose of an architecture framework is to propose such an *appropriate way*. Accordingly, Schönherr (2004, p. 16) sees an architecture framework as a tool that supports the development of different kind of architectures. Janssen et al. (2013, p. 140) define that an architecture framework aims to design architecture elements independently by structuring and interrelating them, what ensures coherency among them. In this regard, an architecture framework can specify, according to Janssen (2012, p. 27), "how ICT is related to the overall business processes and outcomes of organizations, describing relationships among technical, organizational, and institutional components of the enterprise". The definition in ISO/IEC/IEEE 42010:2011 (3.4) defines it as "conventions, principles and practices for the description of architectures established within a specific domain of application and/or community of stakeholders". The Open Group consortium underlines the reference character with their definition: "an architecture framework is a foundational structure, or set of structures, which can be used for developing a broad range of different architectures" (TOG, 2011a, p. 7). TOGAF (TOG, 2011a, p. 21) and Perroud and Inversini (2013, p. 10) add that an architecture framework is not only used to develop an architecture but also to implement and sustain it.

Definition 16. Architecture framework: An instrument consisting of conventions, principles, and practices that guides the architect the development, implementation, and sustainment of a range of different architectures (derived from Perroud & Inversini, 2013; ISO/IEC/IEEE 42010:2011; TOG, 2011a, p. 7).

The ISO/IEC/IEEE 42010:2011 standard depicts the contents of an architecture framework as presented in Figure 4. However, an architecture framework is not limited to these contents, as emphasised in the standard (p. 10). According to the standard specification, frameworks such as the *Zachman Framework* (Zachman, 1987) and *The Open Group Architecture Framework* (TOGAF) (TOG, 2011a) are "in the terms of this international standard" (p. 10).

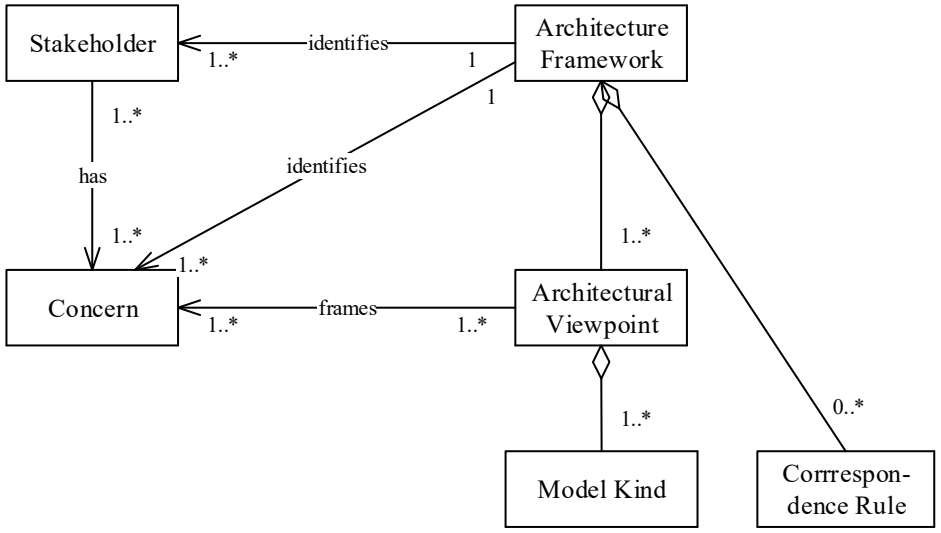


Figure 4. Conceptual model of an architecture framework (ISO/IEC/IEEE 42010:2011, p. 10)

In the context of enterprise architectures and architecture frameworks, architecture development methods (often referred to as guideline in this context) play a major role as the overview of architecture definitions (Table 2) and the previous discussion shows.

Definition 17. Method: A document that guides "the optimal ways to carry out design or implementation activities" (TOG, 2011a, p. 624).

An architecture framework guides the subjective perception, construction, interpretation, and transformation processes to come from a system to an architecture description. An architecture is a mental model of a perceived system documented with the architecture description. Hence, the architecture description is the model. Furthermore, an architecture framework is understood as a metamodel for an architecture description. It provides the conceptual description of the architecture description, which defines the architecture modelling concepts as well as their usage.

The next section synthesises the understanding of e-participation and architecture frameworks to derive an understanding of the term *e-participation architecture framework*.

2.3 E-Participation Architecture Framework

The previous sections define e-participation and architecture framework independently. It is now important to link both terms. In the e-participation research, no convenient definition could be identified. An example from e-government describes an e-government architecture as defining "standards, infrastructure components, applications, technologies, business model and guidelines for electronic commerce among and between organisations that facilitates the interaction of the government and promotes group productivity" (Ebrahim & Irani, 2005). This definition cannot be adopted for e-participation simply as it has a different focus on electronic commerce. As stated in the motivational section, the focus of this research is on guiding the design and implementation of participation services. Even if the e-participation scientific and practitioner literature uses the term *(e-)participation service* (Märker, Wehner, & Gölz, 2009; Sæbø, Flak, & Sein, 2011), no working definition could be identified.

Definition 18. Participation service: A service, which enables citizen participation to the stakeholders.

The definition does not differentiate between electronically supported and traditional participation services, because either participation channels need to be supported in today's society. However, if an emphasis is put on the fact that a participation service is or should be supported electronically, the term *e-participation service* is used in this dissertation. Based on this definition, it is possible to define an enterprise in the e-participation context as follows.

Definition 19. E-participation enterprise (EE): Any collection of organisations that commonly holds a participation vision encompassing the resources, information and technology services, processes, and infrastructure to realise the vision (based on TOG, 2011a, p. 5).

A participation vision constitutes an EE.

Definition 20. Participation vision: A high-level view on the overall impact (Moore, 2000, p. 183), which the EE wants to achieve by providing participation services.

An EE carries out a particular e-participation undertaking (called e.g. *initiative* or *project* in Macintosh, 2004a; Porwol, Ojo, & Breslin, 2016) to provide the participation services to the target group. The political and social context in which the participation takes place forms the environment. According to the architecture understanding, such an e-participation enterprise has an architecture.

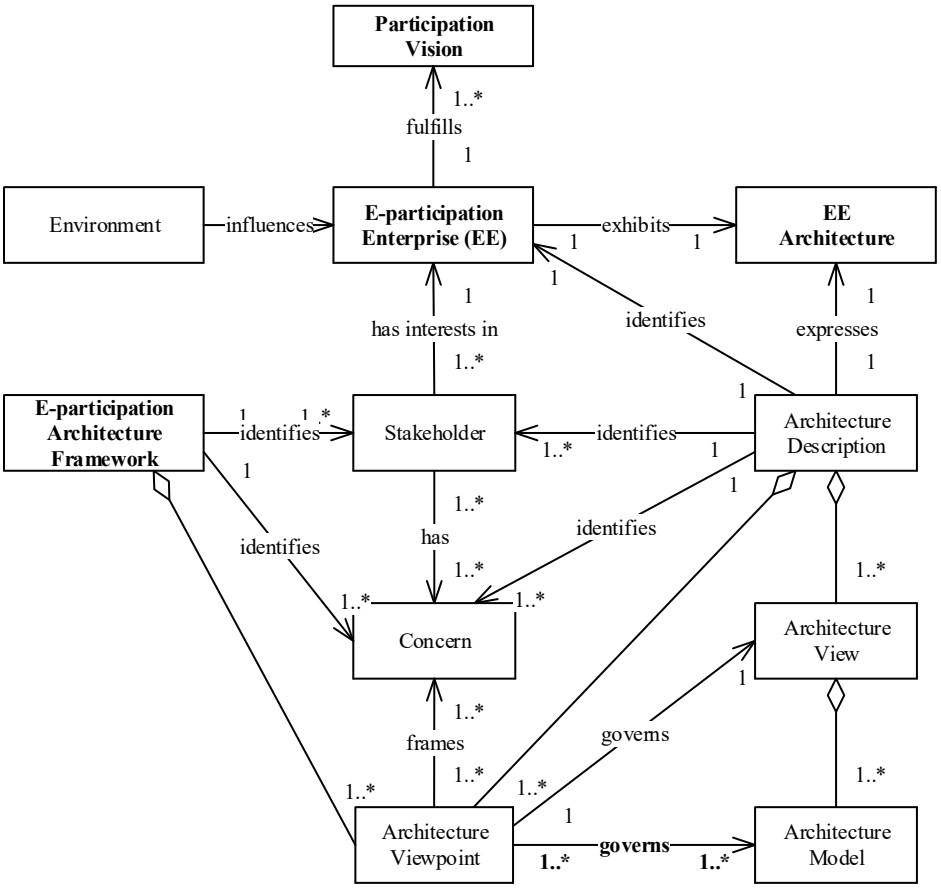
Definition 21. E-participation enterprise architecture (EEA): A conceptualisation of an EE in its fundamental concepts or properties, their relationships to each other and the environment and in design and evolution principles (based on ISO/IEC/IEEE 42010:2011, no. 3).

An architecture description of an e-participation enterprise is a coherent whole of artefacts or work products to document this architecture. An e-participation architecture framework guides this development.

Definition 22. E-participation architecture framework: An instrument that guides the development, implementation, and sustainment of a wide range of different EEAs.

Development refers to activities that form the EE and design how the participation services will be carried out. Implementation refers to the activities to operate the EE and provide the participation services. Sustainment refers to activities that ensure the sustainability of the EE and the services provided. This includes the evaluation of the EE in regards its objectives to derive lessons learned and the documentation of the EEA.

The EPART-Framework defines the modelling concepts as well as their usage to define an EE architecture. Its conceptual structure is based on the ISO/IEC/IEEE 42010:2011 (cf. Figure 5). According to this standard, architecture frameworks can "include additional content, prescriptions and relationships, such as process requirements, life cycle connections, and documentation formats" not yet standardised (ISO/IEC/IEEE 42010:2011, p. 26). It is the aim of this research to study what *additional content the EPART-Framework should include and how appropriate model specifications look like* in order to support its objectives as defined in Section 1.2.



Legend: UML class model. Bold fonts indicate specialisations and amendments to the ISO/IEC/IEEE 42010:2011 standard.

Figure 5. Conceptual model of the EPART-Framework (derived from ISO/IEC/IEEE 42010:2011, p. 5)

After setting the theoretical foundations in this section, the next section sets the methodical foundations of this dissertation.

3. Research Design

This chapter introduces the research approach. Research is a systematic process (Punch, 2013, p. 5; Saunders, Lewis, & Thornhill, 2009, p. 5) to answer research questions or test hypothesises (Punch, 2013, p. 5) i.e. "to find things out" (Saunders et al., 2009, p. 5). To select an appropriate research strategy is crucial to be able to argue that results are meaningful and to point out existing limitations (Saunders et al., 2009, p. 5). Answering the three research questions employs a multimethod approach as detailed in Figure 1 (p. 8) combining the methods *literature review* (Webster & Watson, 2002), *action research* (Baskerville & Wood-Harper, 1996) and a constructivist approach known as *DSR* (Hevner et al., 2004; Peffers et al., 2006). The following three sections introduce these research methods in the same order and describe their application in the frame of this research.

3.1 Literature Review

Hart (1998, p. 1) defines literature review as "the use of ideas in the literature to justify the particular approach to the topic, the selection of methods, and demonstration that this research contributes something new". Reviewing literature can be seen as an important part of any research for facilitating development of theories (Webster & Watson, 2002, p. xiii). According to Webster and Watson (2002), a literature review encompasses the following activities: identification of literature, structuring the review, identification of critical knowledge gaps and motivating further research. This sort of literature review is fundamental in the *DSR* to guarantee that the research contributes to the e-participation body of knowledge, is pertinent to practitioners and correctly uses architectures and architecture frameworks.

Before the EPART-Framework can be developed, it is vital to determine the state-of-the-art. This is to avoid wasted effort and to ensure that any contribution builds on existing knowledge. In the course of this dissertation, reviews of primary and secondary literature are performed. Therefore, the literature review is two-fold. First, it focusses on e-participation literature to study e-participation characteristics, e-participation frameworks, e-participation guidelines and manuals. Second, architecture frameworks literature is reviewed to identify the content that constitutes an architecture framework. Literature review is supported by a comparative analysis of literature in order to synthesise the results.

The literature selection strategy is based on searching scientific and non-scientific databases. Leading journals and international conference proceedings in the e-participation and architecture framework domain were examined. Accordingly, the following scientific databases were used: IEEE Digital Library, ACM Digital Library, Science Direct (as a leading full-text scientific database including journals such as *Government Information Quarterly*), JSTOR, Springer Link, and Google Scholar. They were chosen according to the recommendations by Webster and Watson (2002) and Brereton, Kitchenham, Budgen, Turner, and Khalil (2007) to select scientific databases relevant to the research discipline. The review of non-scientific literature aimed to identify practical guidelines published, e.g. by public administrations or NGOs or existing architecture frameworks. The non-scientific

literature was found using Google. The literature selection strategy considered two opposing goals, between which a possible optimal trade-off had to be found: (1) A high homogeneity of the studied literature to ensure comparability and focus on the research question. (2) Heterogeneity in order to obtain different approaches, perspectives and ideas for the synthesis and development of the framework. The sections presenting the results of the literature review start with explaining the key words, selection criteria and procedure for identifying relevant literature. Backword search, i.e. the process of reviewing articles identified to identify further relevant articles, extend the keyword based literature review.

3.2 Action Research

Bryman and Bell (2011, p. 414) define action research as "an approach in which the action researcher and a client collaborate in the diagnosis of the problem and in the development of a solution based on the diagnosis". Originally, action research was introduced in the psychology (Nett & Stevens, 2009) and later on adapted, amongst others, in the IS discipline (Baskerville & Wood-Harper, 1996; Frank, Klein, Krcmar, & Teubner, 1998; Nett & Stevens, 2009). Action research applies fact-finding to practical problem solving with the aim to improve (Baskerville & Wood-Harper, 1996, p. 236) the quality of actions within a social situation (Burns, 2000, p. 443; Frank et al., 1998). Traditional and action research have difference characteristics as presented in Table 3.

Table 3. Characteristics of traditional versus. action research (Frank et al., 1998, p. 75)

Characteristic	Traditional Research	Action Research
Objectives	Description and explanation of reality	Exploitation of activity orientations to change reality
Role of the researcher	External observer, who is not engaged in the research field; logical separation of knowledge production (science), and application (design)	Participant, who uses influencing opportunities for targeted modification of the field
Relationship between researchers and research subjects	Subject-object relationship	Subject-subject relationship: affected parties can determine meanings of their situation better than an external observer
Methodological rigour of the instruments	strong methodological guidance; methodological principles and procedures intended to guarantee truth/goodness; instrumental reason as a means of quality assurance	Little methodological rigor, individual experience and discipline required; social reason as a means of quality assurance
Role of the instrument	Instrument shapes the perception on the research object	Instruments are modelled after the research subject; they are "media in the communication process" between researchers and research subjects
Theory building	Theories are proved based on data	Data form the bases for the discourse in which activity orientations are obtained
Procedure	Sequential: survey, analysis, interpretation	Cyclic, iterative learning process: determine problem scope and objectives, create action plan, implement action, evaluate, if necessary modify action plan etc.

In its nature, action research involves the collaboration and cooperation of researchers, practitioners, and laymen and is situational, collaborative, participatory, as well as self-evaluative (Burns, 2000, p. 443). As such, it is a method to make IS research more relevant

for practice (Baskerville & Myers, 2004, p. 329). Baskerville and Wood-Harper even conclude:

> "We suggest that action research, as a research method in the study of human methods, is the most scientifically legitimate approach available. Indeed, where a specific new methodology or an improvement to methodologies is being studied, the action research method may be the only relevant research method presently available." (Baskerville & Wood-Harper, 1996, p. 240)

Ethnography research, as specific form of action research, is a result of social and cultural anthropology (Meyers, 1999). The theory behind says that researchers are only able to understand a culture when they are enabled to become a part of it (Meyers, 1999). So in contrast to canonical action research, ethnography is a more reflexive dynamic process involving researcher in a subject-oriented way (Nett & Stevens, 2009, p. 61). The ethnographic method is used in many IS research attempts as e.g. in the research regarding the development, management, and impact of ICTs (Meyers, 1999, 1999; Nett & Stevens, 2009). As a project partner, the business ethnographer documents the relationships and development of prototypes in order to enable project partners to promote further developments in a fieldwork (Nett & Stevens, 2009, p. 57). Considering the architecture framework as the prototype, which is tested, this research applies business ethnography. The observer is involved in e-participation design and implementation and thus has first insights into the methods and techniques applied to be integrated in the EPART-Framework to be designed. The main benefit is the deeper understanding the researcher gains of the topic under consideration according to Meyers (1999): Observers see what people are doing over a long period of time and what they say they are doing. Disadvantages are according to Meyers (1999) that it takes a long time for doing the fieldwork, to analyse the material and writing it up – this was also experienced in the research for this dissertation. Another disadvantage is that usually only one organisation or culture is studied (Meyers, 1999). In contrast, this research had the opportunity to study the design and implementation of e-participation in four EU-funded projects (LEX-IS, VoicE, VoiceS, and OCOPOMO) i.e. in four ethnographic studies (action research setting and results documented in Chapter 5).

3.3 Design Science Research

This section presents the design science research approach used in this dissertation. Afterwards, it discusses how to get from the multi-method approach in the DSR to the EPART-Framework.

3.3.1 Overview

The IS discipline is characterised by two paradigms: behavioural science and design science (Schütte, 1998; Yetim, 2009). Design, understood as "the act of creating an explicitly applicable solution to a problem" (Peffers et al., 2006, p. 84; Peffers et al., 2007, p. 45), is an accepted paradigm in applied research disciplines such as engineering (Hevner et al., 2004, p. 76; March & Smith, 1995, p. 252; Peffers et al., 2007). DSR can be defined as a systematic research approach to create and evaluate artefacts to solve problems (Hevner et al., 2004, p. 77). In this sense, IS research, itself being an "applied research discipline" (Peffers et al., 2006, p. 84), has overtaken DSR as research paradigm (Hevner et al., 2004; March & Smith, 1995; Peffers et al., 2007; Vaishnavi & Kuechler, 2004). In IS related

DSR, the researcher constructs artefacts that enable stakeholders (researchers as well as practitioners) to understand and address the organisational challenges of ICT development and implementation (Hevner et al., 2004, p. 77). The artefacts can be constructs (such as vocabulary and symbols), models (such as abstractions and representations), methods (such as algorithms and practices), and instantiations (such as implemented prototype systems) (Hevner et al., 2004, p. 77; March & Smith, 1995, p. 253). The developed architecture framework is the artefact of the design science approach applied in this dissertation. Hevner et al. (2004) present guidelines for DSR (Table 4).

Table 4. Design science research guideline (Hevner et al., 2004, p. 83)

Design science guideline	Description
1. Design as an Artefact	"Design-science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation."
2. Problem Relevance	"The objective of design-science research is to develop technology-based solutions to important and relevant business problems."
3. Design Evaluation	"The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods."
4. Research Contributions	"Effective design-science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies."
5. Research Rigour	"Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artefact."
6. Design as a Search Process	"The search for an effective artefact requires utilizing available means to reach desired ends while satisfying laws in the problem environment."
7. Communication of Research	"Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences."

The literature proposes various procedures for DSR. While several authors claim that there is no concurrence of a specific process in the IS community (Ostrowski & Helfert, 2012, p. 2; Peffers et al., 2006, p. 91; Pfeiffer, 2008, p. 26), similarities in phases can be determined (Hevner et al., 2004, p. 83; Ostrowski & Helfert, 2012, p. 2; Peffers et al., 2007; Pfeiffer, 2008, p. 26):

- *Problem Identification and Objectives Definition:* Identification of the problem and motivation is substantial for any kind of research. In design science, this phase contributes to determine the problem scope concerning Guideline 2: Problem relevance. It identifies the problem scope and relevant research gaps in the knowledge base**.** The Definition of objectives determines "clear and verifiable contributions" concerning Guideline 4: Research contributions.
- *Design:* Design of the artefact needs to rely on rigorous research methods (Guideline 5: Research rigour) and is a search process (Guideline 6: Design as a search process). The results of the artefact design phase are the conceptual design and the artefact (Guideline 1: design as an artefact).
- *Evaluation:* Evaluation of the artefact supports the assessment of its utility, quality, and efficiency (Guideline 3: Design evaluation) and needs to rely upon the application of rigorous methods (Guideline5: Research rigor).
- *Communication:* Communication means the presentation of research to appropriate audiences (technology-oriented as well as management-oriented, see Guideline 7: Communication of research)

An iterative approach of design and evaluation is essential for this research (Hevner et al., 2004, p. 96). DSR demands for a structured way of the artefact construction through the application of rigorous research methods. Rigour can be "derived from the effective use of

the knowledge base - theoretical foundations and research methodologies" (Hevner et al., 2004, p. 87). Accordingly, the research design for the construction of the EPART-Framework is based on a qualitative multi-method research approach combining behavioral and design science paradigms as suggested by Hevner et al. (2004, p. 79). In general, a **multi-method research** approach refers to the combination of different qualitative data collection techniques with associated analysis techniques (Saunders et al., 2009, p. 152). Qualitative data can be a result of different research methods and mean all kind of non-numeric or non-quantifiable data (Saunders et al., 2009, p. 480). For example, Ostrowski and Helfert (2012, p. 2) propose a combination of the qualitative data collection techniques literature review, collaboration of practitioners and information modelling for data analysis to construct "abstract design knowledge".

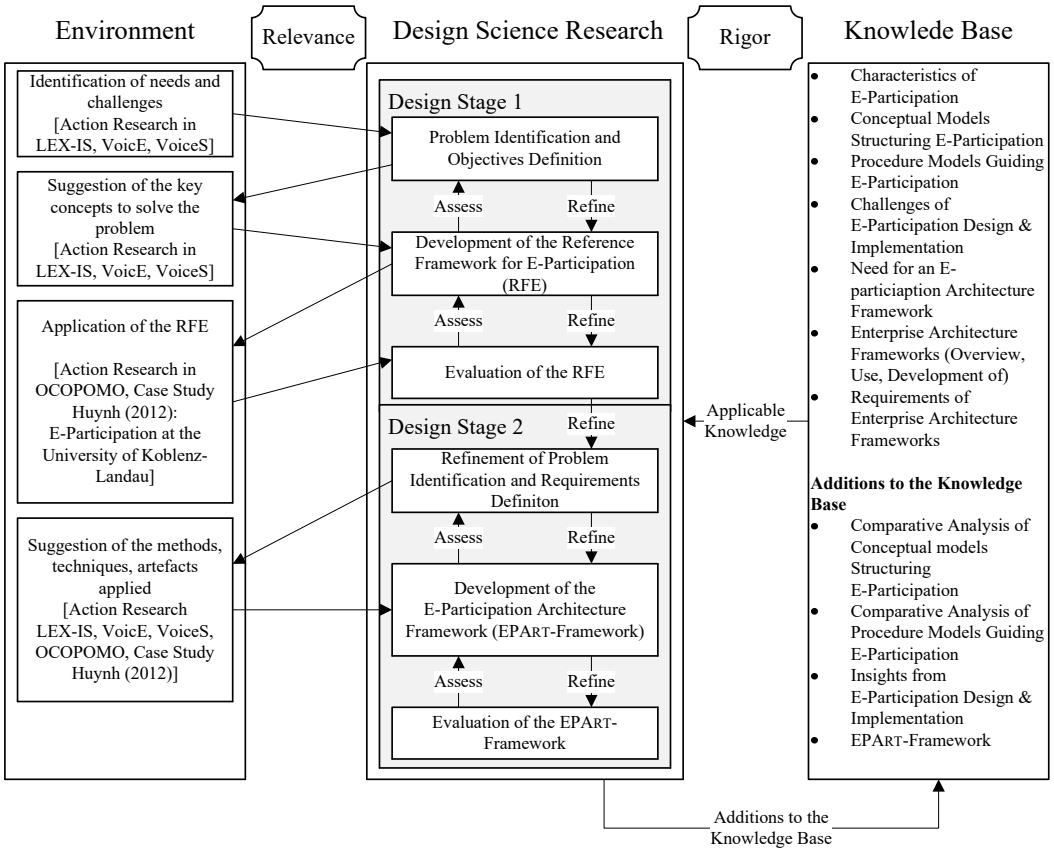


Figure 6. Design science research concept applied in this dissertation based on Hevner et al. (2004, p. 80)

This research employs the DSR concept by Hevner et al. (2004, p. 79), see Figure 6, as follows: The EU-funded e-participation projects, which build the basis for the action research (cf. Section 3.2) constitute the *environment* that defines the *problem space*. The exchange with the environment ensures the *relevance* of the problems to be solved and the solutions proposed. The needs for and challenges of a comprehensive approach for e-participation design and implementation are assessed and evaluated within the context of the projects LEX-IS, VoicE and VoiceS. Given this need, DSR is conducted in two successive stages, each one comprising a phase of problem identification and objectives definition, **de**velopment, evaluation, and communication (to ensure additions to the e-participation knowledge base). In the *Design Stage 1*, the initial version of the EPART-Framework is developed. The OCOPOMO project uses this initial version to design and implement its

e-participation pilots. Huynh (2012) applies the initial EPART-Framework for designing and implementing e-participation at the University of Koblenz-Landau. The evaluation of both applications assesses its application in two independent environments and identifies weaknesses and the need to refine and reassess the framework in *Design Stage 2*. The insights serve to refine the problem identification. Requirements are an important input to DSR (Hevner & Chatterjee, 2010, p. 17) as they can define the objectives of the solution (Peffers et al., 2007, p. 12). Requirements analysis is a systematic approach for requirements specification (Braun, Benedict, Wendler, & Esswein, 2015, p. 138; Rupp, 2012, p. 5). Its main objective in this research is the specification of the framework requirements and refinement of the objective definition. The design process of the EPART-Framework is an iterative process to synthesise the practical insights and the literature studies. The synthesis contributes to identify logical relationships, to structure practice-oriented problems, and to formulate and revise drafts of the EPART-Framework. Finally, the EPART-Framework is evaluated to derive recommendations and limitations. The knowledge base provides on the one hand the foundational theories and methodologies of research applied in the design phase and the evaluation phase. On the other hand, it provides the knowledge on e-participation design and implementation and architecture frameworks. The use of the knowledge base ensures the rigour of this research. This dissertation documents the design research approach as following:

- *Problem Identification and Objectives Definition:* Chapter 1 identifies the problem and motivates the research. Chapter 2 refines the objective with a clear definition of relevant terms
- *Design:* Chapter 3 describes the way in which the design is conducted based on rigorous methods. It describes the evolution of the EPArt-Framework during Design Stage 1 and Design Stage 2 and the design considerations made towards its development. Chapter 4 identifies the applicable knowledge in the e-participation body of knowledge and research gaps supporting the problem identification and objectives definition. Chapter 5 identifies the applicable knowledge in the architecture frameworks body of knowledge and analyses how far this knowledge is applied in the environment. Chapter 6 presents the EPART-Framework, Chapter 7 the supportive method.
- *Evaluation:* Chapter 8 describes the evaluation approach, argues its rigour, presents the evaluation results, and assesses the framework's utility, quality, and efficiency.
- *Communication:* Communications of this dissertation, i.e. additions to the e-participation knowledge base, are documented in Appendix E.

Next, design considerations made along this approach are documented.

3.3.2 Design Considerations

This subsection seeks to document and convey assumptions and decisions as a basis for future discussion. Therefore, it provides a documentation of the main results of the two design science stages applied (cf. Figure 6, p. 33). Eventually, it discusses the selection of appropriate notations and tools to model EEAs with the EPART-Framework and the tools used in this dissertation.

a) Design Stage 1

The initial version of the EPART-Framework evolved from an iterative research approach applying literature review and action research. Ethnographic studies allowed the observational evaluation of the framework components, which evolved during the frame of this research. In fact, the research applied in this dissertation was highly iterative resulting from the high dynamics of action research and in particular ethnographic studies (Nett & Stevens, 2009, p. 61). One activity in one project produced an artefact as a small piece of the overall initial version of the EPART-Framework. This framework was then tested in two experiments (OCOPOMO; Huynh (2012)). The documentation of such dynamic processes in ethnographic studies are one challenge of this research method (Meyers, 1999). However, this section seeks to convey assumptions and decisions made towards the design and evaluation of the initial version of the EPART-Framework.

Table 5 gives an overview of the activities and the artefacts produced during Design Stage 2 towards designing the initial version of the EPART-Framework: *The Reference Framework for E-Participation,* and the *Hands-on Guideline for Regional E-Participation* build the framework. The first column of Table 5 presents the *resulting artefact* that serves as *input* for the activity. It presents how artefacts are iteratively revised. The *Activity* appoints what research action has been undertaken, detailed description follows below. The *Project* appoints the environment of the activity has taken place, if applicable. The *Resulting artefact* appoints the resulting document, catalogue, models or paper. Column *EPART-Framework* indicates the relevance for the result presented in this dissertation. The applications of the framework are highlighted in grey; its components are marked bold. The evolution of the framework was not a sequential approach. The results of several activities in the different projects have flown into the architecture framework. For example, activities 3 and 5 do not have a prior activity; they emerged during the project run-time. A description of the activities follows below.

Table 5. Evolution of the initial version of the EPART-Framework

Note: The first column presents the *resulting artefact* that serves as *input* for the activity. *Activity* appoints what research action has been undertaken, detailed description follows below. *Project* appoints the project in which the activity has taken place, if applicable. *EPART-Framework* indicates the relevance for the result presented in this dissertation. The tests of the initial frameworks are highlighted in grey.

Input	Activity	Project	Resulting artefact	EPART
	1) VoicE requirements analysis	VoicE	a) End users' requirements report (Karamagioli & Titorencu, 2008)	Reference Models
	2) Evaluation of Austrian pilot	LEX-IS	b) Evaluation report (Scherer et al., 2009)	Method, Framework
	3) Heuristic analysis and empirical testing	VoicE	c) Analysis and test results report	Method, Viewpoints
a), b), c)	4) Grounding and generalising with desk research	VoicE	d) Usability engineering in e-participation (Scherer, Karamagioli et al., 2009)	Method, Viewpoints
	5) VoicE platform field observations	VoicE	e) Catalogue of critical points	
	6) Analysis and modelling of to-be participation processes, survey	VoiceS	f) Process and workflow models of participation processes in BPMN g) Survey results on usefulness of the process models (Scherer et al., 2009b)	Method, Reference Models
d), e), f), g)	7) VoiceS requirements analysis	VoiceS	h) VoiceS requirements analysis report (Agnoloni et al., 2009)	Reference Models

	8) Survey among VoicE users	VoicE	i) Role of Web 2.0 for e-participation (Augustin et al., 2010)	
h), i)	9) Generalisation of requirements and recommendations	-	j) Requirements and recommendations for e-participation applications (Scherer, Wimmer, & Ventzke, 2009c)	Reference Models
j)	10) Analysis of e-participation implementation activities	VoicE	k) Guideline for e-participation knowledge transfer (Scherer, Wimmer, & Ventzke, 2009a)	Method
k)	11) Generalising and grounding with literature studies	-	l) Hands-on guideline for e-participation initiatives: lessons from VoicE and VoiceS (Scherer et al., 2010)	Method
	12) Evaluation of the VoicE and VoiceS pilots	VoicE, VoiceS	m) Evaluation report (Scherer, 2010; Scherer et al., 2011; Scherer & Wimmer, 2010) n) Regional participation model to engage citizens in distant decision making (Scherer et al., 2012)	Method
	13) Studying interoperability in e-participation contexts	-	o) Interoperability requirements, recommendations, and standards in e-participation (Scherer et al., 2011)	Reference Models
l)	14) Application of the hands-on guideline in requirements analysis	OCOPOMO	p) OCOPOMO requirements (Bicking et al., 2010)	Method Viewpoints
	15) Evaluation of open source content management systems for e-participation	OCOPOMO	q) Evaluation of content management systems for e-participation (Scherer et al., 2011)	Reference Models
b), n), m), p)	16) Studying e-participation guidelines and frameworks	-	r) Reference Framework for E-Participation (Scherer & Wimmer, 2011b) s) Procedure model for e-participation	Framework, Method
r), s)	17) Application of the architecture framework for e-participation	-	t) Recommendations from the application of the architecture framework in a bachelor thesis (Huynh, 2012)	Framework
p), r)	18) OCOPOMO evaluation	OCOPOMO	u) OCOPOMO evaluation report (Bicking et al., 2013)	Method

The initial version of the EPART-Framework was elaborated from the following activities:

1) *Voice requirements analysis:* The project team conducted a requirements analysis in the beginning of the VoicE project based on two surveys: one with politicians and one with citizens. The team complemented the requirements analysis by use case and goal analysis. The final requirements for the VoicE platform are consolidated into the end users' requirements report (Karamagioli & Titorencu, 2008).
2) *Evaluation of Austrian pilot:* We finalised the LEX-IS project with the evaluation of the Austrian pilot, which brought insights into success factors of e-participation. Results of the Austrian pilot are published in Scherer et al. (2009).
3) *Heuristic analysis and empirical testing:* The design process of the VoicE platform was accompanied by a heuristic analysis[25] and empirical testing's[26]. Experts from VoicE project partners did the heuristic analysis of the VoicE platform. Partners also performed empirical testing with test users for a preliminary VoicE platform

[25] Heuristic evaluation means according to Nielsen (1993, p. 155) a "systematic inspection of a user interface design for usability to find the usability problems in a user interface design so that they can be attended to as part of an iterative design process". Usually, it is accomplished only by a small number of usability experts, who judge the compliance of the user interface with recognised usability principles. Heuristic evaluation is listed as a cost-saving method to identify usability problems before the real users see the system.

[26] According to Nielsen (1993) empirical testing helps to identify usability problems and opportunities in the system and the interface to improve them. Testing methods are thinking aloud, log files, etc. One problem with iterative design is according to Nielsen (1993) that changes in the user interface to solve one usability problem can bring new usability problems. Therefore iterative design and evaluation should be combined.

version. The users worked with the platform and answered a questionnaire afterwards. Additionally, project partners performed some interviews and thinking aloud sessions with the users. I documented the results of both studies in an internal VoicE Analysis and testing results report.

4) *Grounding and generalising with desk research:* I generalised and grounded the platform design process applied in the VoicE project with desk research. The resulting usability engineering process is published as in a recommendation on usability engineering in e-participation (Scherer, Karamagioli et al., 2009).

5) *VoicE platform field observations:* The VoicE team performed field observations with a beta version of the platform. It has resulted in a project intern *Catalogue of critical points and weaknesses of the existing VoicE platform*. The critical points of the VoicE platform flowed into the VoiceS requirements analysis (see activity 8). The weaknesses of the VoicE platform showed new requirements for the advanced VoicE platform implemented in VoiceS.

6) *Analysing and modelling to-be participation processes:* In order to customise participation processes in the VoiceS project for the European decision making processes and thereof to have the best possible result of e-participation, I conducted an analysis of European legislative processes and possible points of participation (Agnoloni et al., 2009). The analysis and modelling of to-be participation processes resulted in process and workflow models in BPMN. We used them to optimise the VoiceS processes and platform features. We evaluated the usefulness of the process models visualised with BPMN based on a survey among VoicE and VoiceS project partners. Results are published in Scherer et al. (2009b).

7) *VoiceS requirements analysis:* VoiceS encompassed a preliminary phase of requirements analysis. Its task was to address the problems, which should be solved, and defining the boundaries of the envisaged system. In addition to the results from activity 4, activity 5 and activity 6, the requirements analysis was based on interviews and questionnaires with citizens in order to gather the requirements from their point of view. Outcomes are documented in the *VoiceS requirements analysis report* (Agnoloni et al., 2009). This report describes the methodology and the results of the overall requirements analysis with focus on the architectural design, participation process models and user roles.

8) *Survey among VoicE users:* A survey among citizens, who visited the German VoicE platform, was undertaken with the aim to analyse the usage of Web 2.0 features for e-participation[27]. The survey, which was filled out by 164 respondents, investigated how the contents and Web 2.0 features of the VoicE platform were accepted by the users and if the use of such features resulted in an added value to achieve the aims of the project. The results are documented in the report Role of Web 2.0 for e-participation and VoicE (Augustin, 2009) and published in Augustin et al. (2010).

9) *Generalisation of requirements and recommendations:* The requirements and recommendations define in the VoicE and VoiceS projects, were generalised, validated or discarded based on desk research. Results are published as requirements and recommendations for e-participation applications (Scherer et al., 2009c).

[27] This research was undertaken in the frame of a student internship supervised by Prof. Dr. Maria A. Wimmer and co-supervised by me.

10) *Analysis of project implementation activities*: The analysis of the project implementation activities undertaken in VoicE and VoiceS was conducted. This analysis flowed into a VoicE project deliverable Guideline for e-participation knowledge transfer (Scherer et al., 2009a).
11) *Generalising and grounding with literature studies:* The VoicE and VoiceS hands-on guideline for e-participation knowledge transfer was generalised and grounded with literature studies. The results are published as Hands-on guideline for e-participation initiatives: lessons from VoicE and VoiceS (Scherer et al., 2010).
12) *Evaluation of the VoicE and VoiceS pilots*: The results and lessons learned from VoicE and VoiceS are of particular importance for the EPART-Framework: First reason is that VoicE and VoiceS incorporated ongoing evaluation through an iterative design cycle. Second, VoicE was evaluated with a layered model of e-participation evaluation, which is used in the EPART-Framework. Third, several lessons learned in VoicE are relevant. Evaluation results are documented in the *VoicE evaluation report* (Scherer, Wimmer, Lorenz, Pannese, & Ventzke, 2010) and the *VoiceS evaluation report* (Scherer, 2010; Scherer et al., 2011) and published in Scherer and Wimmer (2010) and Scherer et al. (2012).
13) *Studying interoperability in e-participation contexts:* A study of interoperability in e-participation was conducted in order to contribute to a better understanding of interoperability in regard to e-participation systems. We analysed the interoperability requirements of e-participation tools and processes per e-participation area, and derived a set of recommendations based on the EIF draft version 2.0 layers (European Commission (EC), 2010) in order to guarantee interoperability between e-participation systems. Results are published in Scherer et al. (2011).
14) *Applying activities of hands-on guideline in requirements analysis:* The methodological approach to analyse the user requirements for the OCOPOMO e-participation toolbox was based upon the design phases of the hands-on guideline for e-participation (activity 11). Target participation processes were modelled. The application of activities of the hands-on guideline in requirements analysis of OCOPOMO resulted in a number of process related requirements, which have been independent from ICT used. These were based on process models for scenario building, policy modelling and participation processes. The results have flowed into the *OCOPOMO requirements report* (Bicking et al., 2010).
15) *Evaluation of open source content management systems for e-participation:* An evaluation of open source content management systems (CMS) was conducted in the OCOPOMO project. Based on a framework proposing different selection criteria for CMS a comparison between different is provided. The framework has been used in the OCOPOMO project for selection of a CMS. The results are published in Scherer et al. (2011).
16) *Studying e-participation guidelines and frameworks:* Desk research on e-participation guidelines and frameworks provides input into an understanding of what needs to be conducted in order to implement e-participation, what good practices are and what is common in different projects. Earlier results are published in Scherer and Wimmer (2011b).
17) *Case study of the EPART-Framework:* The initial version of the EPART-Framework (2011b) was used by Huynh (2012) to build up e-participation services for the re-

accreditation of study programmes in the computer science department of the University of Koblenz-Landau. Huynh (2012, p. 61) confirms the applicability of the framework but criticises the limited number of entities in the metamodel and the library.

18) *OCOPOMO evaluation:* The OCOPOMO project based its evaluation on an evaluation framework, which emerged from the consideration of key questions regarding what should be evaluated: the process and the toolbox from the view of the different actors (Bicking et al., 2013). As the initial version of the EPART-Framework was used in the OCOPOMO project (Scherer et al., 2013), the evaluation results brought important inputs to its refinement (see Subsection 8.2.1)

The subsequent activities in Design Stage 2 are outlined in the following section.

b) Design Stage 2

The evaluation of the initial version of the EPART-Framework assesses its application in two independent environments (see Activity 17) and Activity 18) above) and identifies weaknesses and the need to refine and reassess the framework in Design Stage 2. Table 6 documents the consecutive activities to accomplish this aim by extending Table 5. The transition between Design Stage 1 and Design Stage 2 is fluent; this means that some activities in Design Stage 2 start before the evaluation of the initial version of the EPART-Framework is finished. These activities are assigned to Design Stage 2 because the results did not influence the initial EPART-Framework evaluated.

Table 6. Evolution of the EPART-Framework (extension of Table 5, p. 35)

Note: The first column presents the *resulting artefact* that serves as *input* for the activity. *Activity* appoints what research action has been undertaken, detailed description follows below. *Resulting artefact* appoints the resulting document, catalogue, models or paper. *EPART-Framework* indicates the relevance for the result presented in this dissertation.

Input	Activity	Resulting artefact	EPART
u)	19) Studying enterprise architectures in e-participation contexts	v) Applicability of enterprise architecture frameworks in e-participation (Scherer & Wimmer, 2011a, 2012a)	Framework
f), g)	20) Case studies of procedures in e-participation	w) BPMN models for e-petitioning, participatory budgeting, e-campaigning, spatial planning (Scherer & Wimmer, 2012b)	Reference Models
	21) ICT security analysis	x) Security requirements for trustworthy e-participation (Scherer & Wimmer, 2015)	Reference Models
o), q), t), u) , v), w) x)	22) Desk research to synthesise results and develop the EPART-Framework	y) EPART-Framework	Framework
y)	23) Analytical Evaluation	z) Evaluation results	Evaluated Framework

The EPART-Framework was elaborated from the following activities:

19) *Studying enterprise architectures in e-participation:* The application of EA frameworks in the context of e-participation was analysed to explain how EA frameworks can support the development and implementation of e-participation. The study is published in Scherer and Wimmer (2011a, 2012a).

20) *Case studies of procedures in e-participation:* Study of cases in the following areas participatory budgeting, spatial planning, e-petitioning, e-campaigning, and e-con-

sultation[28]. Based on these studies, traditional' and electronically supported participation processes were modelled in BPMN. This research builds the basis for process models developed and integrated in the EPART-Framework. A revision of the process models for participatory budgeting is published in Scherer and Wimmer (2012b).

21) *ICT security analysis:* In the frame of the KoMePol[29] project, we undertook an ICT security analysis applying the reference model of Grimm, Simić-Draws, Bräunlich, Kasten, and Meletiadou (2014). The result is a security concept for e-participation (Scherer & Wimmer, 2015) that was added partly to the Reference Requirements Catalogue.

22) *Synthesis of results to develop the EPArt-Framework:* I conducted further desk research and literature review in order to consolidate results and develop the EPART-Framework as it is presented in this dissertation. The synthesis is described in detail in the following.

The dissertation identifies 19 requirements for the content as relevant for the EPART-Framework (see Appendix A) and requirements for the structure based on the GoM (proven as adequate in Subsection 5.1.3). The requirements derived are fully taken into account for the design and development of the EPART-Framework. The EPART-Framework is thus designed by synthesising the results from the literature review and the action research (see Chapter 4 and Chapter 5). The main activities are described in the following for each of the framework components:

- *Viewpoints:* Its development is based on the analysis of architecture framework viewpoints and of stakeholder concerns:
  - the analysis of viewpoints in architecture frameworks and their applicability in e-participation contexts
  - the analysis of stakeholder concerns and developed artefacts,
  - the synthesis of results and integration into one set of viewpoints
- *Metamodel:* Its development is based on:
  - the analysis of entities and their relationships identified in conceptual models structuring e-participation
  - the analysis of architecture framework metamodel entities and their relationships, as well as their applicability in e-participation contexts
  - the synthesis of results and integration of entities into one metamodel
- *Method:* Its development is based on the review of guidelines for e-participation, and of architecture development methods of existing architecture frameworks, and practical experience:
  - the identification of relevant phases and activities in e-participation (

[28] A research internship at University of Koblenz-Landau (Forschungspraktikum "Referenzprozesse für E-Partizipation"), supervised by Prof. Dr. Maria A Wimmer and me. See also Appendix E.

[29] The research grant "Communication, Media and Politics" (KoMePol) investigates, among other aspects, trust in mediation, perception and processing of politically relevant discourses. The project is divided into distinct sub-projects, where "mPart - mobile participation of citizens with privacy protection" focuses on the role of trust in e-participation. More information is available at https://www.uni-koblenz-landau.de/de/komepol/ (last accessed 2016-03-24).

  - the analysis of architecture development methods in e-participation contexts
  - the analysis of design and implementation approaches experienced
  - the synthesis of results and integration into an architecture development method for EEAs.
- *Reference Models:* Their development is based on the review of reference models in architecture frameworks, the artefacts developed in the projects, and the insights coming from the additional literature review, e.g., to define reference models for participatory budgeting (see Scherer & Wimmer, 2012b):
  - the identification of reference models from analysis of architecture frameworks
  - the identification of reference models from literature and experienced in projects
  - the synthesis of results and development of reference models according to the Viewpoints.

Using the viewpoints and the metamodel to design the reference models resulted in an incremental revision of these components.

This subsection concludes with the selection of appropriate notations and tools needed to design an EEA with the framework.

c) Notations and Tools

A number of description languages are common for modelling businesses and IT. Nevertheless, no standardised language for modelling architecture frameworks exists, but a number of aspects have been categorised as important: multi-perspective modelling, management of variants and reuse and adaption (Fettke & Loos, 2007, p. 6). Lankhorst (2009, p. 37) regards the suitability of the following description languages in the area of organisations, business processes, applications, and technology (pp. 30ff): Integrated Computer-Aided Manufacturing Definition (IDEF), Business Process Modelling Notation (BPMN), TestBed, Architecture of Integrated Information Systems (ARIS), Unified Modelling Language (UML[30]), and Architecture Description Languages in general. Resulting a number of limitations of these languages in the enterprise architecture domain are described in Lankhorst (2009, p. 38):

- Relations between different views cannot be extensively defined
- Models form different views are not further integrated
- Some languages are not formally defined
- Some languages are missing "the overall architectural vision"
- Some languages have their base either in the business or in the application and technology subdomains
- UML as "mainstream modelling approach" is criticised as "not readily accessible and understandable for managers and business consultants" what would demand for specific visualisations (Lankhorst, 2009, p. 38).

In principle, there are two options for employing an architecture framework with existing software solutions:

[30] An Object Management Group (OMG) modelling specification which is now ISO/IEC 19501

1. The architects select an existing tool, which relies on a metamodel and viewpoints, similar to the e-participation metamodel. The architects define analogies between these metamodels. An example would be an enterprise architecture tool supporting ArchiMate or TOGAF such as the free *ArchiMate Modelling Tool*[31].
2. The architects select an existing tool, which allows the modification of the metamodel and the viewpoints. An example is ADOit[32] by the BOC Group. Its professional edition includes an administration toolkit to modify the ADOit metamodel and viewpoints.

While both options deal with aforementioned limitations, they also have disadvantages. With the first option, the architects cannot benefit from the full potential of the EPART-Framework. Chapter 5 demonstrates the disadvantages of using existing EAFs for e-participation. Another challenge is that this option demands the architects to know the underlying framework in detail. The effort to formalise transition rules is high (Estrem et al., 2014; see e.g. the transition rules between ArchiMate and TOGAF Estrem & Gonzalez, 2014)

The second option seems to be a better choice for the EE architects, in particular if it is necessary to modify the EPART-Framework. This option, however, demands a high familiarity with the software in order to adapt the metamodel and the viewpoints. It is not easy to adapt the metamodel or the viewpoints library in these tools.

The adaption of the metamodel is a challenge for the design of the EPART-Metamodel, the EPART-Viewpoints and EPART-Reference Models during Design Science Research Cycle 2. The synthesis of research results is an iterative approach, where the resulting artefacts (metamodel, viewpoints, and reference models) are refined in several steps. As these components are interdependent, changes in one component need to be transferred to the other components. This procedure demands flexibility. Another challenge is that a standardised EA notation does not exist: different tools use different notations. For example, the notations of both above-mentioned tools, i.e. the ArchiMate 2.1 specification and the ADOit metamodel, use different symbols for representing processes. Both however do not integrate BPMN to model business processes, even if its recommended by the ArchiMate 2.1 specification (TOG, 2013, p. 20). BPMN is selected as the notation to model participation processes as we used it successfully for communication and planning in VoiceS (Scherer et al., 2009b). In addition, the use of the standardised UML notation provides a high flexibility. Therefore, the technical solution for integrating different models types and tables is based on the use of MS Visio[33]. The solution uses the following stencil sets[34]:

– The UML 2.5 Symbols Stencils Set[35] is used to model conceptual diagrams of metamodel entity instances and their relationships
– The MS BPMN Standard Stencils Set is used to model process flows

[31] http://www.archimatetool.com/ (access: 2015-10-13)

[32] ADOit® is registered trade mark of the BOC Group, see https://de.boc-group.com/adoit/ (access: 2015-12-08).

[33] Microsoft Visio is a diagramming and vector graphics application, see https://products.office.com/en/visio (access 2016-05-18).

[34] Stencil set provide predefined symbols to develop diagrams.

[35] http://www.softwarestencils.com/uml/#Visio2013

– The MS Project Management Stencils Set is used to model project plans with Gantt charts[36].

It is possible to extend diagrams with any stencil sets available in MS Visio. MS Excel[37] is used to define and catalogue matrices. It is possible to link the data defined in an MS Excel spreadsheet with symbols in an MS Visio diagram. For the design of the EPART-Framework components, the solution turned out to be useful because of its flexibility. Nevertheless, this solution has the disadvantage that maintaining the consistency within the architecture description is challenging. The architects need to add each new entity instance to the diagrams manually and vice versa. The same applies for deleting instances in the database or the diagrams. Even if these disadvantages exist, the solution presented in this dissertation shows the technical applicability.

After grounding the research design, the next part moves forward with presenting the results of the literature review and the action research.

[36] See PMI (2000) for information on Gantt charts.

[37] Microsoft Excel is a spreadsheet tool, see https://products.office.com/en-gb/excel (access 2016-05-18)

Part II. LITERATURE REVIEW AND ACTION RESEARCH

4. State of the Art in E-Participation Design & Implementation

This chapter reviews the relevant literature drawn from academic and practitioner sources in the e-participation body of knowledge. It presents comparative studies of models structuring e-participation and procedure models for e-participation and summarises the challenges of e-participation design and implementation. The purpose is to study the characteristics of e-participation and identify the research gaps that this dissertation seeks to address. Furthermore, this analysis seeks to identify requirements for the EPArt-Framework (cf. Chapter 3 for an overview of the research design).

The remainder of the chapter is as follows: Section 4.1 studies the characteristics that determine e-participation. Section 4.2 continues this research by reviewing the scientific literature for conceptual models that structure the e-participation domain. Section 4.3 investigates procedure models that guide e-participation and derives important phases and activities. Section 4.4 reviews the need for an e-participation architecture framework based on the gaps identified in the e-participation body of knowledge.

4.1 Characteristics of E-Participation

The purpose of this section is to study the characteristics of e-participation (Kalampokis et al., 2008; Macintosh, 2004a; Wimmer, 2007b): In general, e-participation needs to be placed in the context of the relevant policy-making processes. In formal participation, the policy-making cycle affects these processes (Subsection 4.1.1). A huge challenge in this regard is the participation paradox (Subsection 4.1.2). E-participation promises benefits, but also carries risks (Subsection 4.1.3). The level of participation (information, engaging, empowering) determines the power the stakeholders may have (Subsection 4.1.4). The area of participation describes the particular field in which citizen participation takes place and determines the activities of the participation process (Subsection 4.1.5). Participation techniques define the type of participation (Subsection 4.1.6). Participation processes provide activities to realise the techniques and integrate participation into existing legislative and administrative processes (Subsection 4.1.7). In the e-participation domain, electronic tools support these activities (Subsection 4.1.8). Guidelines regulate e-participation (Subsection 4.1.9).

4.1.1 Participation in the Policy-Making Cycle

E-participation, at least if it is formal, needs to be embed in the policy-making cycle (Macintosh, 2004a). Policy making is complex in its nature and researchers made different attempts to systematise it. The policy-making process can be regarded as a stage model consisting of a number of consecutive activities (Anderson, 2010, p. 3; Birkland, 2004, p. 221;

Howlett et al., 1995), referred to as the 'policy cycle' (Howlett et al., 1995, p. 9)[38]. The approach of Howlett et al.(1995) has been adapted with a slightly different naming scheme in different attempts (e.g. in Kalampokis et al., 2008; Macintosh, 2004a; Organisation for Economic Co-operation and Development (OECD), 2003; Phang & Kankanhalli, 2008; Wimmer, 2007b). It describes the policy-making process with the following five stages as a cycle (Figure 7):

- **Agenda Setting** is the stage by which governments recognise problems.
- **Policy Formulation** is the stage by which governments formulate policy options.
- **Decision Making** is the stage by which governments adopt a particular course of action or non-action.
- **Policy Implementation** is the stage "by which governments put policies into effect".
- **Policy Evaluation** is the stage by which state and societal actors monitor the results of policies.

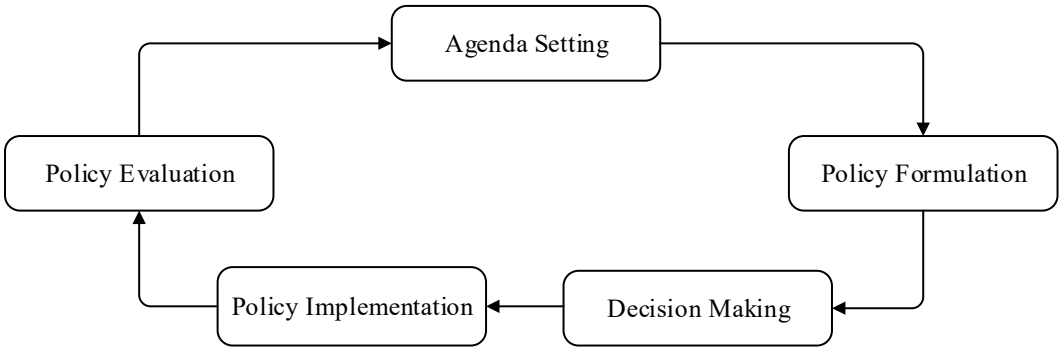


Figure 7. Simplified policy-making cycle (Howlett et al., 1995, p. 11)

Different stages of the policy-making cycle provide different participation opportunities. Hence, it is important when to engage. For example, Macintosh (2004a, p. 3) describes how to embed participation activities in the policy-making stages. She states that consultation activities have more influence on the outcome when done in earlier stages (in particular during the agenda-setting stage or the policy-formulation stage). Furthermore, participation in the policy-formulation stage or the decision-making stage needs stakeholders with proper communication skills and skills for interpreting documents. These skills are necessary to be able to give valuable comments (Macintosh, 2004a, p. 3). Phang and Kankanhalli (2008, p. 130) highlight different e-participation goals in the stages of the policy cycle: *input probing* in the agenda-setting stage; *information exchange* in the policy-formulation stage; *supplementary input to consider* in the decision-making stage, *education and support-building* in the policy-implementation stage; and *information exchange* in the policy-

[38] Some authors criticise that a simplification of the policy-making process implies that policy making is a systematic step-by-step process with a clear start and end point (Howlett, Ramesh, Perl, & Ramesh, 1995, p. 12; Birkland, 2004, p. 221). Actually, not all policies reach all stages. For example: "a policy concept may reach the agenda, but (...) any ideas generated may not get beyond mere discussion" (Birkland, 2004, p. 221). Policy making is also more an "ad hoc and idiosyncratic process" (Howlett, Ramesh, Perl, & Ramesh, 1995, p. 12). It is not realistic to separate policy implementation from evaluation; the latter "happens all the time as a policy is being implemented" (Birkland, 2004, p. 221). Nevertheless, stage models can at least be helpful to structure "thinking about policy process" and to see "how all the pieces of the policy process fit together" (Birkland, 2004, p. 223). This can facilitate the "understanding of public policy making" Howlett et al. (1995, p. 12). In this regard, the work at hand uses the policy-making stage model described by Howlett et al. (1995, p. 11).

evaluation stage. Stakeholder participation in the policy implementation stage with the aim to influence the policy is rather not possible. Accordingly, the possible influence of participation declines with each stage from agenda setting to policy implementation (Reinert, 2003, p. 37).

Consequently, the following requirement for the EPART-Framework is noted:

Requirement 1. Policy-making cycle: The EPART-Framework should regard the policy-making cycle and guide the integration of the participation services into the policy stages.

However, the interests of potential participants is not always conform to the participation opportunities during the policy-making cycle as outlined in the following subsection.

4.1.2 Participation Paradox

One challenge of participation is referred to as the *participation paradox* (Reinert, 2003, p. 37): the interest of target groups is less in the earlier stages of policy making – exactly when their potential influence of participation could be the greatest (see above). Their interest rises with the ongoing policy-making process and is greatest during the implementation of a policy – when potential influence of participation is at its lowest (Figure 8).

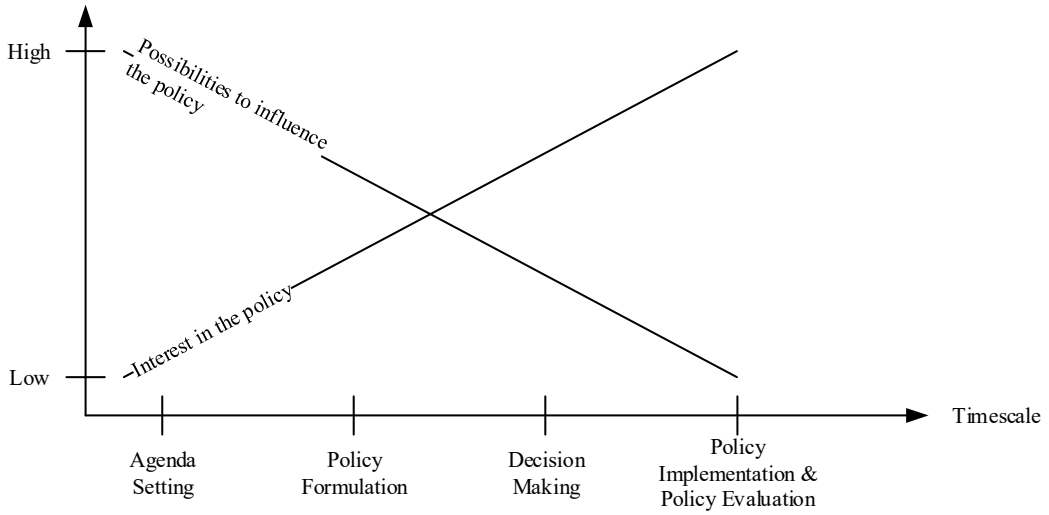


Figure 8. Participation paradox: target groups have the greatest interest in the policy when they have the least possibilities to influence the policy-making process (Reinert, 2003, p. 37)

A prominent example of the participation paradox is Stuttgart21[39] – the large-scale project of Deutsche Bahn AG, the state Baden-Württemberg, the Stuttgart Region association, the city of Stuttgart, the Federal Republic of Germany and the European Union[40]. Its aim is the fundamental transformation of the Stuttgart train station and its connection to the airport terminal. In 1994, the then head of Deutsche Bahn AG, Heinz Dürr, presented the project to the public for the first time; first contracts were signed in November 1995[41] (*agenda*

[39] http://www.bahnprojekt-stuttgart-ulm.de/ueberblick/was-ist-das-bahnprojekt-stuttgart-ulm/s21-neuordnung-bahnknoten-stuttgart/ (access 2015-11-19)

[40] https://www.stuttgart.de/stuttgart21 (access 2015-11-19)

[41] http://www.focus.de/politik/deutschland/stuttgart-21/tid-20063/chronologie-zu-stuttgart-21-erst-grossprojekt-dann-grossprotest_aid_559169.html (access 2015-11-19)

setting stage). The planning approval procedure, i.e. the *policy formulation stage*, started in October 2001 (Eisenbahn-Bundesamt, 2005, p. 134). The city of Stuttgart released the detailed plans for consulting opinions of the public from 2002-09-09 to 2002-10-08; the public participation period ended on 2002-10-22. This is the time, granted by law, when citizen participation is possible in such public building projects[42]. Different agencies, public bodies, and associations were involved; approximately 2,700 private objectors commented on the proposals (Eisenbahn-Bundesamt, 2005, p. 24). In February 2005, the Federal Railway Authority (Eisenbahn-Bundesamt) issued a building permit for Stuttgart21 and first complaints started[43]. Three years later, the project was a topic in the German Bundestag and adopted – the *final decision was made*. In 2009, protest rallies against the project started and by 2010 demonstrations with 10,000 to 80,000[44] participants were taking place twice a week (Baumgarten & Rucht, 2013, p. 100), while *policy implementation* (i.e. construction works) started. The situation escalated as officials refused to hear the voice of the citizens and take them seriously (Brettschneider, 2013, p. 185, 2013). The then Prime Minister Stefan Mappus initiated a consultation procedure with Heiner Geisler as arbitrator – a *democracy experiment* (Brettschneider, 2013, p. 186). Civil engagement resulted in new participation opportunities in the case of Stuttgart21. However, in the Agenda Setting and Policy Formulation stages, when regular participation was granted by law, the interest of private corporations was low. It is not yet clear how similar large-scale projects could be handled in the future. However, the challenges need to be overcome. According to a Forsa study of 2014, a majority of 79 % states that online participation in large scale projects enhances trust in the politics (forsa, 2014, p. 11) and in 2011, the German Chancellor commits to enable more and earlier participation[45]. The course has been set, but there are just individual measures so far. At the same time, we must bear in mind that (electronic) citizen participation offers several benefits, but poses risks at the same time, as outlined in the following.

4.1.3 Benefits and Risks

The literature assesses the benefits and risks of citizen participation in policy making differently. For example, Westle (1992, p. 137) highlights a *danger for democracy*. Heidbreder, Feller, and Frieß (2014) analyse if participation leads to *more democratisation – and conclude with a "no"*. Macintosh (2004a, p. 2) emphasizes that the system of *representative democracy is strengthened* with e-democracy, e-participation or citizen participation in general. Wolff (2006, pp. 17–20), Luyet, Schlaepfer, Parlange, and Buttler (2012, p. 214) and Roberts (2004, pp. 323–327) provide discussions and literature reviews on benefits and risks. They describe benefits such as the integration of various interests and opinions, improved policies and higher acceptance of decisions. On the opposite of the benefits,

[42] „Bei der Planfeststellung sind die von dem Vorhaben berührten *öffentlichen und privaten Belange* einschließlich der Umweltverträglichkeit im Rahmen der Abwägung zu berücksichtigen." (Allgemeines Eisenbahngesetz, 1993)

[43] http://www.focus.de/politik/deutschland/stuttgart-21/tid-20063/chronologie-zu-stuttgart-21-erst-grossprojekt-dann-grossprotest_aid_559169.html (access 2015-11-19)

[44] Numbers vary from officials and organisers as Baumgarten and Rucht (2013, p. 100) outlines.

[45] DAPD Nachrichtenagentur: "Merkel will mehr Bürgerbeteiligung" (Merkel wants more citizen participation), see http://www.themenportal.de/nachrichten/merkel-will-mehr-buergerbeteiligung-72485 (access 2016-04-21)

however, they call the risks such as disappointed participants, time-consuming and expensive processes and non-representative decisions. Andersen et al. (2007) analyse e-participation from a management point of view. They conclude that e-participation reduces public service' costs in the long term, even if it results in higher workload and administrative costs (p. 41). However, the need to support citizens' engagement with ICT is undoubted. Technological developments can and will not leave participation and democracy untouched (Schaal, 2016). Macintosh lists the *benefits* of using ICT in citizen participation as follows (2004a, p. 2, 2004b, p. 33):

- *Reach a wider audience* to enable broader participation.
- Support participation through a range of technologies to *cater to the diverse technical and communicative skills of citizens.*
- *Provide relevant information* in a format that is both more accessible and more understandable to the target audience to enable more informed contributions.
- *Engage with a wider audience* to enable more in-depth contributions and support deliberative debate.
- *Facilitate the analysis* of contributions to support policy-makers and to improve policy.
- *Provide relevant and appropriate feedback* to citizens to ensure openness and transparency in the policy-making process.
- *Monitor and evaluate the process* to ensure continuous improvement.

During the policy-making process, the power of citizens varies with the levels of participation as discussed in the following subsection.

4.1.4 Participation Levels

E-participation literature refers to *objectives of citizen participation* or the *power that is put in the hands of the stakeholders* with *participation levels* (Arnstein, 1969, p. 217; International Association for Public Participation (IAP2), 2007; Kalampokis et al., 2008, p. 28; Macintosh, 2004a, p. 3; Wimmer, 2007b, p. 91). This results in the following requirement:

Requirement 2. Participation levels: The EPART-Framework should consider the participation levels and support their alignment with the objectives of participation.

Table 7 gives an overview of participation levels from the literature and compares the interpretation of the different levels. The power of the stakeholders increases from the first to the latest row in the table. The OECD (2001) categorisation limits the power of citizens more than others; the final decision remains in the hand of the government. Differentiation between the levels is sometimes not as obvious and straightforward as, e.g. between involvement, collaboration, and empowerment in IAP2 (2007).

Table 7. Comparison of levels of participation proposed in literature

Note: Same rows indicate comparable participation levels concerning the power given in the hands of the citizens.

Arnstein, 1969	IAP2, 2007	OECD, 2001	Macintosh, 2004a	Rowe & Frewer, 2005	UN, 2014	Wimmer, 2007b
Manipulation	-	-	E-empowering	-		-
Therapy	Inform	Informing	E-enabling	-	E-information	E-informing
Informing				Public Communication		
Consultation	Consult	Consultation	E-engaging	Public Consultation	E-consultation	E-consulting
Placation	Involve	Active participation		Public Participation	E-decision-making	E-collaborating
Partnership	Collaborate		E-empowering			
Delegated power	Empower	-		-		E-empowering
Citizen control				-		

This dissertation uses the following levels of participation, which expands Macintosh's (2004a) categorisation:

- *Enablement*: Stakeholders are enabled to participate or to follow policy making:
  - *Information*: Stakeholders are provided with information in the political arena.
  - *Education*: Organisation of training courses and provision of information and material to teach stakeholders about participation (youth in particular) with the objective to encourage them to participate.
- *Engagement*: Stakeholders are engaged in a wider deliberation. The final decision stays in the hand of government/parliament. The following sub-levels can be differentiated:
  - *Consultation*: Stakeholders are asked for their opinions and views.
  - *Collaboration*: Stakeholders collaborate on an issue e.g. with government or parliament but the decision remains in the hand of the government/decision makers.
  - *Deliberation*: Stakeholders are involved in a deliberative debate on policy issues.
- *Empowerment*: Stakeholders collaborate on an issue and the final decision is made in this collaboration process. Citizens emerge as policy producers rather than policy consumers. This includes the wider collaboration of government or parliament with citizens, with the final decision remaining in the hands of the citizens, e.g. by a polling or voting procedure.

Next, an overview of participation areas follows.

4.1.5 Participation Areas

Participation Areas describe where citizen participation takes place (Kalampokis et al., 2008; Tambouris, Liotas, & Tarabanis, 2007, p. 3; Wimmer, 2007b). Sometimes, the literature refers to *e-participation activities* in this context (see e.g. Medaglia, 2012; Sæbø et al., 2008). Requirement 3 results of the importance of these areas for e-participation:

Requirement 3. Participation areas: The EPART-Framework should support different participation areas and their alignment with participation objectives.

Tambouris et al. (2007, p. 3) adopt a list of twenty e-participation areas identified in the DEMO-net project (Fraser et al., 2006; Kalampokis et al., 2008, p. 28; Wimmer, 2007b, p. 92). Sæbø et al. (2008, p. 407) refer to a shorter list of e-participation activities comparable with aforementioned areas (see also Medaglia, 2012, p. 348). Table 8 shows a list of participation areas derived from Tambouris et al. (2007, p. 3). Tambouris et al.'s list is extended with the area *budget planning* and reduced by areas not focussing on citizen engagement such as *cultural politics*, *inclusion/exclusion*, and *service delivery* and areas representing a participation level as *information provisioning* and *education*.

Table 8. Participation areas (based on Tambouris et al., 2007, p. 3)

Name	Description
Budgeting	Process of planning and allocating a budget.
Campaigning	Lobbying, protesting, petitioning and other forms of activism to form a collective action.
Citizen Journalism	Involve citizens who voluntarily collect, report, analyse and disseminate news and information.
Community Building	Support individuals to form communities, empower these communities and support their collaborative teamwork.
Consultation	Process of seeking views of individuals and groups (usually between those proposing a course of action and those likely to be affected by it).
Deliberation	Public exchange of opinions in order to achieve consensus on policies/politics developed from this exchange
Discourse	Dialogue between citizens and between elected representatives and citizens.
Electioneering	Actions of candidates and political parties in the context of election campaigns.
Environmental Planning	Process of planning and implementing environmental protection measurements.
Law Making	Law creation in the agenda setting and formation stages as well as debate of draft legislation in the implementation and evaluation stages.
Mediation	Process where a third part intervenes to resolve a dispute or a conflict.
Petitioning	Launch a petition on a topic of general interest including sending out invitations to support it.
Polling	Surveys to measure public opinion and/or sentiments by using sampling.
Referenda	Possibility for citizens to decide on particular issues; regulated by law. Refers to the statutory process of enabling citizens to vote for a proposal brought in by a parliament or government.
Spatial Planning	Process of acquiring the opinion of the public or specific stakeholders in decisions related to the development and the use of land.
Voting	Decision-making method, where the final decision is based on the number of people in favour of each alternative. A specific voting is a referendum (see above).

Different participation levels, areas, and target groups demand different participation (or participatory) techniques (Arnstein, 1969; Kalampokis et al., 2008; Phang & Kankanhalli, 2008) as described next.

4.1.6 Participation Techniques

Participation Techniques (or participation methods) are instruments or methods applied to engage stakeholders in the policy-making process (Kalampokis et al., 2008, p. 28). The

framework should consider them to design appropriate support of processes and technologies as identified in Requirement 4.

Requirement 4. Participation techniques: The EPART-Framework should support the integration of different participation techniques and the alignment with the objectives.

Thirty participation techniques are presented in Ley and Weitz (2003) – a method handbook for practice participation. Glass (1979) outlines a number of traditional participation techniques supporting different objectives (Table 9). Rowe and Frewer (2000) list and evaluate eight participation techniques, which they call "the most formalised public participation methods"(p. 8-9): referenda, public hearing/inquiries, public opinion surveys, negotiated rule making, consensus conference, citizens' jury/panel, citizens/public advisory committee, and focus groups. Guidance on the selection of appropriate participation techniques, including participation processes and pros and cons is provided, among others, by Ley and Weitz (2003) or Arnstein (1969).

Table 9. Objectives and techniques of citizen participation (Glass, 1979; Phang & Kankanhalli, 2008, p. 131)

Objectives (Glass, 1979)	Information exchange	Education Support building	Decision-making supplement	Representational input
Technique Category (Glass, 1979)	Unstructured	Structured	Active process	Passive process
Techniques (Glass, 1979)	1. Drop-in centres 2. Neighbourhood meetings 3. Agency information meetings 4. Public hearings	1. Citizen advisory committees 2. Citizen review boards 3. Citizen task forces	1. Nominal group process 2. Analysis of judgement 3. Value analysis	1. Citizen survey 2. Delphi process
ICT Tools that Provide the Features Desired (Phang & Kankanhalli, 2008)	Web portal with online discussion forum, Online chat	Electronic profiling, Online chat, Discussion forum with login feature, Teleconferencing, Videoconferencing, E-mail	Group support systems with process restrictiveness feature, Online pairwise structured survey, Visualisation tools	Online survey questionnaire, Web comment form, Data analysis tools

One question in e-participation research and practice is how to support these participation techniques electronically (Kubicek, 2016, p. 308). Different attempts exist to transform them into electronically supported methods. For example, Phang and Kankanhalli (2008) describe how Glass' techniques can be supported by electronic means (Table 9). Another approach is presented by Ali (2010, p. 115), where participation methods are mapped with collaboration patterns, which are decomposed into collaborative tools to support them. However, the transformation of participation techniques into e-participation techniques does not only mean to support the traditional techniques by electronic tools. *New ways of participation emerge from social changes and digitalisation* as e.g. the concept of liquid democracy (Reichert & Panek, 2014, p. 299).

Next section looks into the participation processes supporting the application of participation techniques, also with ICT support.

4.1.7 Participation Processes

Participation processes[46] describe the procedure of participation that results in participation outputs adding value to policy making and democratic decision making. Often, personnel in administrations does not have the knowledge how to proceed participation offerings (Stock, 2011, p. 13). Even if methods and best-practices are available, knowledge does not reach relevant positions or are only partly available (Stock, 2011, p. 14). The same time, engagement of external service provider may not be possible because of budget limitations (Stock, 2011, p. 14). Resources for moderation and evaluation are often underestimated when planning e-participation for the first time. Resulting, administrations are overwhelmed with the additional work. Therefore, the following requirement is noted:

Requirement 5. Participation process design: The EPART-Framework should support the design of participation processes based on defined participation objectives and their integration into policy-making processes.

A challenge is that participation processes have so far not been extensively modelled and standardised (Sajjad, Lee, Kamal, & Irani, 2011, p. 204; Scherer et al., 2011, p. 100). Even if first process models and patterns exist (see e.g. Ali, 2010; Märker et al., 2009), there is still a lack of reference models for process patterns and process chains describing common processes in e-participation. Advantages of process models experienced in the private sector have so far not been exploited in e-participation (Sajjad et al., 2011, p. 206). The EPART-Framework should provide support as identified in the following requirement:

Requirement 6. Reference participation process models: The EPART-Framework should integrate reusable participation process models.

In order to analyse procedural aspects of e-participation, a case study of participatory budgeting complements the literature review. Participatory budgeting is a popular application of e-participation in Germany, even if only about one hundred local governments have executed participatory budgets in the last years[47]. Law in Germany does not formally request citizen participation in public budget planning. In addition, it does not define the legal procedures to settle the budget of local governments. In consequence, different procedures exist, which lead also to different implementations of procedures in participatory budgeting. The case study of participatory budgeting in Germany aims at deriving insights on the traditional as well as the participatory budgeting processes. Objectives, target groups, criteria, and phases of (participatory) budgeting are investigated in order to identify reference artefacts informing the reference library with reusable architecture models. These models aim to support cities and municipalities to assess the benefit and the human and financial resources to execute participatory budgeting.

Porto Alegre (Brazil), which implemented the first participatory budget in 1989 to fight corruption in administrations (Sousa Santos, 1998; Souza, 2001), is one of the most studied cases in the field of participatory budgeting (Abers, 2001; Herzberg, 2002; Novy & Leubolt, 2005). Participatory budgeting in Porto Alegre is running throughout the year and composed of four main phases (Herzberg, 2002, p. 54): (1) prioritising topics through

[46] This is defined in analogy to business processes. A business process means according to Scheer and Nüttgens (2000, p. 376) a procedure that adds value to an organisation and is viewed from start to end.

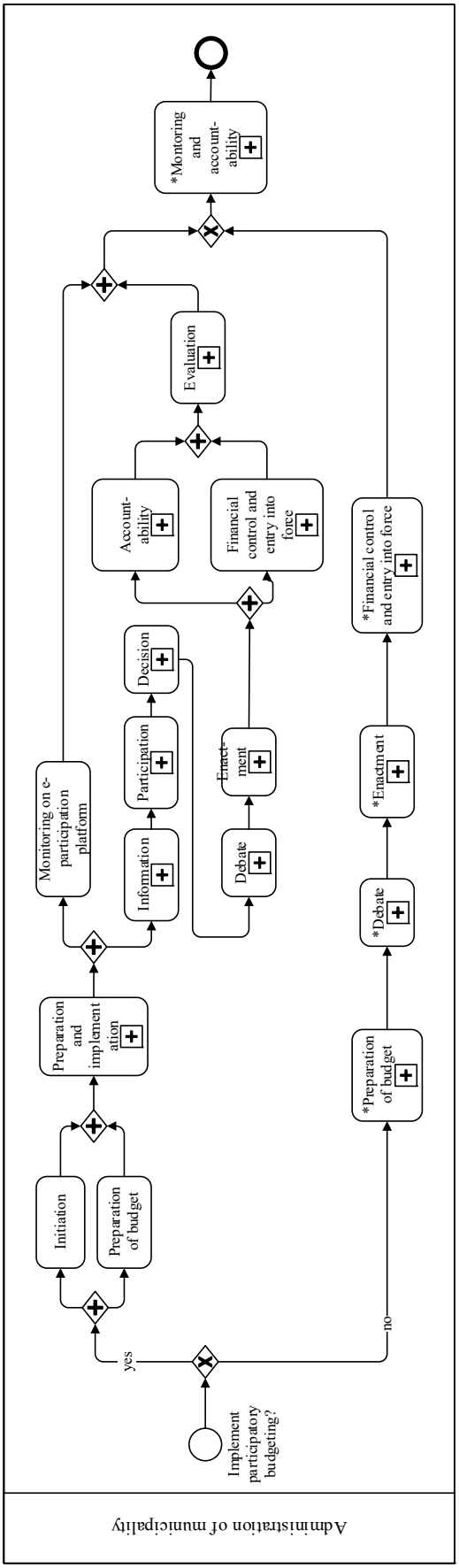
[47] See 5th status report available under http://www.buergerhaushalt.org/category/grundlagen/ and overview of municipalities with their status of decision or discussion under http://www.buergerhaushalt.org/status (access 2015-12-08)

citizenship, (2) elaborating the budget proposal, (3) enacting the budget in city council and (4) elaborating, implementation and control of the investment plan. Turning focus onto the German territory, local governments implement participatory budgeting the late 1990s. Participatory budgets in Germany aim at providing citizens the possibility to have influence on the prioritization of distributing public budget to particular communal tasks and duties. Participatory budgeting in Germany is not a form of direct democracy, because the budget law rests with the municipal and city councils. The implementation of participatory budgeting varies broadly on how citizens can express their ideas and proposals and how these can be integrated and considered in the budget (Behrens & Pröhl, 2004; Franzke & Kleger, 2010; Ganuza, 2010; Herzberg, 2005).

Communal budgeting phases - and participatory budgeting alike - can vary, because no statutory provision is in place. However, the five phases can be suggested from the literature review (Behrens & Pröhl, 2004, p. 14; Günther & Schwengers, 2007, p. 77; Herzberg, 2005, p. 9; Märker et al., 2009, p. 36) as visualised in Figure 9.

- *Initiation and Design:* Decision on the implementation of the participatory budgeting endeavour, and formulation of objectives. It also includes the draft of the budget, in which the council is elaborating the conditions of the budget.
- *Preparation:* Design of participation processes and selection of technical tools.
- *Implementation:* Implementation of technical components, preparation of documents, and marketing strategy.
- *Participation:* This phase consist of the following sub-phases:
  - Information: Citizens are informed through different channels about the budget, the content and procedure of the budgeting.
  - Participation: Citizens' participation in budgeting with focus on the development and rating of proposals.
  - Decision-making: The panel (usually a city or municipal council) debates the proposals of the participation endeavour and their implementation.
- *Accountability:* To ensure the plausibility and acceptance of participatory budgets, the city or municipal council has to give account for budget decisions and their implementation.
- *Evaluation:* This phase has twofold purposes: (a) evaluation of the participatory budgeting endeavour against its objectives with regards to expectations and impact achieved; and (b) evaluation of needs for improvement in a next iteration of participatory budgeting.

The following subsection looks into the electronic tools used.



Legend: BPMN 2.0; * indicate processes defined in law.

Figure 9. Overview of traditional and participatory budgeting process

4.1.8 E-Participation Tools

A variety of software tools and applications (Tambouris, Liotas, Kaliviotis, & Tarabanis, 2007, p. 289; Wimmer, 2007b, p. 92) support participation techniques (Tambouris et al., 2007, p. 289) and areas (Wimmer, 2007b, p. 92). Examples vary from Facebook[48] for social networking, to *regular* CMS such as Joomla[49] and *specialised* e-participation platforms such as ditto 6.0[50] (Fraser et al., 2006). Websites and discussion forums dominate (Bohman, 2014, p. 79), even if the usage of mobile applications increased during the last years (Wimmer, Grimm, Jahn, & Hampe, 2013). Typically, e-participation relies on the use and adaptation of established ICT rather than exploiting new ICT (Sæbø et al., 2008, p. 411). However, e-participation tools need to be adapted to the objectives of participation and the target groups (see Requirement 7).

Requirement 7. E-participation tools: The EPART-Framework should support the design of e-participation tools to meet participation objectives.

Table 10 indicates types of ICT used extensively (black cells) or in a supportive way (grey cells) in the different e-participation areas (extending and refining the categorisation presented in Fraser et al., 2006; Scherer et al., 2011, p. 100). Specifications of these types of e-participation tools are provided, e.g. in Fraser et al., 2006; Scherer et al., 2011, p. 100; Scherer, Ventzke, & Wimmer, 2011. The characteristics of a particular e-participation are influenced by the guidelines, which are set by the organisation, who offers the e-participation. Such e-participation guidelines are analysed next.

Table 10. Analysis of ICT use in e-participation areas (adapted from Fraser et al., 2006; Scherer et al., 2011, p. 100)

Note: ++ indicate extensive use of ICT in e-participation, + is for supportive use.

Types of e-participation tools / E-participation area	CMS	Forum	Weblogs	Surveys	Voting	Polls	Online Meetings and Chats	Serious games	Community Systems	GIS and Map Based Tools	Combined Collaboration
Budgeting	++	++		+	+	++		+		+	+
Campaigning	++	+	+						++		+
Citizen Journalism	++		++						+		+
Community Building	+	++	+				++		++		++
Consultation	++	++	+	++	+	+			++		++
Deliberation	++	++									+
Discourse	++	++									+
Electioneering	++	+	++						+		+
Environmental Planning	++	++		+	+	++		+		++	+
Law-making	++	++		+	+	+	+	+		+	++
Mediation		+					+				++
Petitioning	++	++			++	++					+
Polling						++					+
Referenda	++	++			++						+
Spatial Planning	++	++			+	++		+		++	+
Voting				+	++						+

[48] See http://www.facebook.de [accessed 1 September 2015]

[49] See http://www.joomla.org (access 2015-12-15)

[50] See http://www.ontopica.de/dito.php (access 2015-12-15)

4.1.9 E-Participation Guidelines

E-participation guidelines are conventions or principles an EE should meet with its e-participation offer[51]. This research selects nine different documents participation guidelines published by city councils, and private consulting companies (Table 11). Some guidelines, e.g. the one published by the city of Bonn and the city of Darmstadt, were developed and decided with the support of citizens' participation. Consultancies, such as Zebralog, documented their experience from past e-participation.

Table 11. Documents studied to derive participation guidelines

Source	Publisher type
Arbeitsgruppe Leitlinien Bürgerbeteiligung Bonn (Bonn),	City government
Arbeitskreis Bürgerbeteiligung der Stadt Darmstadt (Darmstadt), 2015	City government
Bonnemann, 2010	Consultancy
Bundeskanzleramt Österreich (BKA) & Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft Österreich (BMLFUW), 2009	Ministry
International Association for Public Participation (IAP2)	NGO
Kreisjugendring München-Stadt (KJR), 2013	Agency
Lindenberg, 2011	Consultancy
Ruesch & Märker, 2013; Zebralog Agentur für crossmediale Bürgerbeteiligung (Zebralog)	Consultancy

Participation guidelines need to be conform to the objectives of the e-participation. Furthermore, the guidelines inform processes and ICT usage. For example, if a principle states that anonymous participation must be possible, the participation processes as well as the ICT tools must provide and ensure participants' anonymity. As participation guidelines are important to identify the constraints and regulations of e-participation, the following requirement results:

Requirement 8. Participation guidelines: The EPART-Framework should support an EE to develop its own participation guidelines.

Examples of guidelines identified from these eight documents are given in Table 12. After studying characteristics of e-participation, conceptual models structuring them are analysed in the following section.

Table 12. Overview of participation guidelines

Short name	Guideline	Source
Better decision-making	Public participation is a process to make better decisions that incorporate the interests and concerns of all affected stakeholders and meet the needs of the decisions-making body.	(IAP2)
Target group	Public participation is based on the belief that those who are affected by a decision have a right to be involved in the decision-making process. It promotes sustainable decisions by recognizing and communicating the needs and interests of all participants, including decision makers.	(Bonnemann, 2010)
Trust building	Participation aims to build trust and credibility for the process among all the participants.	(IAP2)
Transparency and Openness	The public's role in the decision-making process is carefully considered and accurately portrayed. Disclosure of all information relevant to the public's understanding and evaluation of a decision will be encouraged	(IAP2; Lindenberg, 2011)
Inclusion	We will ensure that stakeholders have fair and equal access to the public participation process and the opportunity to influence decisions. Access to participation must be easy.	(IAP2; Ruesch & Märker, 2013)

[51] In German, they are often referred as „Leitlinien Bürgerbeteiligung", see the selection of participation guidelines.

Short name	Guideline	Source
Respect for Communities	Strategies that risk polarizing community interests or that appear to "divide and conquer" are to be avoided.	(IAP2)
Education	New practitioners in the field, decision makers and the public are mentored and educated about the value and use of public participation. Qualification programs for residents are offered in order to build democratic and participation skills. The residents, politicians, and government employees are encouraged to use such offers. The aim is also to train residents as neutral facilitators or presenters and to use them in participatory processes.	(Bonn, 2014, p. 12; IAP2)
Scope for Decision Making	There is some scope for decision-making. There is something to decide or influence. No decision is taken during a running e-participation. The results of participation are to be integrated into administrative and political processes and decisions.	(BKA & BMLFUW, 2009, p. 7; Bonn, 2014, p. 12; Bonnemann, 2010; IAP2; Lindenberg, 2011; Ruesch & Märker, 2013; Zebralog)
Knowing the Opponent	Participants have the right to know their opponent. Nobody wants to talk, for example, with a federal ministry as a whole.	(Lindenberg, 2011)
Addressee	When the participation starts, it is clear how and by whom the results of participation will be used. The government must genuinely aim to integrate the results into decision-making processes.	(Ruesch & Märker, 2013; Zebralog)
Participation framework	The binding rules and procedures of the participation are clearly communicated. Citizens must be informed if final decision-making power rests with a political body, for example.	(BKA & BMLFUW, 2009, p. 11; Lindenberg, 2011; Ruesch & Märker, 2013; Zebralog)
Public relations	The participation offer is promoted actively and cross-media so that the target group has a realistic chance to get informed about it. Promotion activities are to be recorded.	(Zebralog)
Accessibility	The access to the participation offer must have minimal technical, linguistic and structural barriers. Human, clear and straightforward language is to be used.	(BKA & BMLFUW, 2009, p. 8; Lindenberg, 2011; Zebralog)
Channel	The channels of participation must be chosen according to the citizens' media habits. Multiple channels must be used for participation.	(OECD, 2001, p. 86; Ruesch & Märker, 2013)
Anonymity	Anonym participation is possible. Participation must be possible without providing real names or personal data.	(Lindenberg, 2011; Ruesch & Märker, 2013; Zebralog)
Fair and Neutral Moderation	A fair participation procedure has a neutral moderation with defined and traceable competencies. The participatory space should be "neutral ground". A moderation can help ensure this.	(BKA & BMLFUW, 2009, p. 8; Ruesch & Märker, 2013; Zebralog)
Responsiveness	The organising actors (administration, politics, and moderation) consider themselves as an active part of participation processes and respond to questions and suggestions.	(Zebralog)
Feedback Preparation	Results are prepared in a neutral and traceable form, comprehensible to citizens	(Bonn, 2014, p. 19; Zebralog)
Timely feedback	Well-documented results accompany the process and are published timely via the e-participation tool.	(Bonn, 2014, p. 19; Zebralog)
Feedback	It is necessary to inform participants how their input affected the decision making.	(Bonnemann, 2010)
Interactivity	The set-up must be interactive. Providing information is only a prerequisite for participation.	(Ruesch & Märker, 2013)
Continuous feedback	Citizens must receive continuous feedback about how the results are handled and the implementation process.	(Ruesch & Märker, 2013)

Short name	Guideline	Source
Come-in late	Participants have the right to come-in late in the participation process.	(Lindenberg, 2011)
Silence	Participants have the right to be silent.	(Lindenberg, 2011)
Collaboration	Participants have the right to come in contact and to collaborate.	(Lindenberg, 2011)
Opinion	Participants have the right to change their opinion.	(Lindenberg, 2011)
Rules	Participants have the right to question the rules.	(Lindenberg, 2011)
Process	Public participation seeks input from participants by designing how they participate.	(Bonnemann, 2010; Lindenberg, 2011)
Resources	Adequate financial, human and technical resources are needed for effective public participation. Government officials must have access to appropriate skills, guidance and training material.	(Bonn, 2014, p. 12; OECD, 2001, p. 86)
Active citizenship	Governments benefit from active citizens and a dynamic civil society. They can take concrete actions to facilitate citizen's access to information and participation, raise awareness, and strengthen civic education and skills. They can support capacity building among civil society organisations.	(BKA & BMLFUW, 2009, p. 7; Bonn, 2014, p. 16; OECD, 2001, p. 88)
Quality	Participation is based on well defined quality criteria and requirements	(Bonn, 2014, p. 17)
Legal framework	Participation is provided within existing laws.	(BKA & BMLFUW, 2009, p. 9)

4.2 Conceptual Models Structuring E-Participation

Conceptual models present entities and their relationships, which characterise the e-participation domain. As such, they can be a means for designing an EEA and identifying relevant entities, their attributes and relationships. This section presents conceptual models and analyses them with regards to entities identified.

The list of search criteria to identify conceptual models structuring the e-participation domain includes terms such as *e-participation*, *electronic participation*, *eParticipation*, *citizen participatio*n or *public engagement* and *framework*, *model,* and *ontology*. As a result, eight conceptual models were identified (Table 13).

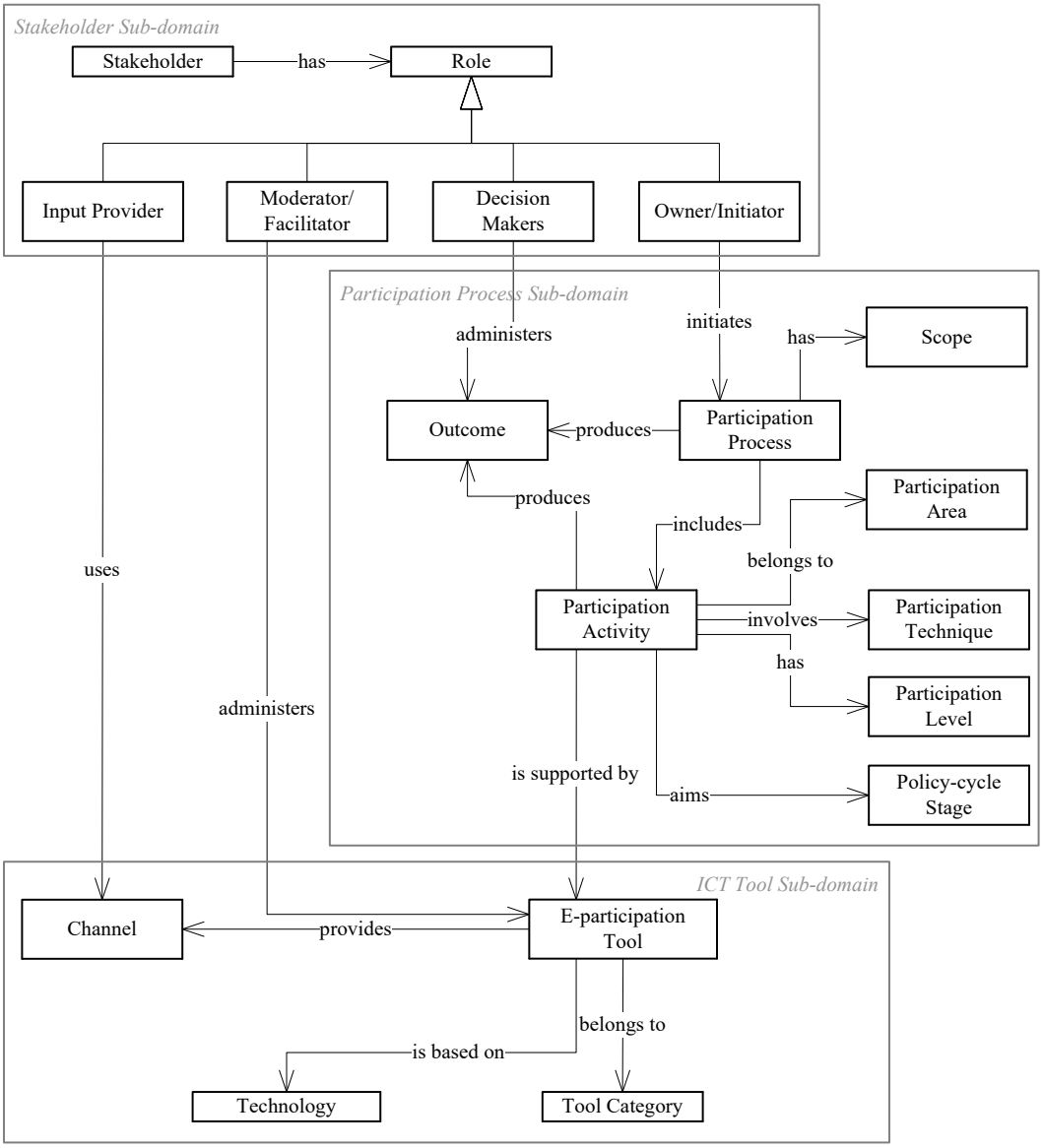
Table 13. Overview of conceptual models structuring the e-participation domain

Note: The columns Source and Name identify the model. The column Form indicates the presentation of the framework differentiated by RDF model, UML model and written description.

Source	Name
Kalampokis et al., 2008 see also Tambouris et al., 2007	Domain model for e-participation
Porwol et al., 2016	An ontology for next generation e-participation initiatives
Macintosh, 2004a	Characterising e-participation in policy making
Phang & Kankanhalli, 2008	Framework of ICT exploitation for e-participation initiatives
Sæbø et al., 2008	Outline of the e-participation field
Smith et al., 2011 based on Millard, 2008	Generic impact analysis and measurement reference system
Wimmer, 2007b	Ontology for an e-participation virtual resource centre
Yusuf, Adams, & Dingley, 2014	E-participation framework, formula of e-participation

The approaches are:

Kalampokis et al. (2008) introduce the *domain model for e-participation*[52] (Figure 10), which aims to represent "the most important aspects and relations characterising" (p. 1) e-participation. It divides the domain into three sub-domains: *stakeholder*, *participation process*, and *ICT tool* and conceptualises each of them. Finally, the sub-domains are combined in one model to visualise the key relationships between them.



Legend: UML 2.0 diagram

Figure 10. Domain model for e-participation by Kalampokis et al. (2008)

Porwol et al. (2016) propose an *ontology for next generation initiatives*, which aims at facilitating operations of e-participation initiatives and improving knowledge exchange between similar initiatives (Figure 11). The ontology covers the views Platform, Project, and Democratic Process linked with each over. The Platform view covers the entities Tool,

[52] The model is based on the e-participation domain model by Tambouris, Liotas, Kaliviotis, and Tarabanis (2007) consisting of four layers: democratic processes, participation areas, participatory techniques, categories of tools and ICT technologies.

Topic, Feedback, Result and Constraints. The Project view covers Stakeholder, Funding, Strategy, Result and Constraints. The Democratic Process view covers Stakeholder, Instrument, Policy Making, Result, and Constraints. The model is strongly related to the idea that there is one platform, which integrates different participation features.

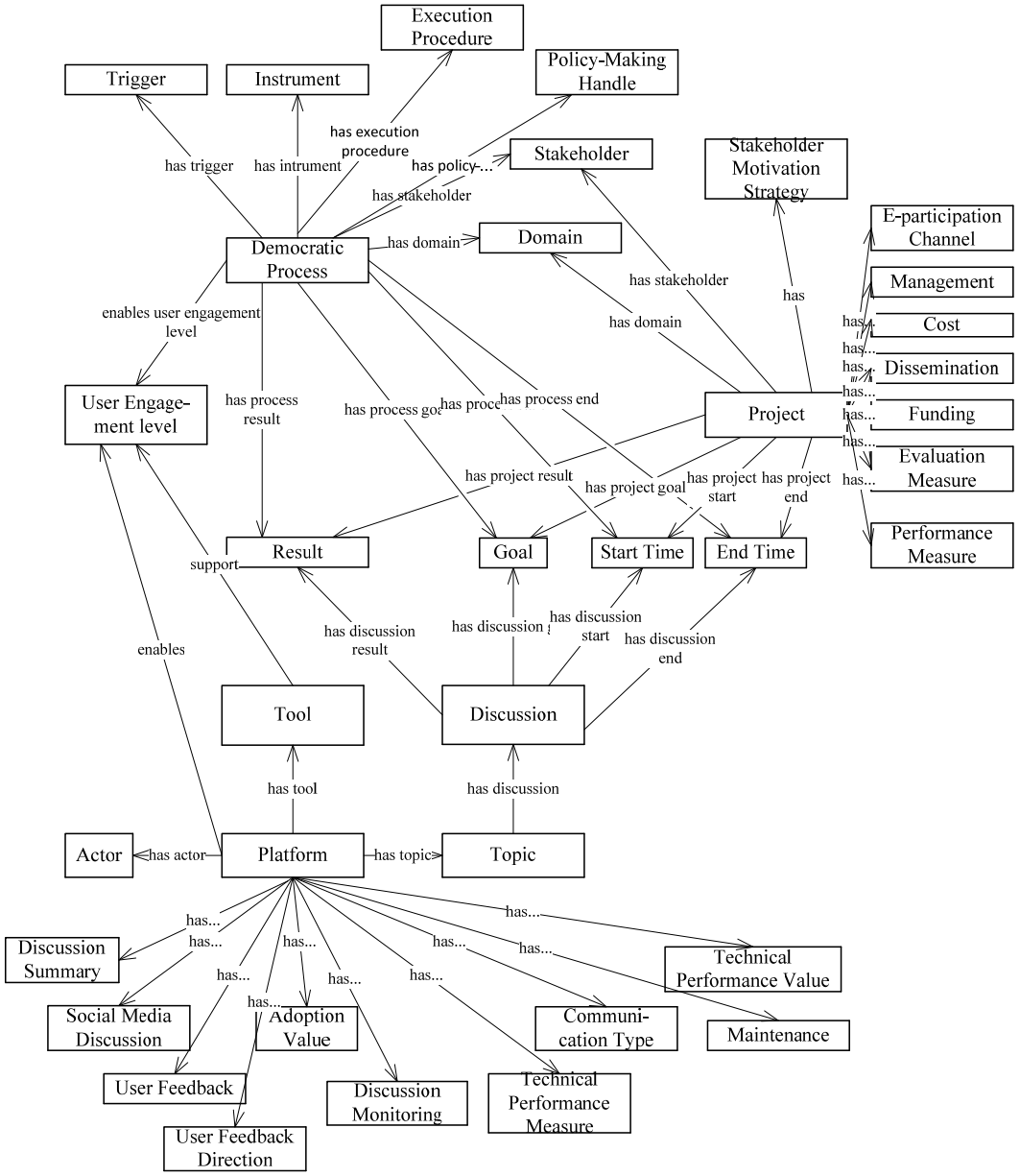


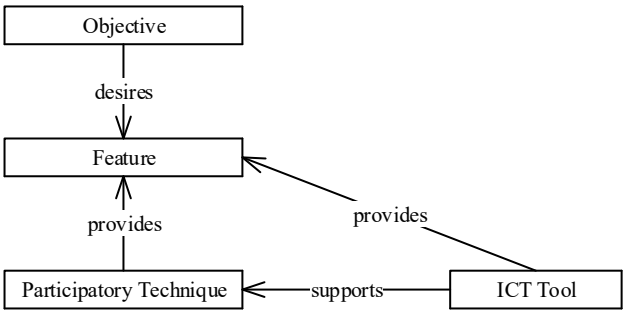
Figure 11. An ontology for next generation e-participation initiatives by Porwol et al. (2016)

Macintosh (2004a) presents the *analytical framework for e-participation*. It addresses the issues of "what should be characterised in [...] pilots", identifies types of participation and supports finding "appropriate technology". The framework proposes a number of key dimensions to characterise e-participation (Table 14).

Table 14. Summary of key dimensions of e-participation by Macintosh (2004a, p. 6)

Dimension	Description
1. Level of participation	What level of detail, or how far to engage citizens
2. Stage in decision making	When to engage
3. Actors	Who should be engaged and by whom
4. Technologies used	How and with what to engage citizens
5. Rules of engagement	What personal information will be needed/collected
6. Duration and sustainability	For what period of time
7. Accessibility	How many citizens participated and from where
8. Resources and promotion	How much did it cost and how wide was it advertised
9. Evaluation and outcomes	Methodological approach and results
10. Critical factors for success	Political, legal, cultural, economic, technological factors

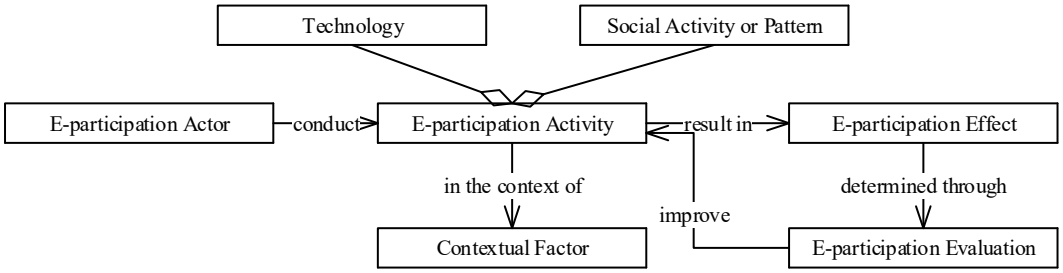
Phang and Kankanhalli (2008) present the *framework of ICT exploitation for e-participation initiatives* (Figure 12). The framework examines how suitable various ICT tools are to achieve e-participation objectives. The work is based on Glass (1979), who analyses offline participation techniques with regards to achieving different objectives of citizen participation programs. Phang and Kankanhalli transfer Glass's results to the ICT domain to support his participation techniques[53].



Legend: UML 2.0 diagram

Figure 12. Framework of ICT exploitation for e-participation initiatives by Phang and Kankanhalli (2008)

Sæbø et al. (2008) present an exploration of actors, activities, contextual factors, effects, and evaluation approaches addressed in the e-participation literature. Medaglia (2012, p. 348) visualises this exploration and adopts it as a guideline to analyse how the e-participation research field develops.

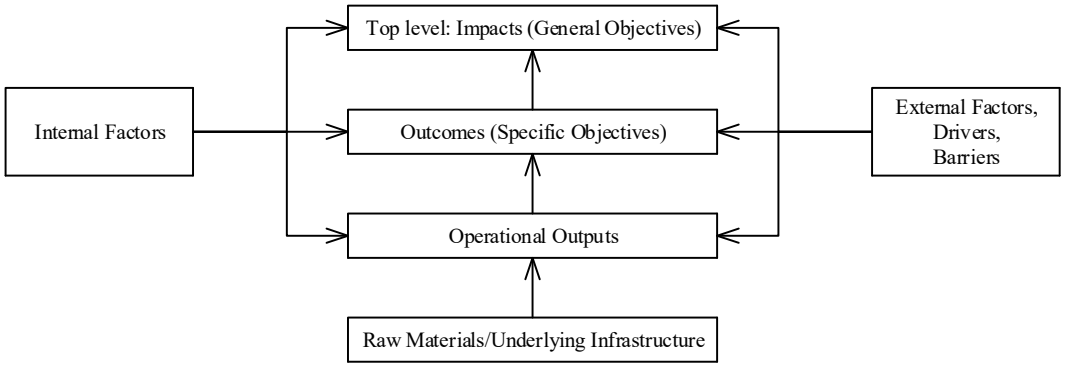


Legend: UML 2.0 diagram

Figure 13. Shape of the e-participation field by Sæbø et al. (2008, p. 417), according to Medaglia (2012)

[53] The DEMO-net project conducted a similar study. The researchers in the project investigated different online tools categories (e.g. forums, games, and wikis) in detail and analysed their suitability for e-participation (Fraser et al., 2006).

Smith et al. (2011) present the *framework of e-participation analysis levels* based on the *generic impact analysis and measurement reference system* by Millard (2008). This framework differentiates e-participation results by their focus on operational objectives = outputs, on specific objectives = outcomes, and on general objectives = impacts (Figure 14).



Legend: Arrows indicate how factors (boxes) influence each other.

Figure 14. E-participation analysis levels by Smith et al. (2011, pp. 308–310).

Wimmer (2007b) presents the *ontology for an e-participation virtual resource centre* (Figure 15). It aims at providing and structuring information available in e-participation research. The DEMO-net deliverables provide the underlying knowledge source for this ontology.

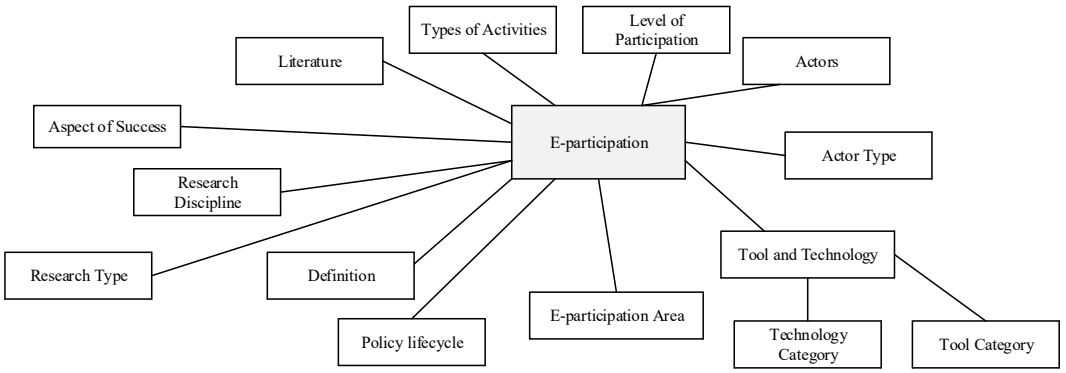


Figure 15. Excerpt of the e-participation ontology by Wimmer (2007b, p. 96).

Yusuf et al. (2014) introduce a model as the result of evaluating other frameworks. The approach categorises entities of other models such as Kalampokis et al. (2008), and Macintosh (2004a) in a new way and includes barriers and drivers of e-participation. It identifies several e-participation entities (Table 15).

Table 15. List of entities in the framework of e-participation by Yusuf et al. (2014)

Entities	Description
Technology	As a conduit and tool between government institutions and people to support participation and encouragement process.
Government institutions	To encourage people to participate in the policy making process and educate people about that policy-making process and the rationale behind the decision.
People	To participate in the policy making process and educate people about policy making process and rational behind the decision.
Participation process	To support policy making process and make sure the policy has a certain quality, is more legitimate and acceptable.
Encouragement process	To educate and support people in the participation and policy-making process.
Complex factors	Drivers and barriers, which influence the e-participation process.
Environment	The context in which the e-participation process takes place.

After introducing the conceptual models, they are analysed and compared in the following in order to identify structural aspects of e-participation. Each conceptual model focusses on and considers slightly different aspects (Table 16). The models by Kalampokis et al. (2008) and Wimmer (2007b) are comprehensive but neglect objectives and a further differentiation of results as Smith et al. (2011) provides. The ontology by Porwol et al. (2016) is also comprehensive but focusses on the comparison of different organisational settings employing e-participation. *No model can provide a complete picture of an EE* and, thus, can be regarded as a metamodel for the EPART-Framework. From analysing and synthesising these eight models, a more comprehensive list of entities of an e-participation enterprise can be derived. However, elements to design managerial aspects (e.g. risks, which may hamper the achievement of objectives) or a data architecture are missing. From these considerations, the following requirement regarding the entities of an EE is noted:

Requirement 9. Entities of an EE: The EPART-Framework should consider the following entities: stakeholder/actor, role, policy-making stage, level of participation, participation area, participation activity, participation technique, participation process, ICT (application/ICT, tool, tool category, and technology), channel, outcome, objective, driver, and barrier.

Table 16. Comparison of conceptual model entities.

Note: Rows show similar or comparable entities identified in the models.

Kalampokis et al., 2008	Porwol et al., 2016	Macintosh, 2004a	Phang & Kankanhalli, 2008	Sæbø et al., 2008	Smith et al., 2011	Wimmer, 2007b	Yusuf et al., 2014	Interpretation
Stakeholder	Actor, Stakeholder	Actor	-	Actor	Raw Materials	Actor; Actor Type	People; Government Institution	Actor
Role	-	Role	-					Role
Policy Cycle Stage	Policy-Making Handle	-	-	-		Stage in Policy Making	-	Policy cycle stage
Participation Level		Level of Participation	-	-		Level of Participation	Participation Level	Participation Level
Participation Area		-	-	-		Participation Area	Participation Area	Participation Area
Participation Activity		Activity	-	Activity		Type of Activity	-	Activity
Participation Technique		-	Participatory technique	Social activity or pattern		-	-	Participation Technique
Participation Process	Democratic Process	-	-	-		-	Participation Process	Process
Tools; Tool category	Tool, Platform	-	Tool; Feature	-		Tool; Tool category	Tool category	Participation Tool
Technology		Technology	-	Technology		Technology (Category)	Technology (Category)	Technology
Channel	E-participation Channel	-	-			-	Channel	Channel
-	Stakeholder Motivation Strategy	Rule of Engagement	-	-		-	-	
-	Cost	Resource	-	-		-	Encouragement Process	
Outcome	Result	Outcome	-	Evaluation	Output	-	-	Outcome
-			-	-	Outcome		-	Output
-			-	Effect	Impact		-	Impact
-	Goal	-	Objective	-	Objective	Aspect of Success	Driver; Barrier	Objective
-		Critical Factor of Success	-					Success factor
-	-	-	-	Context	Context	-	Environment;	
	Project, Topic, others							

As an architecture framework aims to identify the stakeholders of a system, it is vital to examine the aspects *actor* and *role* in detail. Table 17 compares stakeholders and actors proposed in the conceptual models and interprets them (see last column). In conclusion, the stakeholder/actor types list in the following requirement shows the union set of entities described in the literature. As a result, the EPART-Framework should consider the stakeholder and actor types noted in Requirement 10.

Requirement 10. Stakeholder and actor types: The EPART-Framework should consider the following actor/stakeholder types: academia; advisory board, industry/business (in particular consultancies); elected representative; government executive; policy maker; political party/politician; citizen/citizen group; NGO/CSO; the media.

Table 17. Stakeholders/actors in e-participation frameworks and interpretation

Note: Rows show similar or comparable entities identified in the models.

Macintosh, 2004a	Porwol et al., 2016	Wimmer, 2007b	Kalampokis et al., 2008	Sæbø et al., 2008	Yusuf et al., 2014	Sæbø et al., 2011	Interpretation as Actor/Organisation Type <name>
Decision Maker	Decision Maker	-	-	-	-	-	Should be a *Role*
Champion of the Particular Policy, Expert		Multi-disciplinary Team of Specialists to Support the Process	Academia Research, Industry	Voluntary Organisation	-	-	Research Institution; Researcher
Business		Business	Industry	-	-	Business	Enterprise; Employee
Government Minister		Government Minister	Government	Government Institution	Government Institution	Government	Government Institution; Administration
Elected Representative		Elected Representative	Elected Representative	-	Elected Representative		Elected Representative
Government Employee Responsible for Implementing Policy		Government Employee Responsible for Implementing Policy	Executive	-	Government Executive		Government Employee
Policy Maker		Policy Maker	-	-	-		Policy Maker
CSO		CSO	(Quasi) NGO/CSO. Citizen Group.	-	-	Citizen	Citizen Group; NGO and Members
-	Citizen	Individual Citizen		Citizen	People		Citizen
-		-	Political Party	Politician	Political party	-	Political Party; Politician
-		-	Mass Communication Media	-	-	-	Press
-		-	-	-	-	-	Advisory Board (see e.g. Bonn, 2014)
-	Facilitator	-	-	-	-	-	Should be a *Role*

The next paragraph analyses relevant *role* entities, i.e. roles that stakeholders can take over in e-participation.

Kalampokis et al. (2008) propose concrete roles. Macintosh (2004a) describes some activities that can be interpreted as roles. Sæbø et al. (2011) present a further differentiation of stakeholder roles. Table 18 compares roles described in these three frameworks. Furthermore, Rozanski and Woods (2012) brings in software engineering roles. The literature study and the interview with a representative of the participatory budgeting endeavour of Cologne results in additional roles. Interpretations are in the last column.

Table 18. Roles described in e-participation frameworks and their interpretation

Note: Rows show similar or comparable entities identified in the models.

Macintosh, 2004a	Kalampokis et al., 2008	Sæbø et al., 2011	Rozanski & Woods, 2012	Interpretation as Role
Develop Participation E-content	Input provider	Consumer	Users	Expert; Input Provider; Lurker (recognising information provisioning as a pre-stage of participation (Cruickshank, Edelmann, & Smith, 2010))
Promotion	-	Administrator; Service Provider	Communicators	Marketing/Promotion
Analyse Results	-		Communicators	Facilitator
Evaluate				Evaluator
Disseminate Results	-		-	See Marketing and Facilitator but also Marketing
Provide Background Information/Material	-		-	See Facilitator, Owner, and Initiator.
-	Owner/Initiator	-	Acquirers; Assessors	Owner; Initiator (separated as the owner may not necessarily be the initiator)
Incorporate Results into Policy	Decision Maker	Politician	-	Decision maker; Administration;
-	-	Activist	-	-
-	Moderator/ Facilitator	Service provider	Communicator	Moderator; Facilitator (separated because moderation should be a neutral)
-	-	-	-	Project management
-	-	Vendor	Developers; Maintainers; Production Engineers; Suppliers; Support staff; System Administrators; Testers	ICT Developer; ICT Supplier; Consultant; ICT Maintainer; ICT Administrator; Support Staff

These roles can be both; internal part of the team and external. Table 18 serves to derive the following list of actor/stakeholder roles that are important in e-participation as outlined in the following requirement:

Requirement 11. Actor roles: The EPART-Framework should consider the following actor roles: input provider and lurker as participant; decision maker; administrator, consultant, evaluator, expert of the particular policy, facilitator, initiator, ICT developer, ICT maintainer; ICT supplier, moderator, marketing/promotion, owner, project manager, support staff.

The review presented seven conceptual models structuring e-participation. Based on a synthesis, a set of entities relevant in an EE was developed. Furthermore, it was argued that none of these seven models is seen as complete. The next section studies guidelines for

e-participation to examine if they can guide the development of an e-participation enterprise architecture.

4.3 Procedure Models Guiding E-Participation

Procedure models guiding e-participation propose activities and tasks necessary to design, carry out, and evaluate e-participation. This section presents a selection of procedure models and analyses them. The list of search criteria to identify such literature included terms such as *e-participation*, *electronic participation*, *eParticipation*, *participation* or *public engagement* and *procedure model*, *guideline*, *manual* or *procedural model*. In order to identify non-scientific approaches, a search in German was done with terms such as *E-Partizipation, Partizipation, Beteiligung, Vorgehensmodell*, *Vorgehen*. The following review separates literature in scientific literature (Subsection 4.3.1) and practitioner literature steaming from consultancies or public administrations (Subsection 4.3.2). Finally, Subsection 4.3.3 discusses the procedure models and concludes with an identification of phases and activities.

4.3.1 Scientific Literature

This paragraph presents six procedural models identified in scientific literature (Table 19).

Table 19: Overview of procedure models in scientific literature

Note: The procedure models are sorted by the year of publication. *Source* indicates the literature. *Name* can be either the name indicated by the author(s) or an English translation. *Publisher* indicates the type of publishing organisation. *Geo* states the geographical focus of the approach. *Init* means who starts/initiates the e-participation (TD: top-down, BU: bottom-up). *Area* indicates the e-participation area.

Source	Name	Publisher	Geo	Init	Area
Oppermann, 2001	Public involvement and conflict resolution techniques in environmental planning	University	Germany	TD	discourse in environmental planning
Creighton, 2005	The public participation handbook	Book publisher	International	TD	general
Islam, 2008	Implementation model for sustainable e-participation	European Practise Journal	Europe	TD, BU	general
Phang & Kankanhalli, 2008	Three-activity procedure for e-participation initiative implementation	Paper	general	TD, BU	general
Ali, 2010	Collaboration pattern language for e-participation: a strategy for reuse	Dissertation	local	TD	general
Bryson, Quick, Slotterback, & Crosby, 2013	Designing Public Participation Processes	Scientific journal	International	TD, BU	general

The approaches are:

Oppermann (2001) presents discourse techniques for conflict resolution in environmental planning. The proposed procedure consists of four main phases: conception, negotiation, discourse and transfer.

Creighton (2005) presents a guideline for citizen involvement in decision making, addressing public agencies in particular. The so-called *public participation handbook* presents a number of activities for the analysis of the decision-making processes, and participation process planning. In addition, the handbook includes a public participation toolkit

proposing different participation techniques, e.g. for getting information to and from the public.

Phang and Kankanhalli (2008) propose three steps to help the selection of appropriate ICT tools: identifying objectives, choosing the best participation techniques, and choosing the electronic tools which support the participation techniques and thereof the achievement of the objectives.

Islam (2008) presents the *implementation model for sustainable e-participation*, which aims to introduce concrete guidelines in order to realise effective participation. As Islam (2008, p. 8) designed the model to be suitable under any "socio-economic conditions of a country" and "be initiated both by public (state) and private agencies". Islam describes the iterative procedural model in seven consecutive phases.

Ali (2010) proposes a pattern language to guide e-participation designers how to choose suitable collaborative technologies. The pattern language is based on previous work in collaboration and software engineering. The five phases support the selection of adequate collaboration patterns: (1) develop a high-level participation description, (2) develop a use context diagram, (3) identify collaborative participation family, (4) select relevant atomic collaboration patterns, and (5) map collaboration patterns onto technologies patterns.

Bryson et al. (2013) aims to provide research grounded *participation design guidelines*. The authors state that they have consulted more than 250 articles and books. As a result, twelve interrelated and iterative tasks are proposed (Bryson et al., 2013, p. 24). They are categorised into three phases: (1) *assess and design for context and purpose*, (2) *enlist resources and manage the participation*, and (3) *evaluate and redesign continuously*.

Figure 16 provides an overview of the activities proposed by these procedure models. The following paragraph presents procedural models proposed in practitioner literature.

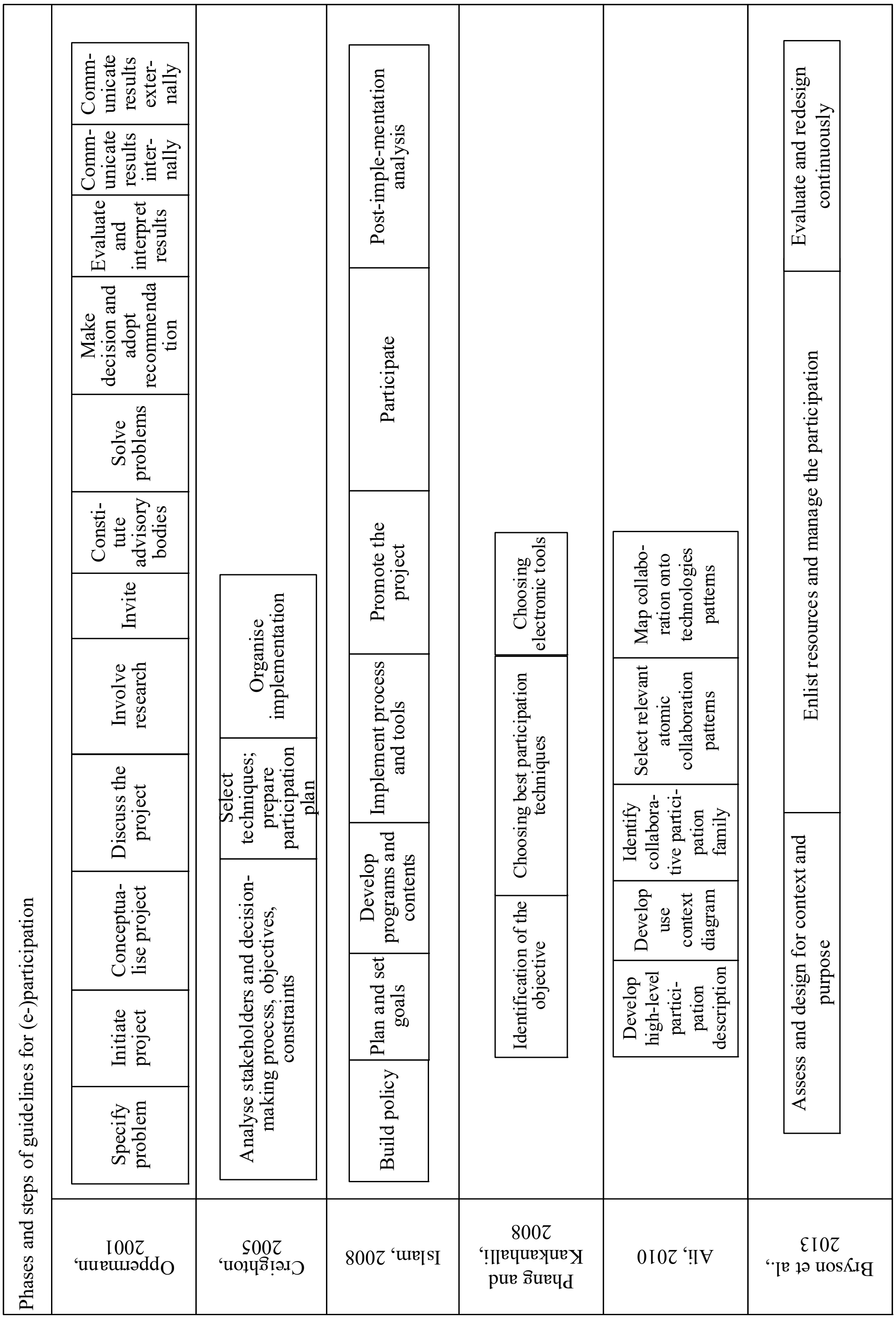


Figure 16. Overview of activities proposed in procedural models in scientific literature

4.3.2 Practitioner literature

This paragraph presents eleven procedural models identified in practitioner literature (Table 20). Different national, regional, and municipal authorities, consultancies, and NGOs published them. Moreover, they focus on different countries and regions.

Table 20. Overview of procedure models in practitioner literature

Note: Source indicates the literature. *Name* can be either the name indicated by the author(s) or an English translation. *Publisher* indicates the type of publishing organisation. *Geo* states the geographical focus of the approach. *Init* means who starts/initiates the e-participation (TD: top-down, BU: bottom-up). *Area* indicates the e-participation area.

Source	Name	Geo	Init	Area
OECD, 2001	Strategically planning and acting	International	TD	general
Acland, 2008	Dialogue by design: a handbook of public and stakeholder engagement	International	TD, BU	general
Canadian Environmental Assessment Agency (CEAA), 2008	Canadian Environmental Assessment Agency Public Participation Guide	Canada	TD	environmental planning
Märker et al., 2009	Guideline for local e-participation	Germany	TD	consultation, participatory budgeting
Koop, 2010	Guideline for online consultation: practical recommendations for the involvement of citizens over the internet	Germany	TD	consultation
Bundeskanzleramt Österreich (BKA) & Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft Österreich (BMLFUW), 2011	Standards for public participation: practice guide	Austria	TD	information, consultation, cooperation
Scottish Parliament (SP), 2011	User Guide VOiCE - Visioning Outcomes in Community Engagement	United Kingdom	TD	community
Asian Development Bank (ADB), 2012	An Asian Development Bank guide to participation	Asia	TD	Participation in the operations of ADB
Walz et al., 2012	Handbook for participation	Germany	TD	general
eCitizenII, 2012	E-Participation Best Practice Manual	Europe	TD, BU	general
United States Environmental Protection Agency (EPA), 2013	Getting in activity: engaging stakeholders in your watershed	USA	TD	environmental planning

The approaches are:

The OECD (2001) handbook sees the building of a framework, which "provides a setting, where [government-citizen] relations can evolve and be strengthened", as a "prerequisite" for boosting these relations (OECD, 2001, p. 27). The OECD proposes a structure for strategically planning and implementing participation.

Acland (2008) presents the *dialogue by design handbook*. It describes three design factors centred around engagement processes that can be posed as questions: *Why are you doing it? Who should be involved? How to do it?* The approach describes the following phases for addressing these questions (Acland, 2008, p. 15): (1) situation analysis, stakeholder analysis; (2) goal analysis, (3) process design. Acland (2008) proposes a number of methods, recommendations and questions to guide the reader through the engagement process design.

CEAA (2008) depicts public participation requirements under the *Canadian Environmental Assessment Act*. After describing fundamentals of public participation in environmental planning, it regards activities and techniques for participation design, implementation, and evaluation. The guide includes eight stages.

Märker et al. (2009) introduce the *guideline for local e-participation* initiated by local administrations. In contrast to the other approaches, Märker et al. expand the preparatory phase to include the decision for e-participation and administrative tendering procedure before a participation is even started. They propose an approach with seven, partly overlapping phases. Parts of the procedure are modelled as business processes using event-driven process chain (epc) notation[54].

Koop (2010) presents the *guideline for online consultation* providing citizens engagement recommendations. It describes when online consultations can be useful, which actions the team needs to undertake, plus when and where which methods and ICT tools can be used. The practical implementation guideline is composed of four phases. For each phase, the guideline proposes questions that should be answered while designing e-participation.

Bundeskanzleramt Österreich (BKA) and Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft Österreich (BMLFUW) (2011) [55] introduce general recommendations for public participation in Austria. The *practical guide for public participation* provides decision support measures for public participation during the policy development, programs and legal acts. It differentiates four phases and provides detailed recommendations for the three participation levels information, consultation, and empowerment.

The Scottish Parliament (2011) sees the *User Guide VOiCE - Visioning Outcomes in Community Engagement* as part of its support for implementing its National Community Engagement Standards. Furthermore, the guide informs the reader about objectives and use of the VOiCE planning and evaluation tool. The tool aims to assist "individuals, organisations and partnerships to design and deliver effective community engagement" (SP, 2011, p. 3).

The guide of the *NGO and Civil Society Centre* of the Asian Development Bank (ADB) aims to enable meaningful participation in ADB operations (ADB, 2012, iv). It introduces tools supporting the implementation and promotion of stakeholders' participation and presents participation core principles.

eCitizenII (2012) presents the so-called *e-participation best practice manual*. It is a result of the Interreg IVC-Financed project *eCitizen II – Towards citizen-centered e-government in European cities and regions*. An interactive website, illustrating the activities with success stories and best practices, supports the guide (eCitizenII, 2012, p. 4).

Walz et al. (2012) presents a *handbook for participation* published by the city of Berlin (Germany), which addresses employees of administrations and persons working on behalf of them. It aims to motivate key personnel, inform them about backgrounds and procedures, as well as give hints regarding e-participation processes (Walz et al., 2012,

[54] For more details on epc, the reader is referred, e.g. to Scheer, Thomas, and Adam (2005).

[55] Federal Chancellery of the Republic of Austria and the Federal Ministry of Agriculture, Forestry, Environment and Water Management, Austria

p. 8). The handbook describes general conditions for participation in Berlin, including participation phases and challenges. It furthermore mentions participation opportunities as well as constraints and lessons learned from past experiences.

The *United States Environmental Protection Agency* presents a guide to engage stakeholders in watershed planning processes (EPA, 2013). The guide introduces a framework for stakeholder involvement and provides tips to build stakeholder groups and to advance the participation processes.

Figure 17 illustrates the activities proposed in the procedure models.

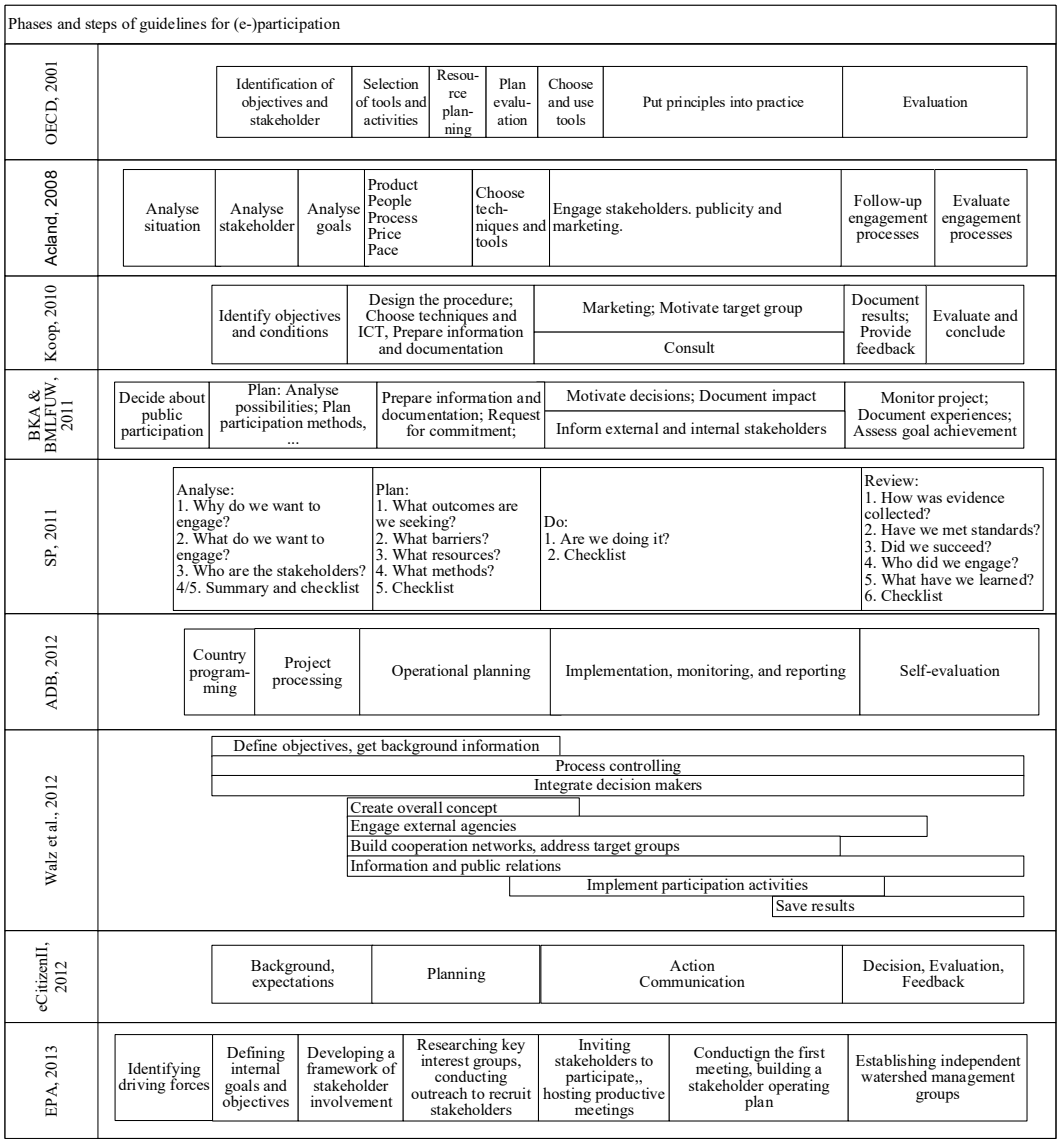


Figure 17. Overview of activities proposed in procedural models in practitioner literature

4.3.3 Identification of Phases and Activities

The procedure models introduced in this section focus on different aspects that are necessary in order to implement e-participation. Most models provide rather superficial information (e.g. Islam, 2008), while some models focus on particular aspects (e.g. SP, 2011 presenting a criteria catalogue). Märker et al. (2009) and Walz et al. (2012) present a detailed step-by-step procedure. However, both focus on e-participation started by communal governments. There are also differences about how to prepare the decision or negotiation on e-participation. For example, Oppermann (2001) starts with the conceptualisation before

the negotiation, while Märker et al. (2009) proposes a reverse procedure. Bryson et al. (2013) proposes tasks, but does not recommend a sequence. No approach guides the integration of participation method and software selection strategies. The next section deals with this point in particular.

Two approaches focus particularly on such activities guiding responsible staff how to decide on the participation methods and ICT have been identified: Phang and Kankanhalli (2008) and Ali (2010). Both approaches consider an important aspect for e-participation development: the necessity to define first the objectives and then to choose appropriate tools for them. Nevertheless, the selection strategies are not integrated into an overall procedure of designing and implementing e-participation. ICT needs to be adapted and integrated with respect to legacy systems and different participation activities selected.

The investigation of procedure models reveals that there is no one approach, which can serve as a reference procedure for different types of e-participation. The rationale for this statement is:

- No approach covers all tasks from the different categories – to some extent, models are complementary to each other.
- Access to proposed activities, recommendations etc. is not possible from the perspective of a particular responsibility (e.g. editorial management).
- The approaches do not support the integration of ICT engineering.
- Sustainable implementation of e-participation asks for the integration of the e-participation toolbox into the existing legacy ICT landscape. The approaches do not consider this appropriately. For example, they do not consider the integration of legacy systems.
- Only Islam (2008) and Bryson et al. (2013) refer to previous research in the field, but the approaches are the same time rather superficial. Hence, no consolidated scientific approach exists that provides a detailed and comprehensive view on e-participation.

The following aspects are missing in all approaches:

- The integration of ICT and participation processes into organisational or institutional architecture is not handled.
- Documentation of the EEA in an architecture description is missing.

In the following, the phases and main activities documented in these guidelines are identified. Table 21 categorises the described activities into phases. No activity remains uncategorised.

Table 21. Categorisation of activities described in procedure models into the phases for e-participation

Note: The first column indicates the source. Each row shows one approach presenting a procedure model, each column one phase. A semicolon (;) separates activities in one cell from each other.

	Phase I	Phase II	Phase III	Phase IV	Phase V
OECD, 2001	Identify objectives and stakeholders; Plan resources	Select tools and activities; Plan evaluation and choose evaluation tools		Use tools; Put principles into practice	Evaluate
Oppermann, 2001	Specify problem; Initiate project	Conceptualise project; Discuss the project	Involve research; Invite; Constitute advisory bodies	Solve problems; Make decision and adopt recommendation	Evaluate and interpret results; Communicate results internally; Communicate results externally
Creighton, 2005	Decide who needs to be involved in decision analysis; Clarify who the decision maker will be; Clarify the decision to be made or the problem to be answered; Specify the stages in the decision-making process and the schedule; Identify institutional constraints and special circumstances that could influence the participation process; Decide whether public participation is needed, and, if so, what level of participation is required; Decide who needs to be in the planning team; Identify stakeholders, and identify potential issues or concerns;	Asses the probable level of controversy; Define public participation objectives; Analyse the information exchange; Identify special considerations that could affect selection of techniques; Select public participation techniques; Prepare a public participation plan	Organise implementation		
Acland, 2008	Analyse situation; Analyse stakeholders; Analyse goals	Design project, people involvement, processes, prices/costs, and pace; Choose techniques and tools		Engage stakeholders, publicity and marketing; Following-up engagement process	Evaluate engagement process
CEAA, 2008	Establish objectives; Collect preliminary information; Identify key interested parties; Contact key interested parties; Determine level of participation; Select activities; Identify time line; Allocate financial resources; Establish team; Develop a documentation process	Prepare a detailed plan for each activity; Plan to adapt and evaluate the process	Provide early notification; Ensure accessible information	Implement the public participation activity; Monitor and adapt the activity; Review and record the input; Analyse and incorporate the input; Provide feedback	Review plan activities and outcomes; Inform decision makers on evaluation results: Communicate the evaluation outcomes
Islam, 2008	Policy and capacity building	Planning and goal setting; Programs and contents development; Process and tools	Promotion	Participation	Post-implementation analysis

	Phase I	Phase II	Phase III	Phase IV	Phase V
Märker et al., 2009	Identification of participation need; Review of participation idea; Proposal; Evaluation of application by e-part advisory board; Decision of council about project	Conceptual design of the procedure (time schedule, participation methods, involvement of decision makers and administration)	Test platform and procedures; Prepare marketing; Prepare information	Start participation with campaign; Assistance; Maintenance servicing; Moderation; Participation of administrations; Finalizing participation process	Analyse of participation results; Logging of results and decisions
Koop, 2010	Identify objectives, constraints, stakeholders, financial resources, schedule	Design participation concept and methods; Choose of participation technique; Choose means of communication; Structure the procedure	Prepare information and documentation	Motivate target group; Marketing; Document participation results;	Provide feedback; Document impact achievement;
BKA & BMLFUW, 2011	Decide about public participation; Identify objectives, basic conditions, target group	Analyse possibilities for impact achievement; Plan participation methods, intensity, process consulting, time schedule, concept of participation process; Choose means of communication	Prepare information and documentation; Request for political commitment; Request for considering results	Inform external and internal stakeholders; Motivate decisions; Document impact achievement;	Monitor project implementation; Document experiences; Asses goal achievement
SP, 2011	Why do we want to engage? What do we want to know? Who are the stakeholders? Summary Information; Checklist	What outcome are we seeking? What barriers? What resources? What methods? Checklist		Are we doing it? Checklist	How did we collect the evidence? Have we met the standards? Did we succeed? Who did we engage? What have we learned? Checklist
Walz et al., 2012	Set objectives; Obtain background information; Integrate decision makers; Process management	Create overall concept; Engage external agencies;	Build cooperative networks; Address target groups; Information and marketing	Implement participation measures	Save results
eCitizenII, 2012	Background and expectations	Plan the process and e-participation activities		Action and communication	Decision, Evaluation Feedback

<table>
<tr><th></th><th>Phase I</th><th>Phase II</th><th>Phase III</th><th>Phase IV</th><th>Phase V</th></tr>
<tr><td rowspan="3">Bryson et al., 2013</td><td rowspan="2">Identify purposes</td><td>Assess and fit the design to the context and the problem; Design to achieve purposes; Analyse stakeholders; Create appropriate rules and structures to guide the process</td><td>Appropriately involve stakeholders</td><td></td><td rowspan="3">Develop and use evaluation measures; Design and redesign</td></tr>
<tr><td colspan="3">Work with stakeholders to establish the legitimacy of the process; Use inclusive processes to engage diversity productively; Manage power dynamics; Use technologies of various kinds to achieve participation purposes</td></tr>
<tr><td colspan="4">Seek resources for and through participation; Foster effective leadership</td></tr>
</table>

From the consideration of phases, the following requirement is derived:

Requirement 12. Architecture development phases: The EPART-Framework should guide the following fives phases of operating an EE (Table 22): Phase I. Initiation, Phase II. Design, Phase III. Implementation, Phase IV. Participation, and Phase V. Evaluation.

Phase I. Initiation with formulation of objectives based on its envisaged vision including the decision about its implementation. *Phase II. Design* of the overall e-participation including selection of participation methods, design of participation processes and selection of technical tools. *Phase III. Implementation and Preparation* including implementation of technical components, preparation of documents, and marketing strategy. *Phase IV. Participation* and engagement of stakeholders including monitoring of political decision making and feedback to participants. *Phase V. Evaluation* of the e-participation regarding objectives, expectations and impact achieved. Table 22 gives an overview of the activities for each of these phases.

Table 22. E-participation phases and activities

Phase	Activities
I. Initiation	– Initiate EE – Identify problem theming – Identify participation need and level – Allocate resources – Collect preliminary information – Develop documentation process – Identify objectives – Identify stakeholders – Integrate decision makers – Identify schedule – Identify constraints – Establish team – Review participation idea – Decision on the participation endeavour
II. Design	– Analyse stakeholders – Design to achieve purposes; – Select participation techniques and activities – Select tools – Prepare participation plan – Plan evaluation – Analyse information exchange – Analysis of possibilities for impact achievement – Choose communication means – Assess and fit the design to the context and the problem; – Create appropriate rules and structures to guide the process
III. Preparation and Implementation	– Allocate resources – Organising for implementation – Provide early notification – Ensure accessible information; – Test platform and procedures; – Prepare marketing; – Prepare information and documentation, – Request for political commitment; – Request for considering results – Build operative networks – Involve stakeholders – Implement tools
IV. Participation	– Start participation with campaign – Assistance – Maintenance servicing – Moderation – Participation of administrations – Finalizing participation process – Monitor and adapt the activity; Review and record the input
V. Evaluation	– Logging of results and decisions – Review plan activities and outcomes; – Inform decision makers on evaluation results: – Communicate the evaluation outcomes – Documentation of experiences – Assessment of goal achievement

The following analysis of *main activities* has the two purposes: (1) identify capabilities provided by the e-participation enterprise, and (2) identify concerns of the stakeholders. The activities described in the procedure models can be categorised in the following *main activities*:

– *Project management:* Operational management of activities during the EE operation lifecycle and fostering effective leadership.

- *Motivation management:* Definition of the goals and the framework of the e-participation. This means to analyse and communicate to all participants beforehand what impact their participation can realistically generate; and monitor the decisions made based on participation results.
- *Requirements management:* Identification stakeholders expectations and requirements and management of process, functional and non-functional requirements.
- *Participation management:* Planning and carrying out participation activities so that they fit into policy-making process (or political processes); make traceability of participation results sure.
- *E-participation engineering:* Design, implement, deploy and maintain the ICT that supports participation processes.
- *Stakeholder management and communication:* Identify the target group, the stakeholders, define actors and their roles and engage relevant stakeholders.
- *Marketing:* Promote the e-participation among different stakeholder groups.
- *Editorial management:* Preparation of information about the topic, the participation process as well as participation results and moderation activities.
- *Evaluation management:* Evaluate whether the EE has met its objectives and expectations.
- *Decision management:* Manage the decision-making processes in the EE.

For example, Porwol et al. (2016) and Al-Debei, Panagiotopoulos, Fitzgerald, and Elliman (2010) pose questions framing some of these main activities. The interdependencies among the activities require a comprehensive management. They need different viewpoints on the architecture description of e-participation to support different main activities of an EE as identified in Requirement 13.

Requirement 13. Main activities of an EE: The EPART-Framework should guide the activities of project management, motivation management, requirements analysis, participation management, e-participation management, stakeholder management and communication, marketing, editorial management, evaluation management, and decision management.

After studying the characteristics of, conceptual models structuring, and procedure models guiding e-participation, conclusions are drawn in the following section to argue the need for an e-participation architecture framework.

4.4 Need for Enterprise Architecture Frameworks

Citizen participation has increased in importance and attention over the last years. The number of e-participation services provided by governments and other institutions is still growing. As a result, different types of institutions and organisations (e.g. administrations, NGOs) published documents to guide the development and implementation of respective e-participation endeavours. Furthermore, scientists analysed and conceptualised the field and the processes as shown in the previous sections.

However, e-participation design and implementation struggle with a variety of challenges as shown in the motivational section (Section 1.1), which make e-participation a difficult socio-technical exercise. The following list gives an overview and examples of

such challenges. It is structured according to the political, economic, socio-cultural, technological, legal, managerial, and organisational (short: PESTELMO, see Mkude (2016, p. 19)) influence factors that an EE has to take into consideration. The PESTELMO method, introduced by Mkude (2016, p. 19), is applied to study the political, economic, socio-cultural, technological, legal, managerial, and organisational influence factors and identify the challenges accordingly. The analysis method is based on earlier attempts such as ETPS (economic, technical, political, and social) by Aguilar (1967) and PESTEL (political, economic, socio-cultural, technical, environmental, legal) by Yüksel (2012). Mkude(2016, p. 19) adds combined *managerial* and *organisational* factors in order to ensure a multi-disciplinary nature of e-government, which is also relevant in the context of e-participation. This research differentiates between the managerial (i.e. the responsibility for and to control the EE) and organisational factors (the structure of and procedures within an EE).

Political. The political environment frames the particular manner of e-participation, because participation has another legitimacy in a representative democracy than in a direct democracy. The integration of participation into the overall policy-making cycle is a big issue in order to ensure the take-up of outcomes or that outcomes from one policy stage are handed over to the next stage (Scherer et al., 2011). Enhanced participation and the use of ICT demand for the change of existing participation processes and the integration of new participation opportunities into political decision-making or a reorganisation of government (Sanford & Rose, 2007, p. 406). Another challenge is politicians' fear to lose ground and that they do not know how to proceed with the demand for participation (Stock, 2011, p. 12).

Economic. Every participation demands the allocation of resources such as funds, staff time and ICT (Bryson et al., 2013, p. 28; Oppermann, 2001, p. 104). EEs (such as governments or other organisations, which start e-participation) usually have insufficient resources available for e-participation in times of budget pressure (Bryson et al., 2013, p. 28). Even if e-participation is supposed to reduce costs in the long run, at first glance it only produces costs and ties up considerable resources (Andersen et al., 2007). Hiring experienced service providers is often not possible because of budget limitations (Stock, 2011, p. 14). Furthermore, the limited resources make it difficult for EEs to invest in sustainability, which is a prerequisite for successful e-participation (Panopoulou et al., 2014, p. 209).

Socio-cultural. The democratic rules demand that e-participation does not exclude any social groups (e.g. young or old persons). However, different social groups might request different information, participation channels, or technical media. Accordingly, the integration of various user types (citizens, citizen groups, elected representatives, governmental executives, political groups, politicians (Kalampokis et al., 2008, p. 27)) and roles (input provider, owner/initiator, decision maker, moderator/facilitator (Kalampokis et al., 2008, p. 30)) as well as their specific needs is a major challenge of e-participation. Another challenge is that the society has changing requirements demanding more transparency, better connectivity and collaboration among different actors (DGCONNECT, 2013).

Technical. One challenge is the selection of appropriate electronic tools to support the participation services under the consideration of rapid technological developments. *Form follows function*, i.e. the providers need to adapt e-participation tools to the services and

processes (and not vice versa). The use of user-friendly participation tools that do not exclude particular user groups targets the socio-cultural perspective as well. Thereby the sensitive integration of supportive e-participation tools into an existing ICT landscape need to be considered, e.g. to allow once-only login for administrative staff. Further interoperability scenarios are outlined, e.g. in Scherer et al. (2011).

Environmental. The infrastructure of the environment can influence the way in which people participate since, e.g. a good technical infrastructure may trigger the use of e-participation. The same applies to the distances between participants and decision makers, e.g. particularly related to national and EU policy making (Scherer, Wimmer, & Schepers, 2012).

Legal. There is a distinction between formal and non-formal participation. Formal participation requires the planning of participation activities according to requirements defined by law or in legal procedures[56]. Non-formal participation requires that the provider needs to identify how to arrange the participation so that it can contribute to political decision-making. Legal challenges also involve the privacy and data security regulations to be considered.

Managerial. Governments are struggling today with financial and personal constraints (DGCONNECT, 2013). Hence, even if the personnel in administrations do not all know how to design, manage and process (e-)participation services (Stock, 2011, p. 13), they cannot hire consultancy. They also might lack knowledge of the potential benefits of these services (Stock, 2011, p. 13).

Organisational. The administration often has a mediator role between the citizens and the politicians. In participatory budgeting, for example, they are the main contact partner for citizens, who have questions to administrative aspects. While their *regular* work is going on, citizens expect to receive feedback immediately at any time, which can strain resource planning. Furthermore, the role of a neutral moderation is important. As the administration is responsible for implementing some of the results later on, the members might be criticised as being biased - which needs to be avoided. Another issue is that e-participation services need to be interrelated with the procedures of offline participation (Macintosh, 2004a, p. 10). Another challenge is that the different EE members can steam from different disciplines or background resulting in difficult communication.

The summary of e-participation challenges shows the complexity, which e-participation design and implementation approaches have to master. The approaches studied in Section 4.2 and Section 4.3 only partially meet these challenges; Table 23 shows an assessment as to what extent the conceptual and procedural models address the challenges of e-participation design & implementation.

[56] See, e.g. the legal procedure for petitioning relevant for the petition platform of the German Bundestag (http://www.bundestag.de/bundestag/ausschuesse18/a02/grundsaetze/verfahrens grundsaetze/260564, access 2016-05-19)

Table 23. Assessment as to what extent the conceptual and procedural models address the challenges of e-participation design & implementation

Note: ++: assessed as comprehensive support; +: assessed as partial support.

Group	Source	Political	Economic	Socio cultural	Technical	Environmental	Legal	Managerial	Organisational
Conceptual models	Kalampokis et al., 2008	++		++	++				+
	Porwol et al., 2016	++	++	+	++			+	++
	Macintosh, 2004a	++	+	++	+			+	+
	Phang & Kankanhalli, 2008				++				
	Sæbø et al., 2008			+	+				
	Smith et al., 2011	+				++			
	Wimmer, 2007b	++		++	++				
	Yusuf et al., 2014			++	++	+			
Scientific procedure models	Oppermann, 2001	++	+	++	+	++	++	+	+
	Creighton, 2005	++		++	+			++	+
	Islam, 2008	++		+	+				
	Phang & Kankanhalli, 2008			+	+				
	Ali, 2010			+	+				
	Bryson et al., 2013	++	+	+	+	+	+	+	+
Practitioner procedure models	OECD, 2001	++		+	+			+	
	Acland, 2008	+		++					
	CEAA, 2008	+		+	+				+
	Märker et al., 2009	++	+	++	+		+	+	+
	Koop, 2010	+	+	+	+			+	+
	BKA & BMLFUW, 2011	+		++	+				+
	SP, 2011			+	+			+	+
	ADB, 2012			++					+
	Walz et al., 2012	+		++			+		
	eCitizenII, 2012	++		+	+				
	EPA, 2013	+		++	+				

For example, the investigation of conceptual models unveils that there is no one solution considering all types of entities that are important for e-participation. In particular, the conceptual models miss elements for designing managerial aspects (e.g. risks, which may hamper the achievement of objectives) or a data architecture. As EA frameworks are used in the IS domain to design complex socio-technical systems, their metamodels could complement e-participation conceptual models. The procedure models guiding e-participation underrepresent software engineering aspects to link technical developments with the objectives of e-participation. Furthermore, they do not consider the integration of e-participation tools into an existing ICT landscape as argued in Section 4.3. Architecture frameworks are used in commercial areas and e-government (see e.g. Janssen, 2012) in order to provide a comprehensive approach managing task diversity in complex system developments. Since architecture frameworks recognise different aspects of an enterprise and analyse their interrelationships in a comprehensive way, they are seen in this research as supportive for planning and implementing e-participation.

After focussing on the e-participation body of knowledge, in the following chapter the literature review moves on to analysing the commonalities and variations around architecture frameworks and e-participation design and implementation.

5. E-Participation & Architecture Frameworks

This chapter investigates to what extent EA frameworks can support successful design and implementation of e-participation services and what adaptations or revisions are necessary in order to streamline architecture frameworks towards e-participation. It shows architecture frameworks' relevance to develop an EEA and identifies the drawbacks in their application. Therefore, this chapter presents a synthesis of the literature review and the ethnographic studies exploring the architecture frameworks' use in e-participation design and implementation.

The remainder of the chapter is as follows. Section 5.1 presents related work from the architecture frameworks domain. Section 5.2 defines the setting of action research contributing the practical insights and Section 5.3 documents challenges experienced and argues the need for an architecture framework. The chapter moves on to identify commonalities and variations around architecture framework viewpoints and metamodels (Section 5.4) before it focusses on architecture development methods (Section 5.5). The chapter concludes with a discussion of findings (Section 5.6).

5.1 Related Work

This part of the literature review provides an overview of architecture purposes and different architecture frameworks. This chapter reviews the relevant literature drawn from academic and practitioner sources. The purpose is threefold:

1. To study the usage of architecture frameworks in the public sector,
2. To provide an overview of architecture frameworks and their content, and
3. To study quality requirements for architecture frameworks.

This section combs the architecture frameworks body of knowledge for purposes of enterprise architectures (Section 5.1.1), a selection of relevant architecture frameworks (Section 5.1.2) and an analysis of architecture framework requirements (Section 5.1.3).

5.1.1 Purposes and Challenges of Enterprise Architectures

Architecture frameworks are used in commercial areas and e-government (see e.g. Janssen, 2012) to provide a comprehensive approach managing task diversity in complex system developments. Internal drivers such as business-IT-alignment and cost-reduction as well as external drivers such as legal requirements play a role (Schöenherr, 2009, p. 404). In general, literature documents many purposes of enterprise architectures:

- Integrate and improve legacy processes to support the business strategy (TOG, 2011a, p. 6).
- Provide a blueprint for further architecture work (Janssen, 2012, p. 29)
- Provide an instrument for informing, guiding, directing, and constraining the decisions taking within an organisation (Janssen, 2012, p. 29).
- Provide "insight into the opportunities and limitations provided by the ICT landscape" (Janssen, 2012, p. 29).

- Provide a means to enable interoperability (Janssen, 2012, p. 30).
- Create "a unified ICT environment" across the enterprise or its business units including "tight symbiotic links to the business side of the organisation (…) and its strategy" (Minoli, 2008, p. 9).
- Create a landscape of ICT tools, business processes, and governance principles to drive an exchange of views about business strategy and how ICT can support it (Minoli, 2008, p. 9).
- Describe "the underlying infrastructure, thus providing the groundwork for the hardware, software, and networks to work together" (Urbaczewski & Mrdalj, 2006, p. 18).

Governments more and more recognise the importance of enterprise architectures for public modernisation (Janssen & Hjort-Madsen, 2007, p. 1) as *national enterprise architectures* (Janssen & Hjort-Madsen, 2007) or *government architectures* (Janssen et al., 2013). According to research by Janssen et al. (2013, p. 144), government architectures consist of frameworks, principles, guidelines and standards to aid the project design and demonstrate how to deal with the complexity. With enterprise architectures, governments seek to overcome a number of public sector challenges (Table 24).

Table 24. Public sector challenges relevant for e-participation and how the use of enterprise architecture seeks to overcome them

Public sector challenge	How the use of enterprise architecture seeks to overcome the challenge
Complexity of the administrative procedures resulting from many actors, many interests, and many goals (Saha, 2010, p. 10; Tarabanis, Peristeras, & Fragidis, 2001, p. 988)	Make services citizen-centred, results oriented and market-based (Saha, 2010, p. 10)
Use of "fragmented, heterogeneous, and unrelated software applications" (Janssen, 2012, p. 24).	Provide an architectural overview including legacy systems (Hjort-Madsen & Pries-Heje, 2009, p. 7) Identify infrastructure components, applications and technologies (Ask & Hedström, 2011; Ebrahim & Irani, 2005, p. 606)
Difficult communication between different hierarchical levels and different public administrations are resulting in "'stovepipe' or 'legacy' systems both organisationally and from an information viewpoint" (Tarabanis et al., 2001, p. 988)	Create a "coherence and comprehensive view across business" in ICT-enabled transformation (Ask & Hedström, 2011, p. 27).
Interoperability is not considered as e.g. isolated development of data sets (Janssen, 2012, p. 24).	Provide a comprehensive view of an organisation (Ask & Hedström, 2011; Ebrahim & Irani, 2005, p. 606) Coordinate the projects across vertical and horizontal levels (Janssen & Hjort-Madsen, 2007)
Differing views, definitions and terminology for same content (Tarabanis et al., 2001, p. 988)	Define standards (Ebrahim & Irani, 2005, p. 606)
Vague definitions of business processes performed by vague defined human roles (Tarabanis et al., 2001, p. 988).	Involve business in discussions about ICT (Hjort-Madsen & Pries-Heje, 2009, p. 6)

Even if enterprise/government architecture frameworks guide the development and documentation of an enterprise/government architecture, it remains a challenging task. The reasons are two-fold. First, such an architecture is a huge, abstract and complex artefact that – even if a framework supports its division and structuring– cannot be easily mastered. Second, architecture frameworks themselves are complex and rather difficult to use. Selecting

a suitable framework is already a demanding task, which has been compared to a "question of faith"[57]. Accordingly, the EA literature describes various challenges:

- Involved architects have a different understanding regarding the "described and perceived EA - not to mention the way they applied the concept" (Hjort-Madsen & Pries-Heje, 2009, p. 6).
- Implementation of an EA needs to done in such a way that "people understand it" (Hjort-Madsen & Pries-Heje, 2009, p. 7).
- EAs are not able to "substitute the pre-existing organisational IS governance structures" in public agencies (Hjort-Madsen & Pries-Heje, 2009, p. 8).
- Often an EA needs to be re-conceptualised in order to increase/support its acceptance (Janssen, 2012, p. 33).
- EA Frameworks are mostly abstract.

The next subsection moves forward introducing a selection of relevant architecture frameworks.

5.1.2 Selection of Architecture Frameworks

Multiple (enterprise) architecture frameworks exist on the market (Matthes, 2011, p. 37; Schekkerman, 2003, 2011) provided from commercial consultancies, industry consortia, governments or the military. Matthes (2011, p. 39) identifies *seven categories of EA frameworks* based on their planned use: *government and agency*, *management*, *military*, *manufacturing-specific*, *technically oriented*, *interoperability*, and *add-on frameworks*. These categories are not exclusive, so an architecture framework may be classified in different ones (Matthes, 2011, p. 40). The first three categories have the greatest relevance in the context of this dissertation, as argued following:

- *Government and agency frameworks* are provided by governments and administrations to develop a government architecture (see also Janssen, 2012; Janssen & Hjort-Madsen, 2007).
  → They are relevant because e-participation are often initiated by governmental agencies.
- *Management frameworks* support management of enterprises/organisations focussing on information/data, and resource management processes.
  → They are relevant because the architecture framework aims to support operational management.
- *Military frameworks* originate from the military sector. They often focus on system integration and interoperability with a standardised architecture to support multi-national operations.
  → They are relevant, not because of their origins, but because of their focus on system integration.
- *Manufacturing-specific frameworks* aim to support production processes.
  → They are not relevant, because production processes have no direct relevance to e-participation.

[57] See a presentation discussing this question, which was held at Digital Government Institute's Enterprise Architecture Conference, May 12, 2011, available at http://www.digitalgovernment.com/media/Downloads/asset_upload_file706_3453.pdf (last accessed 2015-08-04).

- *Technically oriented frameworks* support a systematic IS management (e.g. software development) with recommendations or guidelines. Management oriented methods and tools (as e.g. BPMN) are not used.
  → They are not relevant because details of the software development process are out the scope of this study.
- *Interoperability frameworks* describe different levels for cooperation among partners.
  → Scherer et al. (2011) outline their relevance for e-participation. This dissertation builds up on these results and provides no detailed analysis.
- *Add-on frameworks* support EA work.
  → They are not relevant because add-ons can only be selected for an existing framework.

For each of the three relevant groups (i.e. Government and agency frameworks**,** Management frameworks**,** Military frameworks, as argued before), one or more prominent frameworks are analysed (Table 25).

Table 25. Overview of studied architecture frameworks

Source(s)	Category	Name, description, and argumentation for its selection
a) Inmon et al., 1997; Sowa & Zachman, 1992; Zachman, 1987	Management framework	The *Zachman Framework for Information System Architecture*, published in 1987 by John Zachman, is a reference point for many EA frameworks published later on (Schönherr, 2004, p. 17). It presents an architecture-based approach for systems development and enterprise engineering. It belongs to the group. The Zachman Framework is the first framework differentiating between abstraction levels/perspectives for dedicated owners or roles in systems development, and different dimensions.
b) TOG, 2011a	Management framework	*The Open Group Architecture Framework (TOGAF***)** is an industry standard for developing EAs. It represents an international approach, commonly agreed upon by many industry players, and complements the Zachman Framework in some regards. TOGAF is the EA framework that is most often used in industry (Cameron & McMillan, 2013, p. 61). TOGAF presents a detailed architecture development method.
c) Scheer, 1999, 2001	Management framework	The *Architecture of Integrated Information Systems (ARIS)* focuses on business process integration. It is widely used in the German IS research community.
d) U.S. Department of Defense (DoD), 2011	Military framework	The *Department of Defence Architecture Framework (DoDAF)* serves as standard also for enterprises not in the military.
e) Federal Enterprise Architecture Program Management Office (OMB), 2013	Government and agency framework	The *Federal Enterprise Architecture Framework (FEAF)* provides a framework for developing processes and information structures between U.S. agencies (Braun, 2007, p. 200).
f) The Open Group (TOG), 2013	Management framework	The *ArchiMate* Specification 2.0 is an integrated architectural approach and language for enterprise modelling (Lankhorst, 2009, p. 75). The Open Group qualifies ArchiMate as "fully aligned with TOGAF"58 (Estrem & Gonzalez, 2014; Estrem, Gonzalez, & Thorn, 2014). Nevertheless, some differences to TOGAF exist.

Thereafter, these architecture frameworks are reviewed. ISO/IEC/IEEE 42010:2011, which serves as metamodel for the EPART-Framework (see Section 2.3), identifies two major components of an architecture framework (see Figure 4): Viewpoints and Correspondence

[58] See http://www.opengroup.org/subjectareas/enterprise/archimate (last accessed 2014-07-02)

Rules. However, it suggests that architecture frameworks have additional content (ISO/IEC/IEEE 42010:2011, p. 26) and it is an objective of this study to determine additional components for the EPART-Framework (see Section 2.3). In addition, the set of viewpoints relevant for e-participation needs to be determined. Both objectives frame the style of studying aforementioned architecture frameworks. Each framework is analysed for its background and purpose, viewpoints, and content.

a) Zachman Framework

Background and purpose. The Zachman Framework integrates systems development and enterprise engineering perspectives by linking ICT to the (business) world. Inmon et al. see the framework as supportive for the architect *"to understand what [the architecture] is attempting to accomplish as well as what it is not addressing"*. The framework aims to enable individual architecture description readers to view their own position in the wider context. This should improve communication between the persons involved in enterprise architecture implementation.

Viewpoints. The Zachman Framework is the first attempt to differentiate between abstraction perspectives for dedicated roles in systems development, and information dimensions in their interplay. By differentiating between perspectives and dimensions in a matrix, the Zachman Framework structures the domain to consider all relevant aspects of the system architecture (Table 26)[59].

Table 26. Zachman Framework and exemplified artefacts (Sowa & Zachman, 1992, pp. 600f)

		Dimensions					
		Data (What)	Function (How)	Network (Where)	People (Who)	Time (When)	Motivation (Why)
Perspectives	Planner (Scope)	some subject areas	major functions	major locations	major departments	major events	goals
	Owner (Enterprise Model)	partial entity relationship model	business processes	network locations	departments	business events	objectives
	Designer (System Model)	partial data model	application function	node functions	sections	system evens	business rule
	Builder (Technology Model)	physical database schema	migration rules	node interaction	direct users	job schedules	operating characteristics
	Subcontractor (Components)	database definition	programs	operating network	access authorisations	interrupts	module operating characteristics
	User (Functioning System)	Running Systems					

[59] Different versions of the Zachman framework are available with slightly differentiating naming of rows and columns even if the concepts behind are comparable (Hay, 2003, p. 5f). This work uses terminology proposed in Sowa and Zachman (1992) and Inmon et al. (1997).

The rows in the matrix represent the perspectives of different enterprise players. The order is important because one row after the other should be implemented from top to bottom (Inmon et al., 1997, p. 60). The framework differentiates between six perspectives:

- The *Planner's Perspective (Scope)* defines the business purpose (Zachman, 1987, p. 458) in the first phase (Inmon et al., 1997, p. 63). Planners define the major components of the product, create basic information for constraints (e.g. budget and legal constraints) and system descriptions addressing the six dimensions (Inmon et al., 1997, 61f).
- The *Owner's Perspective (Enterprise Model)* defines the business nature, including its structure, functions, organisation, and so forth. It describes all the things of interest to the enterprise.
- The *Designer's Perspective (System Model)* describes the information, which the enterprise wishes to collect and maintain.
- The *Builder's Perspective (Technology Model)* describes technology usage to address the information processing needs identified in the previous rows. The builders choose the databases, select the programming languages, define the program structures, describe the user interfaces, etc.
- The *Programmer's Perspective (Detailed Representations)* lists, among other things, programs, database specifications, and networks to constitute a particular system.
- The *User's Perspective (Functioning System)* considers the end-users viewpoints concerning the running system.

The columns represent different areas of interest, i.e. the *dimensions* to be considered from each perspective. They focus on particular situational aspects (Inmon et al., 1997, p. 80). To get a complete view of the architecture from a specific *perspective*, the architects need to develop all dimensions and relations between them (Inmon et al., 1997, p. 85). Hay (2003, p. 4) describes the dimensions as follows:

The *Data (What) dimension* addresses the enterprise's data comprehension and management. The *Planner*'s perspective starts with a list of things important for any organisation in the domain. When passing down through the rows, the *System Analyst* moves to progressively more rigorous data descriptions, until the *Builder*'s perspective specifies the design. The *Programmer*'s perspective presents the detailed data representation on the computer; the system is the working database.

The *Function (how) dimension* transfers the mission into progressively more specific operations descriptions. *Planner*'s perspective shows the sorts of activities conducted by the enterprise. *Owner*'s perspective describes these activities in business process models. *Designer*'s perspective depicts them as data transformation processes. The *Builder* converts the data transformation processes into program modules. *Programmer*'s perspective shows the source code. Finally, system programs execute the source code.

The *Network (Where) dimension* handles the geographical distribution of the enterprise. The *Planner* lists the business locations. From *owner*'s perspective, this becomes a more detailed communications chart that describes the interaction between the various locations. *Designer*'s perspective produces the architecture for data distribution. It itemises where information creation and usage takes place. In the *Builder*'s perspective, the kinds of electronic tools required for each location reflect this distribution. Programmers translate

these requirements into a specification of the required computers, protocols, communication systems, and so forth.

The *People (Who) dimension* describes performers involved in the business. The *Planner*'s model is an organisational units list with each unit's mission. *Owner*'s perspective shows an organisation diagram, whereby roles are linked to the *Function* dimension. In *designer*'s perspective, the interaction diagram specifies who needs what information to do their jobs. The builder's perspective designs the actual interface between each person and the technology, including issues of interface graphics, navigation paths, security rules and presentation style. Programmers convert the design into user interfaces and users access permissions. Finally, people use the new system.

The *Time (When) dimension* depicts time effects on the enterprise. At the strategic (planner's view) level, the business cycle and events are listed. In the enterprise model, the time column defines when and under what circumstances the functions happen. The system model defines the business events that cause specific data transformations and entity state changes. In the technology model, the events become program triggers and messages, and the information processing responses are designed in detail. In the builder's perspective, these designs become specific programs. In the programmer's perspective, the system correctly responds to business events.

The *Motivation (Why) dimension* translates business goals and strategies into specific ends and means. This can include the entire set of constraints that apply to an enterprise's efforts. In the planner's perspective, the enterprise identifies its goals and strategies in general, common language terms. In the owner's perspective, these are translated into the specific rules and constraints that apply to an enterprise's operation. In the designer's perspective, business rules express permitted or not permitted information. This includes constraints on row creation or updates in a database. In the builder's perspective, the business rules are converted to program design elements and, finally, in the programmer's perspective, they become specific programs. In row six, business rules are enforced.

Work on the dimensions is not necessarily done in a particular order, but all dimensions are interconnected (Inmon et al., 1997, p. 78) as visualised in Figure 18. An architect should address all dimensions (Inmon et al., 1997, p. 77). Otherwise, particular aspects can remain unclear or important relationships cannot be identified.

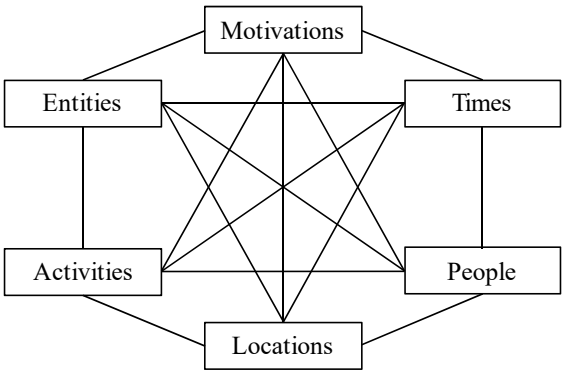


Figure 18. Dimensions equality (Inmon et al., 1997, p. 79)

Content. The Zachman Framework is not a methodology; Inmon and Zachman describe it as a “classification scheme for the deliverables from a methodology” (Inmon et

al., 1997, p. 91). Nevertheless, it proposes seven rules for avoiding ambiguities and preserving its integrity as a systematic approach for product creation (Inmon et al., 1997, p. 78).

b) The Open Group Architecture Framework

Background and purpose. The Open Group Architecture Framework (TOGAF) aims to describe a detailed method and supporting tools for developing an EA (The Open Group (TOG), 2009, p. 3, 2011a, p. 3). The European Commission states that TOGAF "attempts to provide organisations with a complete blueprint that can be adapted to their specific needs" (European Commission (EC), 2008, p. 77). The latest version of TOGAF is 9.1 (TOG, 2011a). Version 9.1 is a "quality improvement"[60] of Version 9 (TOG, 2009).

Viewpoints. In general, TOGAF differentiates between vision, business, data, application and technology different architectures (TOG, 2011a, p. 10):

- *Business architecture*, which describes the business strategy, governance, organisation, and key business processes.
- *Data architecture*, which describes the structure of an organisation's logical and physical data assets and data management resources.
- *Application architecture*, which describes blueprint for the individual applications to be deployed, their interactions, and their relationships to the core business processes for the organisation.
- *Technology architecture*, which describes the logical software and hardware capabilities that are required to support the deployment of business, data, and application services including ICT infrastructure, middleware, networks, communications, processing, standards, etc..

TOGAF represents these architectures in its metamodel. Furthermore, TOGAF states that the initial set of viewpoints is to be developed based on a stakeholder analysis. It proposes the following set of viewpoints as a starting point (TOG, 2011a, pp. 400–434):

- Business Architecture addresses the concerns of users.
- Enterprise Security addresses security aspects of the system.
- Software Engineering addresses the development of the software systems.
- System Engineering assembles software and hardware components into a working system.
- Communications Engineering structures communications and networking elements to simplify network planning and design.
- Data Flow addresses storage, retrieval, processing, archiving, and security of data.
- Enterprise Manageability addresses operations, administration, and management of the system.
- Acquirer addresses acquiring commercial off-the-shelf software and hardware.

Content. TOGAF is a comprehensive book consisting of several parts that guide enterprise architecture development:

[60] http://www.opengroup.org/togaf/faqs.htm states that "TOGAF 9.1 is a maintenance update to TOGAF 9, containing a set of corrections to address comments raised since the introduction of TOGAF 9 in 2009. TOGAF 9.1 supersedes TOGAF 9" (last accessed 2014-05-15).

The *Architecture Capability Framework* provides a set of reference materials describing how to successfully install appropriate organisation structures, processes, roles, responsibilities, and skills in order to realise the *Architecture Capability* (TOG, 2009, p. 629). The *Architecture Capability* defines "the parameters, structures, and processes" (TOG, 2009, p. 517) to govern the Architecture Repository, which maintains a set of reusable building blocks.

The *ADM* (see Figure 19) consists of nine phases for developing an EA (TOG, 2011a, pp. 57–173):

- *Preliminary*: Defining the scope of the enterprise and architectural principles, which form part of the constraints on the architecture work undertaken in the enterprise.
- *A. Architecture Vision*: Developing the architecture vision that enables the business goals, responds to the strategic drivers, conforms to the architecture principles, and addresses the stakeholder concerns and objectives.
- *B. Business Architecture*: Developing the baseline (IS state) and the target (TO-BE state) business architecture. Important differences between IS and TO-BE states are worked out in the form of gaps.
- *C. Information Systems Architecture*: Defining baseline and target architectures, which cover the data and/or application systems domains (depending on scope) and working out differences between IS and TO-BE states.
- *D. Technology Architecture*: Mapping the application components into a set of technology components as a basis for the following implementation work and working out differences between IS and TO-BE states.
- *E. Opportunities and Solutions*: Defining the activities necessary to come from the baseline architectures to the target architectures.
- F. Migration Planning: Delivering a detailed implementation and migration plan describing how to come from baseline to target architecture.
- *G. Implementation Governance*: Monitoring the implementation of the enterprise architecture.
- *H. Architecture Change Management*: Collecting requirements and external effects, used as the basis for the next iteration of the ADM.
- *Requirements Management*: Accompanying all phases with continuous requirements management.

TOGAF sees the ADM as a generic method for architecture development, which can deal with most system and organisational requirements (TOG, 2009, p. 56). Each phase has a detailed description of its objectives, approach, inputs, activities and outputs. The resulting knowledge from one phase is a prerequisite to work with the architecture in the following phases. TOGAF sees ADM as a generic method for architecture development designed to deal with most system and organisational requirements (TOG, 2009, p. 56). Nevertheless, TOGAF states that modifying or extending the ADM is often unavoidable in order to suit specific needs. Hence, it is necessary to review ADM's components for applicability in the specific context, and then tailor them to the individual enterprise. This may produce an enterprise-specific ADM (TOG, 2009, p. 56). The method integrates different techniques and methods such as architecture principles, stakeholder management, architecture patterns, business scenarios, gap analysis, migration planning, requirements, business transformation readiness assessment, risk management, and capability-based planning (TOG,

2009, p. 213). Applying ADM results in a number of deliverables such as process flows, requirements, project plans etc. (TOG, 2009, p. 361), which serve as inputs for and outputs of the ADM phases (TOG, 2011a, p. 435).

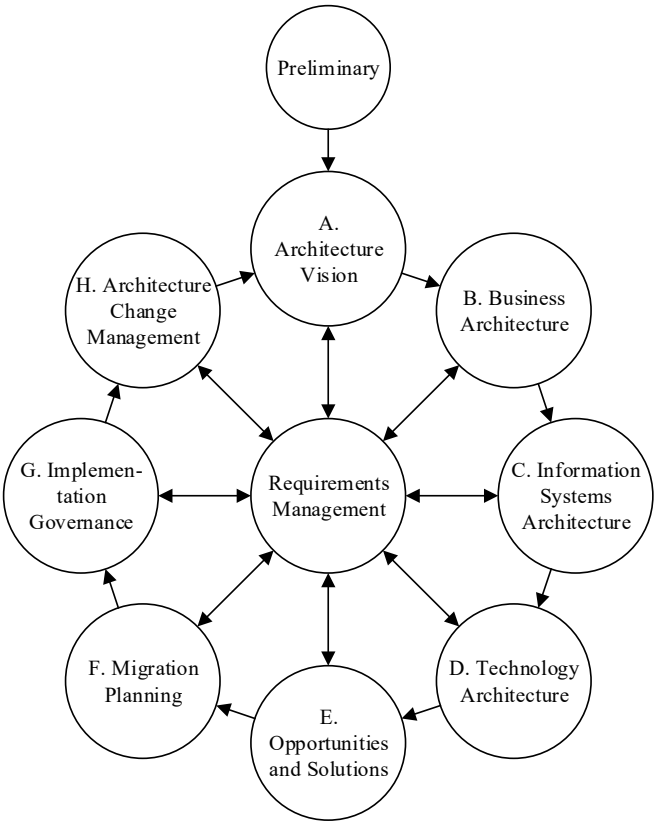


Figure 19. TOGAF architecture development cycle (TOG, 2009, p. 54)

The *Architecture Content Framework* supports defining, structuring and presenting the results of ADM phases consistently. The *Content Metamodel* defines vocabulary to ensure consistency within the ADM application and to guide organisations in implementing their architecture (TOG, 2011a, p. 331). The *Enterprise Continuum* is a virtual repository of architecture assets, such as models, patterns, architecture descriptions, and other artefacts, which exist within the enterprise (TOG, 2009, p. 531). Furthermore, TOGAF includes two *reference models:*

– the *Technical Reference Model* (TRM) provides a taxonomy of generic platform services and its visual representation of the taxonomy and focusses on the application platform space (TOG, 2009, p. 575),
– the *Integrated Information Infrastructure Reference Model* (III-RM) focusses on the application software space and a common systems architecture with regards to architecture efforts (TOG, 2009, p. 607).

The III-RM is a subset of the TRM "in terms of its overall scope" but also provides certain extensions for the TRM (TOG, 2009, p. 607). Like the TRM, the III-RM consists of a taxonomy and its visual representation. The next section describes ARIS.

c) Architecture of Integrated Information Systems

Background and purpose. Originally, the ARIS House of Business Engineering (HOBE) was a concept for controlling the business processes complexity by introducing

description views and development phases (Scheer, 1999). ARIS emerged from a business process-modelling branch using EPC notation. Over time, it evolved into a complex and sophisticated tool suite, which supports structural and behavioural modelling aspects (Noran, 2003, p. 196).

Viewpoints. The HOBE has five viewpoints (named views, Figure 20): organisation, data, performance, function and control (Scheer, 1999, p. 36). They aim to break down the complexity of an IS architecture and, therewith, ease the business process modelling process (Scheer, 1999, p. 33).

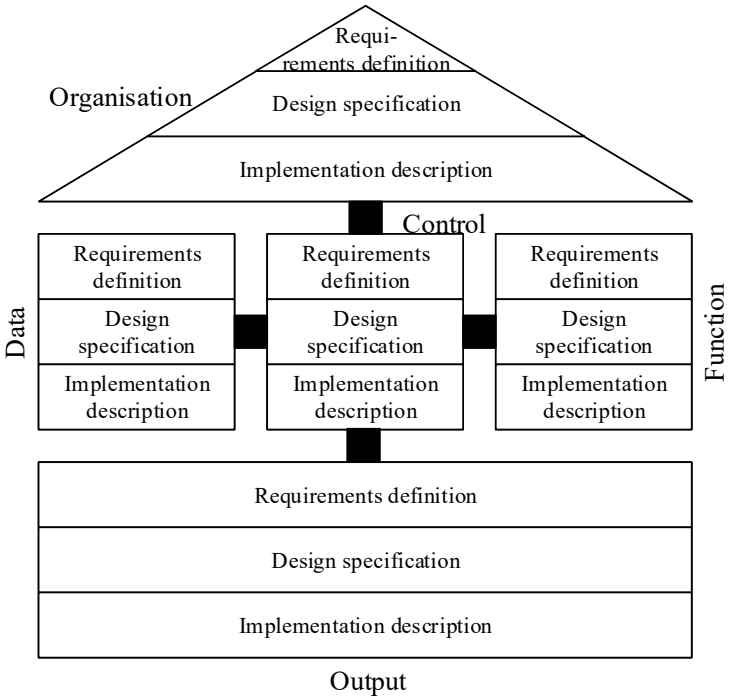


Figure 20. ARIS phase model with HOBE (Scheer, 1999, p. 39)

Each view describes a specific business process model aspect (Scheer, 1999, p. 36):

- *Function* view allocates the objectives and describes the transformation of input into output.
- *Organisation* view creates a hierarchical organisation structure by describing all organisational units and their relationships to other resources (e.g. hardware).
- *Data* view describes all business-relevant information objects.
- *Output* view describes physical and non-physical outputs.
- *Control* view integrates the other views in a logical time schedule to allow the planners to design the procedures.

Content. The HOBE is a reference framework for describing business processes and transferring them into ICT applications (Scheer & Schneider, 2006, p. 613). Furthermore, it provides an approach for comprehensive computer-based business process management (Scheer & Schneider, 2006, p. 614). The ARIS phase model extends HOBE (Figure 20) to a guideline for "developing, optimising and implementing integrated application systems from a process point of view" (Scheer & Schneider, 2006, p. 605). It aims to transform the business descriptions and target conceptual design into ICT objects (Scheer, 2000, p. 1). Based on the general conceptual and strategic design, the architecture is divided into the

ARIS views. The phase model guides the following activities for each view: requirements definition, design specification, implementation description (Scheer, 1999, p. 40). The requirements definition produces models of the individual application system (Scheer, 1999, p. 40). The design specification activity aims to adapt the business models to the requirements (Scheer, 1999, p. 40). The implementation description activity transforms the requirements into structures, components and products (services). The ARIS phase model integrates ICT impact assessment to changes in the next iteration (Scheer, 1999, p. 40). For each view, a metamodel describing the entities, which it can represent, exists (Scheer, 2000).

d) Department of Defence Architecture Framework

Background and purpose. The DoDAF is currently in its version 2.02 maintained by the DoD to support their managers in architectural decision making (DoD, 2011, p. 3). It aims to provide a "data-centric" approach to "facilitate the reuse and sharing of COI [Community of Interest] data" (DoD, 2011, p. 17) by discussing DoDAF-described Models[61] and Fit-for Purpose Views[62] (DoD, 2011, p. 3).

Viewpoints. The DoDAF names eight viewpoints (DoD, 2011, p. 105) describing different architecture entities:

- *All viewpoint*: architecture context aspects related to all viewpoints.
- *Capability viewpoint:* capability requirements, the delivery timing, and the deployed capability.
- *Data and information viewpoint*: data relationships and alignment structures in the architecture content for the capability and operational requirements, system engineering process, and systems and services.
- *Operation viewpoint:* operational scenarios, activities, and requirements supporting capabilities
- *Project viewpoint:* relationships between operational and capability requirements and the various projects being implemented.
- *Services viewpoint*: performers, activities, services, and their exchanges, providing for or supporting operational and capability functions.
- *Standards viewpoint*: applicable operational, business, technical, and industry policies, standards, guidance, constraints, and forecasts, which are applicable to capability and operational requirements, system engineering processes and systems and services.
- *Systems viewpoint:* legacy systems or independent systems, their composition, interconnectivity, and context providing for, or supporting functions.

Each viewpoint proposes a set of models/artefacts for describing the architecture.

Content. The Architecture Development 6-Activity Process guides the architects and the team to develop the architecture descriptions and emphasise the guiding principles. The iterative process consists of six activities (DoD, 2011, p. 11):

1. Determine the intended use of the architecture

[61] i.e. "documents, spreadsheets dashboards, or other graphical representations" that can serve as templates for organising data U.S. Department of Defense (DoD) (2011, p. 3)

[62] i.e. "user-defined views of a subset of architectural data" U.S. Department of Defense (DoD) (2011, p. 3)

2. Determine the scope of architecture
3. Determine the data required to support architecture development
4. Collect, organise, and store the architecture data
5. Conduct analyses to support of architecture objectives
6. Document the results in accordance with the needs of the decision makers

The DoDAF *metamodel* provides a data model for increasing "utility and effectiveness of architectures" (DoD, 2011, p. 22). Its goals are summarised as follows (DoD, 2011, p. 22):

- Define a vocabulary to describe DoDAF models and their usage in the aforementioned process,
- Specify the data exchange semantics and formats,
- Support discovering and understanding of architecture data, and
- Support integrating and analysing heterogeneous architectural descriptions.

The metamodel consists of three levels. The *Conceptual Data Model* (CDM) defines high-level data for constructing non-technical architectural descriptions (DoD, 2011, p. 23). Its key entities are: activity, resource (material, information, performer), capability, condition, desired effect, measure, measure type, location, guidance, project, vision, skill (DoD, 2011, p. 25). These entities are related to the dimensions of the Zachman Framework (DoD, 2011, p. 27). CDM also describes relationships between these entities (DoD, 2011, p. 26). The *Logical Data Model* (LDM) adds technical information to the CDM. The *Physical Exchange Schema* is an XML encoding of the LDM.

e) Federal Enterprise Architecture Framework

Background and purpose. In 1999, the U.S. Federal Chief Information Officers Council developed the FEAF (Chief Information Officers Council (CIO Council), 1999) as a guide for "federal cross-agency or segment architectures" (Bellman & Rausch, 2004, p. 51). In 2012, the EOP published the Common Approach to FEA integrating "strategic drivers, business requirements, and technology solutions" in an "agency-wide enterprise" during development and maintenance of a FEA (Executive Office of the President of the United States (EOP), 2012, p. 3). This includes principles for supporting agencies (who use the framework) in eliminating waste and duplicates, increasing shared services, closing performance gaps, and promoting engagement among government, industry, and citizens" (EOP, 2012, p. 3). This approach targets federal government employees planning, approving, and executing agency programs, and those in industry supporting those activities" (EOP, 2012, p. 3).

Viewpoints. The FEAF integrates viewpoints on different levels of an architecture to address stakeholders' needs (OMB, 2007, p. 7): Enterprise architecture addresses concerns of all stakeholders, segment architecture addresses business owners and solution architecture addresses users and developers (OMB, 2007, p. 8). Furthermore, FEAF is based on five reference models, which aim to comprise a framework to describe important elements consistently (OMB, 2013, p. 20):

- The Performance Reference Model providing the mains to link the strategy with business components and investments,
- The Business Reference Model describing the organisation through the common vision and service areas,

- The Data Reference Model facilitating the understanding of locations and meaning of data,
- The Application Reference Model categorising the standards related to systems and applications as well as the technologies supporting service capabilities
- The Infrastructure Reference Model (SRM) categorising the standards related to the network/cloud and technologies supporting delivery of voice, data, video, or mobile services, and
- The Security Reference Model providing the language and methodology to enable discussions regarding security and privacy

Each of these reference models has an own taxonomy, methods, and use cases providing examples. The relationships between the reference models are important to understand the whole picture. So the reference models provide a view on its underlying metamodel –called the Consolidated Reference Model.

Content. The FEAF proposes the Collaborative Planning Methodology (CPM) consisting of five major steps (EOP, 2012, p. 16): (1) identify and validate, (2) research and leverage, (3) define and plan, (4) invest and execute, and (5) perform and measure. The phases 1 – 3 focus on the organisation and planning phases of an EA. The phases 4-5 on the implementation and measurement phases. Each step specifies its activities (OMB, 2013, p. 14):

1. Identify and validate: 1.1 Engage sponsors and assess stakeholder needs, 1.2 Analyse and validate needs, 1.3 Formulate case to address the needs, 1.4 Identify and engage governance
2. Research and leverage: 2.1 Identify organisations and service providers to engage: 2.2 Analyse opportunities to leverage. 2.3 Determine whether to leverage
3. Define and plan: 3.1 Formalise collaborative planning team and launch planning, 3.2 Refine the vision for performance and outcomes, 3.3 Analyse the current state, determine adjustments, and plan the target state, 3.4 Formulate the integrated plan and roadmap, 3.5 Initiate execution governance
4. Invest and execute: 4.1 Define funding strategy and make decisions, 4.2 Obtain resources and validate plan, 4.3 Execute the plan
5. Perform and measure: 5.1 Operate with the new capabilities, 5.2 Measure performance against metrics, 5.3Analyse and provide feedback.

f) ArchiMate

Background and purpose. ArchiMate[63] is an integrated architectural approach and language for enterprise modelling (Lankhorst, 2009, p. 75). The Open Group qualifies ArchiMate as being "fully aligned with TOGAF"[64] and proposes guidelines describing how to use ArchiMate with TOGAF (Estrem et al., 2014; Estrem & Gonzalez, 2014). However, ArchiMate is a full enterprise architecture framework proposing viewpoints and a metamodel.

[63] ArchiMate® is registered trade mark of The Open Group. See http://www.opengroup.org/archimate/ (last accessed 2014-07-02)

[64] See http://www.opengroup.org/subjectareas/enterprise/archimate (last accessed 2014-07-02)

Viewpoints. The framework differentiates between *Views***,** presenting the passive structure, behaviour, active structure, and motivation, and *Layers***,** for business, application, technology, implementation and migration (Table 27)**.**

Table 27. Main concepts of the ArchiMate core language (Lankhorst, 2009, p. 81)

		Views			
		Passive structure	Behaviour	Active structure	Motivation
Layers	Business	Business objects	Business services, functions and processes	Actors and roles	Stakeholders, drivers, goals, principles and requirements
	Application	Data objects	Application services and functions	Application components and interfaces	
	Technology	Artefacts	Infrastructure services and functions	Devices, networks and system software	
	Implementation & migration	Plateaus, work packages, deliverables			

Content. ArchiMate exemplifies how to create models for different layers and views and proposes best practices (Berg et al., 2013). However, it does not include a detailed architecture development method as e.g. TOGAF.

The next subsection compares the contents of architecture frameworks.

5.1.3 Architecture Framework Requirements

The requirements for the content constitute the components to be contained in an architecture framework. Requirements for the structure determine how the framework can be used. Both types of requirements are analysed following.

a) Requirements for the Content

The content of architecture frameworks differentiate from each other (Franke et al., 2009, p. 327). The most famous approach that identifies general components of architecture frameworks is the *Generalised Enterprise Reference Architecture and Methodology* (GERAM). It is meant to be an "overall definition of a generalised framework" (IFIP-IFAC Task Force on Architectures for Enterprise Integration (IFIP-IFAC), 1999, p. 4). The GERAM consists of a number of generic components that are correlated with each other (Figure 21).

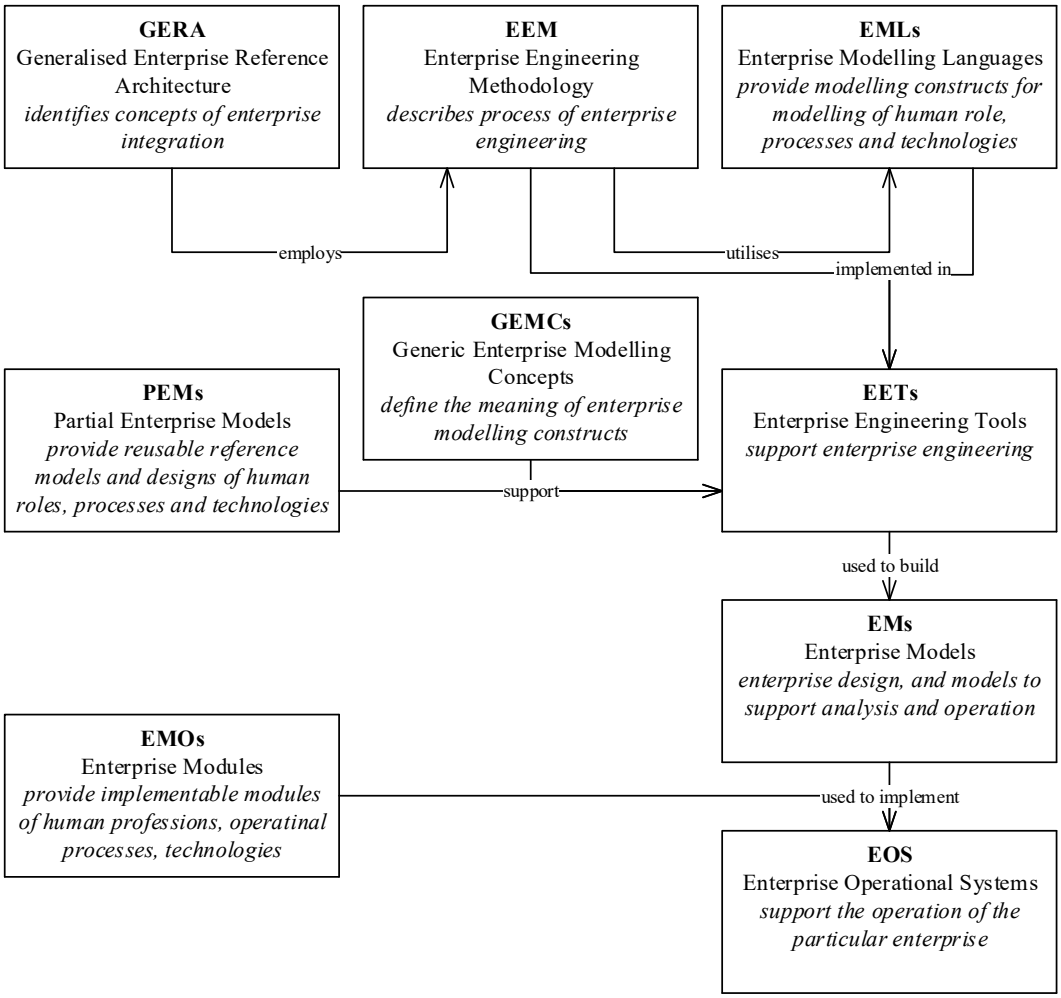


Figure 21. GERAM framework components (IFIP-IFAC, 1999, p. 5)

GERAM was created from the frameworks CIMOSA, GRAI/GIM and PERA (IFIP-IFAC, 1999, p. 4). An earlier approach, which is based on GERAM, is proposed by Franke et al. (2009). They propose a framework for categorising EAFs (EAF^2), which is in accordance to the IEEE 1471 standard (the predecessor of ISO/IEC/IEEE 42010:2011, see Section 2.2). Its development is based on frameworks also considered in this research, such as Zachman, TOGAF, DoDAF, FEA, and ArchiMate. EAF^2 includes the following concepts (Franke et al., 2009, pp. 329–331):

1. *Architecture Governance* describes EA management aspects.
    - 1.1. *Architecture Development Process* describes "the processes of enterprise engineering and integration" (IFIP-IFAC, 1999, p. 6).
    - 1.2. *Architecture Maintenance Process* is about "maintaining and evolving EA models to keep them up-to-date with recent developments with the organization's business and/or IT landscape" (Franke et al., 2009, p. 329).
    - 1.3 *Architecture Guidelines/Principles* are instruments for constructing an organization's architecture aligned with stakeholder's requirements" (Franke et al., 2009, p. 329).
        - 1.3.1 *Building blocks* stem primarily from TOGAF and FEA and "provide units of functionality for fulfilling needs in an organization" (Franke et al., 2009, p. 329).

1.3.1 *Patterns* describe how [building blocks] "are put together into architectural solutions" (Franke et al., 2009, p. 330).

1.4 *Architecture Roles/Skills* "provide a set of roles, skills, and experience norms needed for sufficient governance" (Franke et al., 2009, p. 330).

1.5 *Architecture Maturity Model* "encompasses techniques for quantifying organizational EA maturity (…) and improves understanding of the state of the organization's EA" (Franke et al., 2009, p. 330).

1.6 *Architecture Compliance Guideline & Review Process* "is intended to assure compliance of architecture projects with overall architectural principles and provides a process for review of this" (Franke et al., 2009, p. 330).

2. *Modelling Concepts* provide definitions and formalisms for actual models

2.1 Model Taxonomy "provides a way of structuring models used for enterprise modelling (…) [and] defines which models an enterprise architecture can consist of and provides an overview of the models" (Franke et al., 2009, p. 330).

2.2 *Reference Models* capture "knowledge from previous modelling tasks, in a way similar to that of patterns" (Franke et al., 2009, p. 330). While patterns are rather normative, reference models can be "purely descriptive, i.e. without endorsement showing how building blocks have been previously put together" (Franke et al., 2009, p. 330).

2.3 *Metamodels* formally define "the allowed contents of architectural models, often graphically" (Franke et al., 2009, p. 330).

2.3.1 *Entity Types* "represent architectural classes, e.g. information systems, processes, enterprises, and they are used to guide and delimit the contents and semantics of the EA models" (Franke et al., 2009, p. 330).

2.3.2 *Attribute Types* "are types of entity properties" (Franke et al., 2009, p. 330).

2.3.2 *Relationship Types* "define the legal entity connections" (Franke et al., 2009, p. 330).

2.3.3 *Viewpoints* "show excerpts of the metamodels according to the information needs of different stakeholders" (Franke et al., 2009, p. 330).

This list of components is not meant as to be fulfilled by each architecture framework. Rather it is seen by Franke et al. (2009, p. 331) as a classification scheme to choose an EAF. However, some considerations in regards to the research in this dissertation result in a slightly different scheme:

- The concepts Model Taxonomy and Metamodels are summarised because viewpoints, according to ISO/IEC/IEEE 42010:2011, include the model kinds and, thus, structure the models as a Model Taxonomy does.
- The differentiation between the concepts Building Blocks, Patterns, and Reference Models is not clear. In this dissertation, they are not differentiated.
- The concept Metamodel should include entity types and relationship types.

This research relies the classification scheme presented in Table 28.

Table 28. Classification of frameworks (based on Franke et al., 2009)

Note: ++ The EAF² concept considered is presented and detailed. + The EAF² concept considered is mentioned and discussed. Otherwise, the EAF² concept is not mentioned.

Concepts \ Frameworks	Zachman (Franke et al., 2009)	TOGAF (Franke et al., 2009)	DoDAF (Franke et al., 2009)	ARIS (Scheer, 1997)	FEA (Franke et al., 2009)	ArchiMate (Franke et al., 2009)
1. Architecture Governance						
1.1. Architecture Development Process		++	++	++	++	+
1.2 Architecture Maintenance Process		++		+	++	
1.3 Architecture Guidelines/ Principles		++	++	+	++	
1.4 Architecture Roles/Skills		++			++	
1.5 Architecture Maturity Model		+			+	
1.6 Architecture Compliance Guideline & Review Process		++				
2. Modelling Concepts						
2.1 Viewpoints	++	++		++		++
2.2 Reference Model		++			++	
2.3 Metamodel		++	++	+		++

Based on these insights the following framework components are identified as important for the EPART-Framework:

Requirement 14. Components of the EPART-Framework: The EPART-Framework must constitute of a set of recommended viewpoints, a metamodel, an architecture development Method, and a set of reference models.

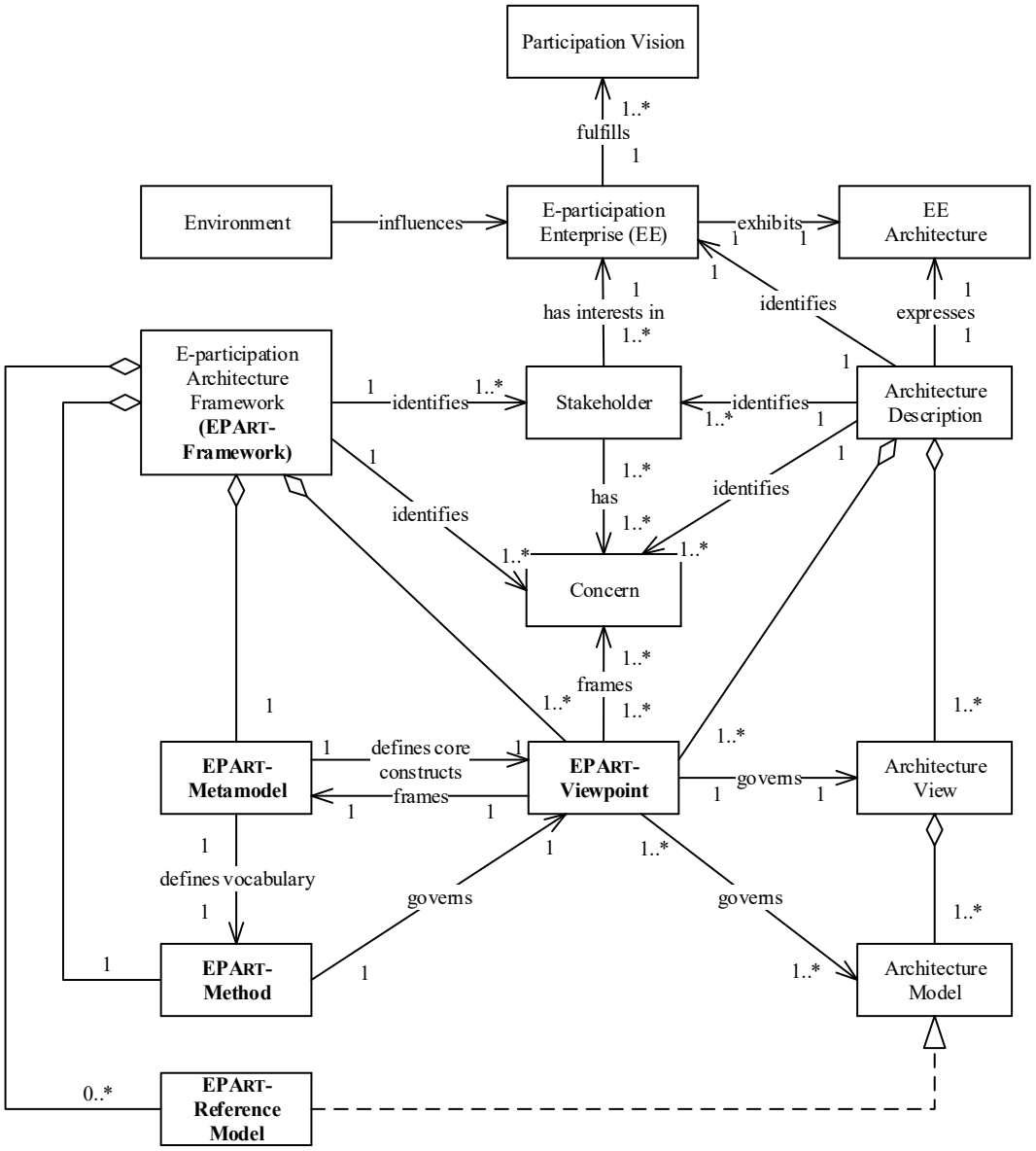
The *Viewpoints* aim to govern the development of views on the architecture considering different stakeholders and their concerns. According to the ISO/IEC/IEEE 42010:2011 standard, a viewpoint should define the model conventions and correspondence rules. However, it does not define how these should be specified but proposes to use a metamodel. The *Metamodel* aims to define the architecture entities and their relationships. It should also be useful as vocabulary or glossary. According to the TOGAF content metamodel, it aims to define "a formal structure for […] terms to ensure consistency within" (TOG, 2009, p. 367) the architecture framework. According to Franke et al. (2009, p. 330)[65], the Metamodel describes:

– *Entities***,** which define the architectural classes, e.g. `Participation Service`, `Participation Result`.
– *Relationships*, which define the connections between entities, e.g. `Participation` Service *produces* `Participation Result`.
– *Attributes*, which define properties of entities, e.g. the name of a `Participation Service`.

The Architecture Development *Method* aims to propose a systematic procedure to develop an architecture and its description (i.e. architecture governance). The *Reference Models* aim

[65] See also ISO/IEC/IEEE 42010:2011.

to store best practices. Figure 22 outlines the conceptual model of the EPART-Framework in accordance to this understanding.



Legend: UML class model. Bold fonts indicate amendments to the conceptual model presented in Figure 5 (p. 28).

Figure 22. Conceptual model of the EPART-Framework (derived from ISO/IEC/IEEE 42010:2011, p. 5)

From these requirements for the content of the EPART-Framework, we move on to studying requirements for its structure in the following section.

b) Requirements for the Structure

This subsection explores requirements determining the structure of architecture frameworks. It starts with a study of the *Guidelines of Modelling (GoM)*. The GoM provide criteria, which are supposed to make statements about the quality of information models (Schütte, 1998, p. 112). The objective of GoM is to provide specific design recommendations to build a model conform with syntactic rules so that its quality is improved (Becker,

Rosemann, & Schütte, 1995, p. 437; Rosemann & Schütte, 1997, p. 17) and subjectivism in the modelling process is reduced (Schütte & Rotthowe, 1998, p. 244). There are two slightly different approaches: The original approach of Becker et al. (1995) consists of the six principles (1) syntactical and semantic correctness, (2) relevance, (3) economic efficiency, (4) clarity, (5) systematic structure, and (6) comparability. This approach is based on the assumption that a model is a representation of the real world and, with this, the correctness of a model can be tested. The criticism that a model is rather a result of an individual modelling process of the modeller (Schütte, 1998, p. 112) resulted in a slightly different approach (see Rosemann & Schütte, 1997; Schütte, 1998; Schütte & Rotthowe, 1998). As the model definition of this dissertation is based on the construction oriented model definition, the latter approach is used. The principles are (Schütte & Rotthowe, 1998, p. 245):

1. The principle of *construction adequacy* is related to consensus about the problem and the type of construction or representation (Schütte & Rotthowe, 1998, p. 245).
2. The principle of *language adequacy* is related, according to Schütte (1998, p. 124), to the model system and the used language. Adequacy (including semantic power, level of formalism, and speech intelligibility; all dependent of the estimated usage of the model) and correctness of used language (meaning the correct usage of syntax) are important.
3. The principle of *economic efficiency* means, according to Schütte (1998, p. 127), that the creation or usage of information models can have effects on economic objectives. So it might produce costs but also might result in reduced costs or maximised benefits.
4. The principle of *clarity* concerns comprehensibility and uniqueness of model systems. According to Schütte (1998, p. 131), the principle comprises the objectives for categorisation, layout and filtering according to the model's addressees.
6. The principle of *systematic design* considers according to Schütte (1998, p. 130) different views or perspectives to the model and consistency between the views. This principle can be determinant to the principle of economic efficiency.
7. The principle of *comparability* focuses on semantic comparability between two models according to Schütte (1998, p. 133). Two models are defined as comparable if it is possible to define equivalence relations between them.

After consulting model quality requirements, this section moves forward to study specific requirements to the architecture frameworks. For some of the GERA Framework Components, the specification delivers requirements, which must be satisfied by its definition. On this base, Buckl (2011) elicits quality criteria of an organization-specific EA management function. It should

– Cover description, design, implementation, operation, maintenance, and improvement of the enterprise (Buckl, 2011, p. 118).
  → This requirement is relevant for the EPART-Framework. However, further studies in the following sections need to determine the details.
– Provide a modelling environment, which leads to executable code Buckl, 2011, p. 118).
  → This requirement is not relevant for the EPART-Framework because this is no objective for the framework.

- Encompass a method, which is easy understandable and usable by the communities targeted (Buckl, 2011, p. 118).
  → This requirement is relevant for the EPART-Framework and is encompassed by the principle of language adequacy.
- Allow the adoption of good practices (Buckl, 2011, p. 118).
  → This requirement is relevant for the EPART-Framework (see Requirement 19).
- Provide viewpoints on the EA supporting integration and adaptation of its constituents (Buckl, 2011, p. 118).
  → This requirement is relevant for the EPART-Framework (see Requirement 16).

After compiling general requirements for architecture frameworks, the aim of the following sections is to explore the use of architecture framework in e-participation design and implementation with practical insights. Next, the setting of action research is presented.

5.2 Action Research Setting

The research group E-Government was involved in the following EU-funded projects relevant to this dissertation [66]:

- *LEX-IS – Enabling e-participation of the youth in the public debate of legislation*, co-funded by the EC within the *eParticipation Preparatory Action* between 2007-01-01 and 2008-12-31
- *VoicE – Giving Citizens a Voice in EU legislation*, co-funded by the EC within the eParticipation Preparatory Action between 2008-01-01 and 2009-12-31
- *VoiceS – Integrating Semantics, Social Software, and Serious Games into E-Participation*, co-funded by the EC within the eParticipation Preparatory Actions between 2009-01-01 and 2010-12-31
- *OCOPOMO – Open collaboration for policy modelling*, co-funded under the Seventh Framework Programme ICT of the EC between 2010-01-01 and 2013-04-30

The purposes of these projects were to design, and implement ICT tools and methods for e-participation (with different focus, and target groups) and the execution of pilots testing them. Each of these projects can be understood as an EE. Their pilots are the e-participation undertakings, which the projects have realised. The following subsections describe LEX-IS, VoicE and VoiceS, and OCOPOMO.

5.2.1 LEX-IS

The LEX-IS project aimed to improve the legislative process in national parliaments through public participation. Public participation was enhanced in the legislation proposal formation and debate of draft legislations stages by using collaborative ICT tools and argument visualisation methods (Loukis et al., 2007; Loukis, Wimmer, Charalabidis, Triantafillou, & Gatautis, 2007). The project's targeted users were younger citizens. From a technical point of view, the project aimed at developing the e-participation tools (the LEX-IS platform) to facilitate this particular type of participation. The project implemented two

[66] See https://www.uni-koblenz-landau.de/en/campus-koblenz/fb4/iwvi/agvinf/projects?set_language=en (last access 2015-12-07)

pilots, one in Austria and one in Greece. Strong cooperation with the staff of the Austrian parliament gave insights into the parliamentary life cycle and the limited possibilities for citizens' participation. In LEX-IS, we were involved in the requirement analysis (Scherer, Wimmer, & Diedrich, 2008), the modelling of legislative procedures (Gatautis et al., 2007), and the planning, implementation and the evaluation of the Austrian pilot (Scherer, Neuroth, Schefbeck, & Wimmer, 2009).

5.2.2 VoicE & VoiceS

In the VoicE project, we developed a regional participation model for distant decision making. It aimed at promoting the dialogue between citizens from two European regions (Baden-Württemberg, Germany and Valencia, Spain) and members of the European Parliament (MEPs) via e-participation tools (i.e. the VoicE platform). The VoicE project aimed at enabling participation in the policy formulation stage, in particular the legislation proposal formation and the debate on draft legislation (Holzner & Schneider, 2008). In the follow-up project named VoiceS, the VoicE platform was advanced and complemented by adding new features such as automatic links, semantic search and social networking features for marketing and promoting the platform to reach wider user groups and stakeholders (Holzner, Schepers, Scherer, & Karamagioli, 2009; Scherer, Holzner et al., 2009). The results and lessons learned from the VoicE project were of particular importance for the follow-up project VoiceS. This way, VoicE and VoiceS incorporated ongoing evaluation through an iterative design cycle. The research group E-Government was involved in the following:

- requirements analysis (Agnoloni et al., 2009; Karamagioli & Titorencu, 2008)
- planning of participation processes (Agnoloni et al., 2009)
- design of e-participation features including usability testing (Scherer, Karamagioli et al., 2009)
- evaluation of the pilots (Augustin, Scherer, & Wimmer, 2010; Scherer & Wimmer, 2010; Scherer, Wimmer, Lorenz, Pannese, & Ventzke, 2011)

5.2.3 OCOPOMO

In the OCOPOMO project, an integrated ICT platform to efficiently support policy development via integrating formal policy modelling, scenario generation, and open collaboration was developed (Wimmer, Scherer, Moss, & Bicking, 2012). The aim was to engage wider stakeholder groups in social and economic policy areas. The project built on methods and tools of policy modelling and scenario-based foresight. It integrated them into a collaboration platform for key stakeholders (such as policy analysts, policy operators, wider interest groups of specific policy domains) using e-participation tools. The OCOPOMO project encompassed three pilot cases, each case tackling a specific policy issue: competence centres for knowledge transfer in Campania region, Italy, heating in Kosice self-governing region, Slovakia, and housing facilities in London, United Kingdom. In the initial use case analyses of OCOPOMO, an earlier version of the EPART-Method was applied, which is published in Scherer and Wimmer (2011b) and Scherer and Wimmer (2012a). In OCOPOMO, we brought in our experience from earlier e-participation for designing the participation platform (Bicking et al., 2010; Scherer et al., 2011) as well as the supporting processes (Scherer, Wimmer, Lotzmann, Moss, & Pinotti, 2015), and evaluating the pilots (Bicking et al., 2013). Prof. Dr. Maria A. Wimmer was the project coordinator.

The need for an e-participation architecture framework observed through the active involvement in these four projects is summarised in the following section. Thus, it argues that this research is relevant as it is fundamental for DSR.

5.3 Need for an E-Participation Architecture Framework

Lessons, experiences and results from the different projects, in which we have been involved, has led to investigating whether appropriate procedural models and engineering approaches for the development, implementation, and evaluation of e-participation exist. In these projects, which aimed at testing particular e-participation tools and participation models, the project teams had to conceptualise and implement the respective ICT and pilots using this ICT. The members of the different project teams could not identify a universal applicable framework for e-participation in terms of a structured engineering approach to this time. Hence, the members of the different project teams conceptualised the pilots as typical software project following a kind of waterfall model[67], i.e. (i) analysis of user requirements, (ii) design of the pilot, (iii) implementation of the pilot, (iv) piloting (including setting up pilot cases for the trials), and (iv) evaluation of the pilot. As these software engineering approaches only address a particular part of a socio-technical system, namely software development, the project team members did not regard them as suitable for more holistic considerations required to develop e-participation. Evaluating 21 EU-funded e-participation projects (see Wimmer & Bicking, 2013, p. 228) and another study of European e-participation projects (see Millard, 2009, p. 8) revealed similar insights and needs. The approaches of the majority of e-participation projects neglected the design of organisational, behavioural and interaction features, which are to be developed or refined in parallel to new technological solutions, as e.g. Wiener and Nagel (1989) argue. We experienced these observations already in the first two projects in which we were involved (LEX-IS and VoicE). Both projects ran in parallel for one year. Since these projects followed such typical software project structures, we identified the need for a comprehensive architecture framework. In consequence, we started the development of a structured procedure guiding the development and implementation of e-participation services (Scherer et al., 2012; Scherer & Wimmer, 2011b; Scherer, Wimmer, & Ventzke, 2010).

From these considerations, the following sections synthesise the results from literature review and practical insights to study commonalities and variations between architecture frameworks and e-participation design and implementation for the EPART-Framework components EPART-Viewpoints and EPART-Metamodel, as well as the EPART-Method. The synthesis starts with findings towards selecting appropriate architecture framework viewpoints and developing a metamodel next.

5.4 Viewpoints and Metamodel

According to ISO/IEC/IEEE 42010:2011, an architecture framework should include viewpoints to frame stakeholders' concerns. Viewpoints are an effective approach for supporting the architecture description design and results documentation (Woods, 2004). However, the type and number of viewpoints used in different architecture frameworks is not consistent

[67] The waterfall model is e.g. described in Royce (1970).

as Schöenherr (2009, p. 405) outlines. According to Schöenherr, the majority of authors considers business processes in the context of organisation but also in application and/or application landscape. Coming back to the selection of architecture frameworks discussed in the related work (Section 5.1), the different terminologies attract the attention. The Zachman Framework calls its viewpoints *dimensions* and *perspectives*. TOGAF provides *architectures*. Perroud and Inversini (2013, p. 10) call the viewpoints *layers*, while Rozanski and Woods (2012) name them *viewpoints* and *perspectives*. This research uses the term viewpoint to frame the stakeholders' concerns (cf. Subsection 2.2.3). Table 29 compares the viewpoints in the architecture frameworks studies in Subsection 5.1.2.

Table 29. Comparison of viewpoints in architecture frameworks.

Note: Rows group viewpoints in accordance with the Zachman Framework. […] indicate that some accordance exist, but no direct match.

Zachman (Inmon et al., 1997)	TOGAF (TOG, 2011a)	ARIS (Scheer, 1997)	DoDAF (DoD, 2011)	FEAF (OMB, 2013)	ArchiMate (TOG, 2013)
Data	Data	Data,	Data and information, [All]	Data	[Business]
Processes	[Business]	Function	Operational, [All], [DIV], [Project]	[Business]	[Business]
People	[Business]	Organisation	[Operational], [Project], [Services]	Consolidated	[Business]
Locations	[Business]	Organisation	[Service],[System]	[Infrastructure]	[Business]
Motivation	[Business]	-	[Capability], [Project]	Performance	Motivation
Time	[Business]	Function	[Project]	[Business]	[Business]
Scope	Preliminary, Architecture vision	-	Capability	Performance	[Business]
Business model	Business	Function	Operational	Business	Business
System model	Application a	Design	System, Standards	Application	Application
Technology model	Technology	Implementation		Infrastructure	Technology
Functioning system	Opportunities and solutions, Migration planning	Control, Operation/maintenance	Operational,	Performance	Implementation and Migration
Others	Requirements management	Requirements	All	Security	-

Before turning to insights into e-participation design and implementation, the Zachman Framework dimensions are studied to analyse their emphasises and how they interrelate with e-participation (based on descriptions of the Zachman Framework in Inmon et al., 1997; Zachman, 1987, 1987 and the six dimensions of communicative interaction presented in Sæbø et al. (2011, p. 417)):

– The *Data (What) Dimension* addresses understanding of, and dealing with information and data in the e-participation. Such information may concern particular discussion topics, the political environment, the policy -making processes, participation methods, estimated impact etc.
– The *Function (How) Dimension* describes the process of translating the mission of the e-participation successively into more detailed definitions of its operations. The project analyses legislative procedures, identifies possible points for participation and plans participation processes.

- The *Network (Where) Dimension* describes the geographical distribution of the policy-making processes, participation activities and involved actors and institutions. → This dimension is not explicitly covered.
- The *People (Who) Dimension* describes the stakeholders involved in the e-participation, i.e. active or inactive actors.
- The *Time (When) Dimension* describes when certain events take place, activities are (to be) performed, and what dependencies exist. For example, a consultation is only meaningful at a time where impact on a decision is still possible.
- The *Motivation (Why) Dimension* targets the translation of e-participation goals and strategies into specific ends and means and describes the entire set of constraints that apply to the effort.

The analysis shows the importance that all dimensions are considered why it is noted as a requirement for the EPART-Framework:

Requirement 15. Dimensions: The EPART-Framework should place emphasis on a multidimensional approach (how, where, who, when, why and what).

The e-participation literature is reviewed next in order to identify relevant viewpoints for e-participation. E-participation literature often refers to the evaluation framework proposed by Macintosh and Whyte (2008) (see e.g., Kubicek & Aichholzer, 2016; Porwol et al., 2016). This evaluation framework differentiates three viewpoints described as overlapping (pp. 20-21): *Democratic* considering criteria to understand how e-participation affects democracy, *Project* considering the aims, objectives, and methods of public engagement, and *Socio-technical* considering to what extent ICT design affects the outcomes. Kubicek and Aichholzer (2016, p. 30) state that this framework "covers almost any aspect that has been mentioned in the literature as relevant or interesting in order to assess and evaluate (e-)participation". The same time they interpret these viewpoints as overlapping (p. 31) – i.e. interrelations between these viewpoints are not considered in the framework by Macintosh and Whyte (2008). Furthermore, Kubicek and Aichholzer (2016, p. 30) assess the *Project* viewpoint as particularly heterogeneous because it considers too many different aspects. As an example, they mention that this viewpoint includes the participation process as well as managerial objectives. Kalampokis et al. (2008) propose a *Socio-technical*, a *Participation Process*, and a *Stakeholder* viewpoint. They neglect general managerial aspects, but add a view on the stakeholders including personal who are in charge for the participation services. The viewpoints of Macintosh and Whyte (2008) and Kalampokis et al. (2008) are combined to identify a set of viewpoints. *Participant Viewpoint* (stakeholder), *Participation Viewpoint* (participation process, democratic objectives), *E-Participation Viewpoint* (socio-technical). Adding the *Implementation & Governance Viewpoint* (managerial and governance objectives) allows a separation of the participation from management processes and methods. The question arises if this set of viewpoint is sufficient for the purpose of this study. A comparison of these viewpoints with the viewpoints in Table 29 (p. 108) outlines some gaps. The set of viewpoints misses a view on data and information, i.e. covering data to be produced, stored, edited in different activities. A separate *Data & Information Viewpoint* enables to link offline inputs with online inputs, which both need to be considered in decision making. In addition, the set does not cover the Motivation (participation scope) to enable a link between objectives, the participation services and ICT tools. However, the vision and objectives should drive the e-participation, and therefore, the following study

considers the motivation as a separate viewpoint in the *Participation Scope Viewpoint*. This is also meaningful to be able to define objectives at a higher level, and to break them down into participation objectives, socio-technical objectives and operational objectives and to define relevant measures.

The questions arises, if this theoretically derived set of viewpoint reflects the concerns of stakeholders in e-participation design and implementation. Moreover, if yes, how the viewpoints should look in detail. The stakeholders and their concerns described in architecture frameworks focus either on the private sector (e.g. customers, and CIO in TOGAF) or on the structures in the governmental organisations (e.g. federal structure in FEA). On the one side, this helps to analyse stakeholders who are members of the EE. On the other side, architecture frameworks are not supportive for analysing the participation stakeholders. Therefore, the following synthesis moves on to enhance the research with insights from practice. This research uses the approach by Schekkerman (2008) for developing appropriate viewpoints to an EE from the insights of projects. Schekkerman (2008, p. 71) proposes to find stakeholders in a first activity; as done in Section 4.2). In the second activity, Schekkerman (2008, p. 71) suggests the identification of stakeholders' concerns. The third activity is to describe relevant viewpoints. The same approach is applied in TOGAF (TOG, 2009, pp. 286–292). The study presented in Section 4.3 is of major importance in doing so. Each of the main project activities, identified in there, represents a class of stakeholders concerns, which viewpoints should target (see Table 30).

Table 30. Categorisation of the main activities of e-participation design and implementation (cf. Requirement 13, p. 81) into the viewpoints

Viewpoint	Main activities (cf. Requirement 13, p. 81)
Participation	Participation management
Implementation & Governance	Project management, evaluation management, decision management
E-Participation	Requirements management, e-participation engineering
Participant	Stakeholder management and communication, marketing
Data & Information	Editorial management
Participation Scope	Motivation management

E-participation literature does not describe stakeholder concerns in detail. In LEX-IS, VoicE, VoiceS and OCOPOMO a wide range of different kind of stakeholders was engaged. The insights serve to derive the concerns of stakeholders and structure them according to the viewpoints identified (Table 31).

Table 31. Overview of the viewpoints, the concerns they frame and stakeholders

Viewpoint	Concerns	Stakeholders
Participation Scope	Why do we want to do the e-participation? What are the expected results? What are the e-participation guidelines? How can the objectives be translated into an effective process and EEA? What is the target group?	All
Implementation & Governance	Is the e-participation successful with regards to its defined objectives? What resources do we have to carry it out and operate the EE? What are our duties? Whom do we have to support? Can we fulfil agreed services?	Operating Team (Owner, Project Manager, Consultant) Evaluator
Participant	What are the relevant stakeholders and actors? Who are the participants and who are the decision makers? How do we can engage them?	Marketing, Participation Experts (Participation Analyst, Expert)
Participation	What commitment is necessary from the side of participants? How much time does it cost? What are the expected results? What happens with the participation input? What are the results? How can participation influence political decision making? What events are important? What events should we organise?	Participation Experts, Participants, Supporters (Administrator, Decision Maker, Initiator)
Data & Information	What data will be produced and how will it be managed? Where will this data be available? How can have access to which data?	Facilitator Team (Facilitators, Moderators), Participation Experts, E-Participation Engineers
E-Participation	What legacy ICT systems exist? What channels are to be supported? Is it possible to reuse any existing systems/software/hardware? What interfaces should exist between systems and to external systems. What ICT do I have to monitor? What is the software update policy? What licences exist? How is the e-participation tool to be deployed? What are the requirements that I have to implement? What ICT system/component do we deliver? Who is responsible for ICT administration and maintenance? How can users be supported?	E-participation Engineering Team (ICT supplier, developer, maintainer, administrator)

In conclusion, the analysis above supports the initially selected set of viewpoints resulting in Requirement 16:

Requirement 16. Viewpoints: The EPART-Framework should integrate viewpoints on the participation scope, implementation & governance participant, data & information participation, and e-participation.

In addition to the roles described in the literature (cf. Section 4.2), the participation analyst, who is responsible for analysing policy-making processes and planning the e-participation processes, is identified. Furthermore, the stakeholders are categorised in groups as follows:

- *Operating team*: owner, project manager, consultant, evaluator
- *Stakeholder engagement team*: marketing, participation analyst, expert
- *Participants*: input provider, lurkers
- *Supporters*: administrator, decision maker, initiator
- *Participation management team*: participation analyst, expert, supporter (administrator, decision maker, initiator)
- *Facilitator team*: facilitators, moderators
- *E-participation engineering team*: ICT supplier, ICT developer, ICT administrator

It needs to be analysed how the viewpoints can correspond to each other, what entities and what model kinds are important. For this, the analysis of deliverables is important. VoicE,

VoiceS, LEX-IS and OCOPOMO produced a considerable number of deliverables, each containing several artefacts, which can be classified according to the defined viewpoints (Table 32).

Table 32. Architectural artefacts produced in the projects LEX-IS, VoicE, VoiceS, and OCOPOMO categorised for viewpoints

Viewpoints	Architectural artefacts	Relevant project deliverables
Participation Scope	Objectives, activities and achievements overview	Voices D1.4 Progress report, LEX-IS D5.2 Periodic progress report
	Overview of constraints (organisational and legal)	Strategic organisational and legal constraints
Implementation & Governance	Risks Overview including mitigation activities	VoicE D1.3 Risk analysis and mitigation report, Voices D1.3 Risk and quality report, OCOPOMO D9.1 Periodic report including quality report
	Overview of issues, measurements	VoicE D1.1 Partner plan
	Roles and responsibilities graphic	VoicE D1.2 Project plan, VoicE D1.1 Partner plan, Voices D1.1 Partner plan. Voices D1.2 Project plan
	Project timetable and status	Voice D1.4 Periodic progress report, Voices D1.4 Progress report
	Financial overview	Voices D1.4 Progress report
	Recommendations/lessons learned	Voice D6.4 Guideline for e-participation knowledge transfer, Voices D7.3 Evaluation report including lessons learned, OCOPOMO D7.1 Evaluation strategy, trial design, and evaluation results
	Evaluation strategy	Voices D5.3 Results analysis and evaluation report, LEX-IS D3.1 Pilot operation plan, OCOPOMO D7.1 Evaluation strategy, trial design, and evaluation results
Participant	Stakeholder analysis	Voices D6.1 Strategy for users involvement, LEX-IS D1.1 User groups and requirements, OCOPOMO D1.1 Stakeholder identification and requirements for toolbox, scenario process, and policy modelling
	Strategy how to attract stakeholders	Voices D6.1 Strategy for users involvement, Voices D6.3 Stakeholder analysis, LEX-IS D3.1 Pilot operation plan
	User requirements	LEX-IS D1.1 User groups and requirements
Participation	Participation outline	OCOPMO D1.1 Stakeholder identification and requirements for toolbox, scenario process, and policy modelling
	Legislative and participative process models	Voices D2.1 Requirements report, LEX-IS D1.2 Legislative process workflow models, LEX-IS D3.1 Pilot operation plan, OCOPOMO D1.1 Stakeholder identification and requirements for toolbox, scenario process, and policy modelling, OCOPOMO D2.1 Platform architecture and functional description of components
	Process requirements	LEX-IS D1.1 User groups and requirements
Data & Information	Content structure	LEX-IS D3.1 Pilot operation plan
	Data entities	OCOPOMO D2.1 Platform architecture and functional description of components, OCOPOMO D4.1 Integrated platform
	Ontology	Voices D2.1 Requirements report,, Voices D3.1+D3.2 Semantic platform description and ontology development,
	Data requirements	LEX-IS D1.1 User groups and requirements

Viewpoints	Architectural artefacts	Relevant project deliverables
E-participation	Technical specification/architecture	LEX-IS Technical specification of the LEX-IS system, OCOPOMO D2.1 Platform architecture and functional description of components, OCOPOMO D4.1 Integrated platform
	Use cases	Voice D2.2 Architecture and storyboard report
	Implementation architecture view	OCOPOMO D2.1 Platform architecture and functional description of components
	Requirements	Voice D2.1 End-users' requirements report, Voice D2.2 Architecture and storyboard report, Voices D2.1 Requirements report, LEX-IS Technical specification of the LEX-IS system, LEX-IS D1.1 User groups and requirements, LEX-IS D3.1 Pilot operation plan, LEX-IS D3.1 Pilot operation plan, OCOPOMO D1.1 Stakeholder identification and requirements for toolbox, scenario process, and policy modelling
	Scenario for the VoiceS serious game	Voices D4.1 Draft of scenario with issues and roles

Furthermore, it is important to analyse what architectural outputs are identified in the procedure models as they give important insights (Table 32). As the approaches focus on procedural aspects, the number of architectural outputs described is limited. However, they include relevant concepts for planning participation services and processes, which the EPArt-Framework should consider as e.g. the participation plan. None of them interestingly considers the design of data even if the approaches describe different kind of data (e.g. user data or participation data). Nevertheless, planners and architects need to consider data and information (as the architecture frameworks highlight) for the alignment of "participation goals; participation purposes; types of engagement; promises made to participants; engagement methods, technologies, and techniques; steps; and resources in the process" (Bryson et al., 2013, p. 31).

Table 33. Architectural artefacts described in procedure models categorised for viewpoints

EPArt-Viewpoints	Architecture Outputs
Participation Scope	– Participatory Assessment (ADB, 2012, p. 37)
Implementation & Governance	– Project management rules (Bryson et al., 2013, p. 28) – Project management structure (Bryson et al., 2013, p. 28) – Benefit-cost-ratio (Bryson et al., 2013, p. 28) – Evaluation measures (Bryson et al., 2013, p. 30)
Participant	– Stakeholder/issues Analysis Matrix (Acland, 2008, p. 30) – Stakeholder Analysis Template (ADB, 2012, p. 30) – Stakeholder Communications Strategy (ADB, 2012, p. 47) – Participant Database (Acland, 2008, p. 81)
Participation	– Engagement Planning Grid (Acland, 2008, p. 22) – Participation Plan (ADB, 2012, p. 41) – Process Model (Märker et al., 2009)
Data & Information	-/-
E-participation	– Objective/Participation Techniques/Tools Matrix (Phang & Kankanhalli, 2008)

After analysing viewpoints, the following study focuses on *metamodels*, which can be governed by the viewpoints. The DoDAF names the purposes of a metamodel as (1) to define vocabulary, (2) to specify data exchange semantics and formats, (3) to improve comprehensibility of EA data, and (4) to provide a basis for semantic precision. It proposes a conceptual data model, a logical data model and a physical exchange schema. The FEAF's metamodel is called the Consolidated Reference Model (OMB, 2013, p. 21). TOGAF describes the purpose of its metamodel is to provide a "formal structure for […] terms to

ensure consistency within the ADM and also to provide guidance for organisations that wish to implement their architecture within an architecture tool" (TOG, 2009, p. 367). TOGAF proposes a core content metamodel ("a basic model with the minimum feature set and then support the inclusion of optional extensions" (TOG, 2009, p. 368)) and extensions. ArchiMate (TOG, 2013) defines the entities used in the modelling language. Table 35 maps architecture framework metamodel entities with the entities identified in e-participation frameworks in the previous section.

Table 34. Mapping entities identified in e-participation conceptual models with entities in architecture framework metamodels

Dimension / Framework	Participation Scope	Participant	Participation	E-participation	Data & Information	Implementation & Governance
Initial Set of E-participation Entities (Section 4.2)	Outcome, Impact, Objective, Driver, Barrier, Guideline	Actor, Organisation Unit, Role	Policy-making Stage, Participation Level/Area/Activity, Technique, Decision-Making/Participation Process	Tool, Tool Category, Technology	Input, Output	Resource, Promotion, Funding,
TOGAF (TOG, 2011a)	Requirement	Actor, Organisation Unit, Role	Process, Business Service, Function, Event	Application/Technology Component, Platform Service, Service Interface	Data Entity	Location, Event
ARIS (Scheer, 2000)	Requirement	Organisational Unit, Position, Role	Process	Network, Component type	Output/Input	Location, Event, Qualification
DoDAF (DoD, 2011)	Guidance	Actor, Organisation, Person/Organisation Type	Activity	System, Service, Service Channel	Resource	Condition, Measure, Capability, Location, Event
FEAF (OMB, 2013)	Goals, Assists (Investments, Programmes), Purpose	Person	Functions, Services, Assets (Processes)	IT Assets, Application (System, Component, Interface), Infrastructure (Platform, Facility, Network), Interface	Data Assets (Domain, Subject, Topic),	Business Capabilities, Measurement Areas/Categories, Risk, Control
ArchiMate (TOG, 2013)	Requirement, Assessment	Business actor, Stakeholder, Business role	Product	Application Component, Interface, Application Function, System Software	Data Object	Location, Event

The entities from TOGAF, the DoDAF and the ArchiMate metamodels are the best match with the initial set of e-participation entities. All three metamodels are comprehensive and modifiable. Hence, *it is not necessary to develop a new metamodel from scratch*. However, there are *reasons for arguing that modifications are necessary*: The existing metamodels

do not include some entities needed for e-participation and vice versa. The e-participation metamodel should consider specific entities relevant to e-participation, such as particular stakeholder groups and roles to ease its application for e-participation experts. The focus on commerce and business could confuse e-participation stakeholder such that tailoring a framework could waste time needed for planning the participation services. The existing metamodels are rather complex and large. The complexity makes it difficult for non-experts to use them. Examples should ease the use.

Table 35. Mapping entities identified in e-participation conceptual models with entities in architecture framework metamodels

Note: The first column shows entities identified in conceptual models structuring e-participation. Entities in the other metamodels are categorised within the same rows.

Initial Set of Eparticipation Entities (Section 4.2)	TOGAF (TOG, 2011a)	ARIS (Scheer, 2000)	DoDAF (DoD, 2011)	FEAF (OMB, 2013)	ArchiMate (TOG, 2013)
Stakeholder/ actor	Actor, Organisation Unit	Organisational Unit, Position	Actor, Organisation	Person	Business actor, Stakeholder
Role	Role	Role,	Person Type, Organisation Type	-/-	Business role
Policymaking stage	-/-	-/-	-/-	-/-	-/-
Participation level/area	-/-	-/-	-/-	-/-	-/-
Participation activity	[Business service], [Function]	Function	Activity	Functions, Services	[Business process/function], Business interaction
Participation process	Process,	Process			
Tool. Tool category. Technology	Application component, Technology component, Platform Service	Network,	System, Service	IT Assets Application, Infrastructure	Application Component, Interface, Application Function, System Software
Channel	[Service Interface]	Component type	Service channel	Interface	-/-
Input	[Data Entity]	Output/Input	Resource,	Data Assets (Domain, Subject, Topic)	[Data object]
Output	Product, [Data Entity]	Output/Input	Resource,	Data Assets (Domain, Subject, Topic)	Product
Outcome	-/-	-/-	Desired effect, Condition, Measure	-/-	Value
Impact	-/-	-/-		-/-	
Objective	Goal	-/-	Vision	Goals	Goal
Driver	Driver	-/-	-/-	Assets	Driver
Barrier	Constraint	-/-	-/-	-/-	Constraint
Funding	[Constraint]	-/-	-/-	-/-	[Constraint]
Guideline	Principle	-/-	Guidance	-/-	Principle
Resource	-/-	-/-	Resource	-/-	
Promotion	-/-	-/-	Material	-/-	
-/-	Requirement	Requirement	-/-	-/-	Requirement. Assessment
-/-	Capability	Qualification	Capability	-/-	Capability
-/-	Location	Location	Location	-/-	Location
-/-	Event	Event	Event	-/-	Event

The metamodels underlying the LEX-IS project and the VoicE & VoiceS projects have different complexity. A first attempt of a LEX-IS metamodel exists from project documentation (Gatautis et al., 2007, p. 15). However, it is kept rather simple (see Figure 23).

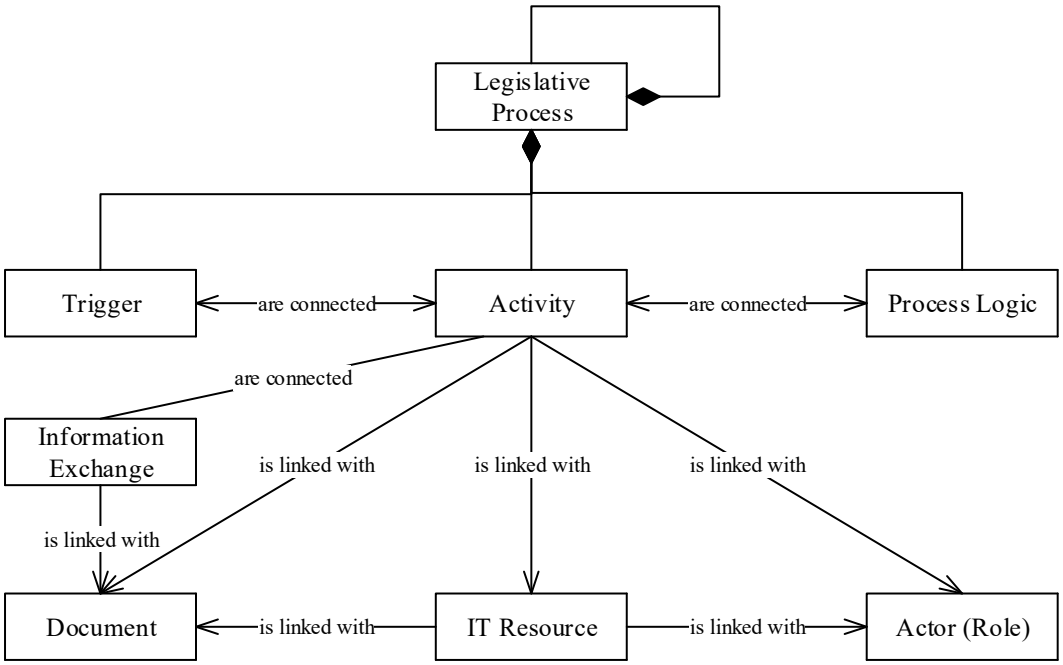
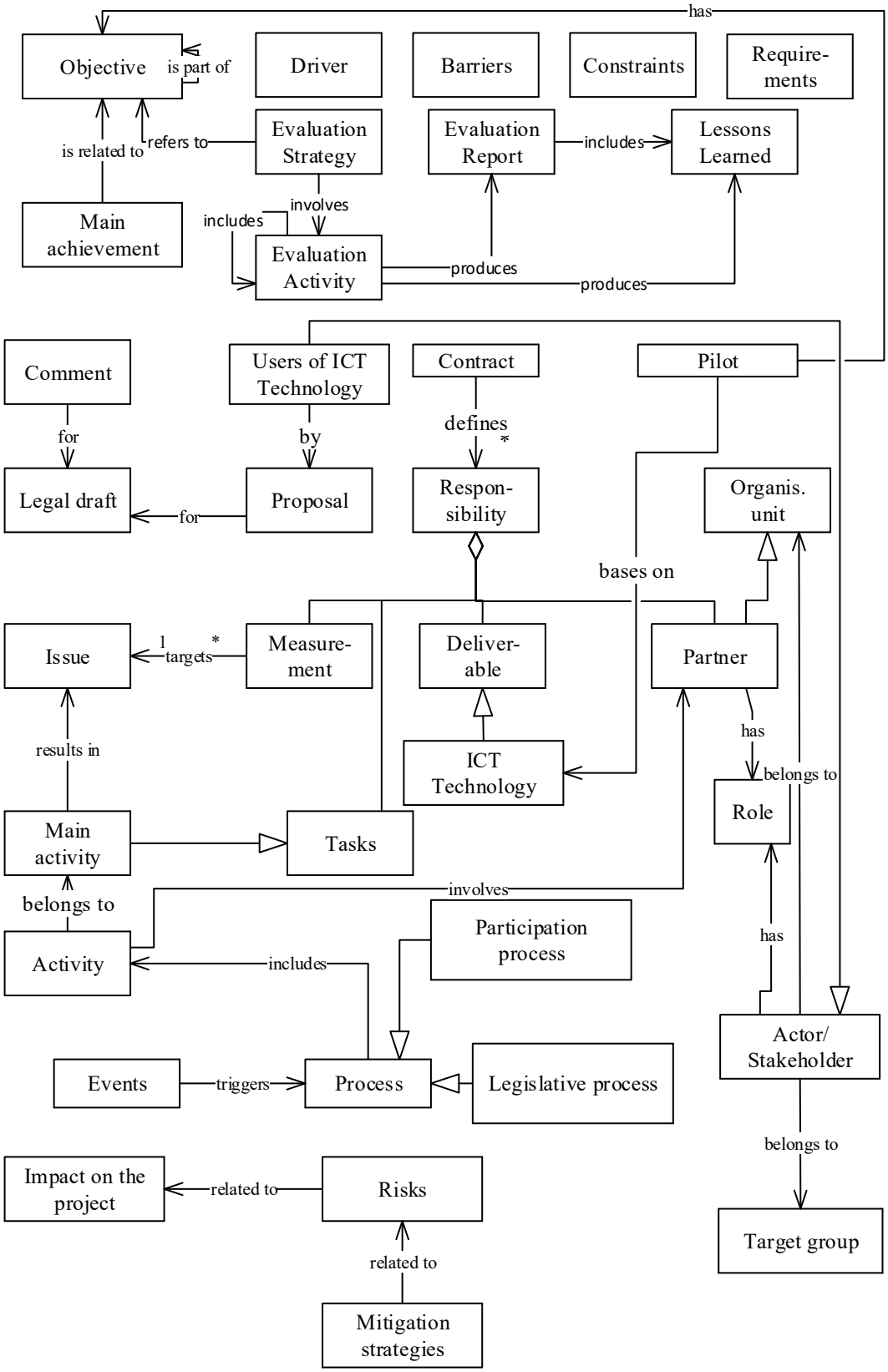


Figure 23. Attempt to define a metamodel for LEX-IS (derived from Gatautis et al., 2007, p. 15)

In VoicE, VoiceS, and OCOPOMO such work is not available. An attempt to design a metamodel for Voice and VoiceS[68] results in Figure 24. It shows that e-participation design and implementation involves more entities as identified in the conceptual models studied in Section 4.2. The approach to develop a customised metamodel is to (a) select common entities in existing metamodels, (b) adapt them to the needs and specifications of e-participation and (c) limit the number of elements and relationships to a minimum of entities needed to define an e-participation architecture.

After studying commonalities and variations between architecture frameworks focussing on the metamodel and viewpoints levels, the study now moves on to architecture framework methods and approaches guiding designing and implementing of e-participation.

[68] Both projects have a similar structure.



Legend: UML class diagram.

Figure 24. Attempt to define a metamodel for the projects VoicE and VoiceS

5.5 Method

This section identifies commonalities and variations between architecture development methods and approaches guiding the design and implementation of e-participation (Subsection 5.5.1). Afterwards, it documents the experiences from the projects LEX-IS (Subsection 5.5.2) and VoicE & VoiceS (Subsection 5.5.3).

5.5.1 Architecture Development Methods

Architecture frameworks provide guidance to structure the development process of an architecture and its architecture description. These architecture development methods consist of phases; each detailing a number of activities. Table 36 compares the phases described in the architecture frameworks with the phases identified in procedure models for e-participation (cf. Section 4.3)[69]. Exemplary for this comparison, the following list analyses the ADM concerning its applicability to e-participation (based on TOG, 2011a):

- *Preliminary Phase*: Define the high-level objectives of the participation services, e.g. impact on democracy, and break them down into specific objectives.
- *Phase A*: Develop a participation vision that enables its objectives, responds to the political and strategic drivers, is conform to the good governance principles, and addresses stakeholders' concerns and objectives.
- *Phases B-D*: Develop the participation architecture, the data architecture, and the e-participation Architecture. Depending on the baseline architecture, which may vary between no previous participation, only offline participation, or a predecessor e-participation, the difference between the baseline and the target architecture is either big or small.
- *Phase F*: Replace an existing e-participation solution or integrate the e-participation tools into an existing ICT landscape.
- *Phase G*: Ensure smooth running of the e-participation tools including all accompanying and maintaining activities such as moderation.
- *Phase H*: Evaluate the outputs in relation to objectives by applying an appropriate evaluation framework such as Macintosh and Whyte (2008).

[69] The Zachman Framework is left out from this comparative analysis because it does not provide any methodical guidance.

Table 36. Comparison of phases in architecture development processes proposed in architecture frameworks.

Note: Each column identifies one architecture framework. Each row identifies comparable phases.

E-participation phases (Section 4.3)	TOGAF (TOG, 2011a)	ARIS (Scheer, 1997)	DoDAF (DoD, 2011)	FEAF (OMB, 2007)	GERA life-cycle phases (IFIP-IFAC, 1999)
I. Initiation	Preliminary	-	-	Identify and Validate	Identification
				Research and Leverage	Concept
				Formalise collaborative planning team and launch planning	Requirements
	Architecture Vision	Design Specification	Determine Intended Use of the Architecture	Define funding strategy and make decision	Preliminary Design
II. Design				Refine the vision or performance and outcomes	
	Business Architecture		Determine Scope of the Architecture	Analyse the current state, determine adjustments, and plan the current state	
	Information Systems Architecture		Determine Data Required. Collect, Organise, and Store Architecture Data	Formulate the integrated plan and roadmap	Detailed Design
	Technology Architecture			Initiate execution governance	
				Obtain resources and validate plan	
III. Implementation and Preparation	Opportunities and Solutions	-	Conduct Analyses in Support of Architecture Objectives	Execute the plan	Implementation
	Migration Planning	-	-		
IV. Participation	Implementation Governance	Implementation Description	-	Perform with the new capabilities	Operation
V. Evaluation	Architecture Change Management	Runtime: Operation and Maintenance	Document Results in accordance with decision maker needs	Measure performance against metrics	Decommission
				Analyse and provide feedback	
Requirements Management	Requirements Management	Requirements Definition	-	-	Requirements

TOGAF ADM is the most comprehensive approach in regards to architectural work. This is according to TOGAF's understanding of how essential is architecture design for an en-

terprise. TOGAF sees the ADM as a generic procedure method for architecture development. Nevertheless, the method needs to be modified or extended to suit specific needs in a complex systems environment (TOG, 2009, p. 213):

> "While a complete framework is useful (indeed, essential) to have in mind as the ultimate long term goal, in practice there is a key decision to be made as to the scope of a specific enterprise architecture effort." (TOG, 2011a, p. 56)

The direct comparison between the phases of e-participation design and implementation with the ADM shows the complexity of TOGAF. The number of artefacts, which are produced during the ADM, is very large and it should be beard in mind that with each iteration, the number even increases (TOG, 2011a, p. 56). Nevertheless, the high complexity seems to appear for architecture frameworks in general (Buckl, 2011). The methods put a strong emphasis on the development of an architecture, while the implementation phase is not considered adequately in the most frameworks. However, FEAF provides a useful overview of steps and activities in governmental collaborative planning processes, partly tailorable for e-participation design and implementation as shown in Table 36. Overall, the methods should be adapted for e-participation design and implementation to ease their application. The enterprise architecture effort should be minimised. That is why the following two subsections summarise the experiences from LEX-IS and VoicE. At this time, no framework for e-participation existed. So it is analysed how the design and implementation was done during these projects and the drawbacks are identified.

5.5.2 LEX-IS

The following discussion focuses on the Austrian pilot, the only one in which we were involved.

Phase I. Initiation. The *Phase I. Initiation* corresponded with the proposal preparation phase, which resulted in a submission of the project proposal to the EC call of the eParticipation Preparation Action. The LEX-IS project aimed at engaging the youth in the policy formulation stage. The Austrian pilot aimed to facilitate and enable participation of the youth in the public debate on legislation in Austria. It was conceptualised and implemented by the research group E-Government in collaboration with a member of the *Austrian Parliamentary Administration*.

Phase II. Design. The *Phase II. Design* aimed to identify stakeholders, analyse the relevant legislative processes, investigate specific user, process and system requirements, design the LEX-IS Platform (the e-participation tool used to engage the participants) and conceptualise the participation processes. We selected pupils as the target group. Close cooperation with the Austrian parliament's staff allowed us insights into the parliamentary lifecycle and its limited possibilities for citizens' involvement.

The project team created a questionnaire to obtain an overview of the current status and specific needs of support in parliaments in terms of stakeholders, documents, dissemination of documents, processes, and technology (Diedrich, Scherer, Wimmer, Gionis, & Schefbeck, 2006). We based the design of the participation processes on the questionnaire results. The design procedure started with modelling the legislative processes in the partner countries, called the public process view. The team described each process activity in detail by identifying the relevant documents and ICT involved, and developing the workflow models. This procedure aimed to identify possible points of participation. There were two

challenges in designing the participation: (1) young citizens and citizen groups were not particularly involved in the Austrian legislative process and (2) citizens of any age were involved through political parties. Therefore, we had to identify a point in the policy formulation stage where the participation of stakeholders could have an influence. In 1999, the Austrian parliament decided that ministerial draft bills should be published, including the corresponding stakeholders' opinions, within the pre-parliamentary consultation procedure online (for more details see Scherer et al., 2009). We decided that the Austrian pilot should focus on this pre-parliamentary consultation procedure and designed the participation process accordingly (Scherer et al., 2009): After the publication of a ministerial draft bill, we should prepare information, the platform and invite the stakeholders. Stakeholders should be able to deliberate on the draft bill for three weeks, moderated by us and/or teachers. Afterwards, the moderators should prepare a statement summarising the opinions of the stakeholders. The participants should deliberate on this statement again for one week. Afterwards, the moderators should summarise the results in a final statement and submit it to the Austrian parliament's portal.

The design of the LEX-IS Platform was based on the user, process and system requirements derived from the questionnaire answers. Eventually it was a challenge that the team did not adapt some requirements to the final, agreed upon participation processes. In broad terms, the resulting LEX-IS Platform was a website with a specific type of forum, which enabled users to structure their deliberations according to alternatives for issues, providing pro and contra arguments, i.e. an argumentation support system (Loukis et al., 2007). The *Pilot Operation Plan* documented the participation processes, supporting documents, engaged stakeholders, general processes such as platform setup, user registration, and user invitation, as well as the evaluation strategy.

Phase III. Preparation. While preparing the Austrian pilot, we, i.e. the team from the University of Koblenz-Landau and the member of the Austrian parliament, studied ministerial draft bills to find one that could be especially interesting for young people. Eventually, we selected a draft bill that directly affected and/or extended young citizens' knowledge of their own rights: the "Child and Youth Welfare Act"[70]. Furthermore, we identified contact persons in schools, prepared a formal letter with information targeted to arouse the interest of teachers, and sent it to the contacts. When a number of schools expressed their interest, we planned our route so that there would be a kick-off event with each participating school.

The preparation of comprehensive and easily understandable information material suitable for young pupils (e.g. about the legislative process and the particular draft bill in Austria) was another important aspect. The students needed to catch up on concepts such as democracy, and the legislative process in Austria, as well as on e-participation. Some teachers used this material to prepare the students before the kick-off of the participation activities. In retrospect, it was easier for these particular young citizens to participate in the discussions.

The software engineering team implemented the LEX-IS Platform (one separate instance for each pilot). We analysed the draft bill in order to identify legislative issues of interest to the target group and to create an initial forum structure for the LEX-IS Platform. The ministerial draft bill was not a draft amendment of an existing law. It was supposed to

[70] Bundes-Kinder- und Jugendhilfegesetz 2009, online available at https://www.parlament.gv.at/PAKT/VHG/XXIII/ME/ME_00231/index.shtml (last accessed 2016-03-24)

replace the existing law so that, unlike draft amendments, no text comparison was part of the draft bill. The draft bill consisted of 45 sections divided into two parts (i.e. a rather complex structure from young people's point of view). Finally, we created seven discussion threads taking different sections of the draft bill into account. One thread contained the compilation of the final statements of the seven successful threads, aiming to create one unique statement. The threads contained a description and some supporting documents as well as the specific paragraph. At first, we initiated seven threads; in later stages, we added two threads after users' remarks (see Phase IV. Participation).

Phase IV. Participation. The pilot finally reached eight participating classes from different types of schools (vocational and general secondary schools) and different geographic regions. Altogether, they formed a good sample of Austrian students of the age intended. A team of two project team members started the pilot in the schools (the kick-off) with a short presentation to introduce the idea and give background information. After that, an initial, moderated discussion took place in the classes. We asked the students to build groups, discuss the legislative issues in these groups, and then to post their reflections in the forum. It was necessary to motivate their participation and to take away their fear of poor diction and "stupid" posts. Beyond this, we tried to motivate teachers or students to take over the role of *moderation* for individual threads in order to integrate them more effectively in the discussions. In the end, the pilot had four moderators: my colleague from the University Koblenz-Landau, one teacher, one pupil, and me.

Discussing the draft bill took about three weeks. Pupils and teacher discussed during the school lessons and from home. Online moderation was necessary in this stage, with manageable effort, to prevent misuse or fake postings. We added two additional discussion threads upon participants' remarks; however, the pupils barely contributed to both new threads, i.e. in the end, the discussion went on in the threads opened at the beginning. Obviously, the initial threads influenced the final discussions. This shows the importance of the initial content setup depending on the target group. After the first discussion period, we asked the moderators to summarise the discussions in their threads and draft one official statement per thread. The participants discussed these statements again in a separate thread for a period of one week. Although only few pupils participated in this stage, these suggestions and complaints were very relevant. The moderators incorporated them into updates of their statements, which the pupils validated again.

At the end of this deliberation phase, the project team consisting of my colleague, the member of the Austrian parliamentary administration and me formulated the final statement. We decided to have one statement in the name of all participating schools in order to have a "louder voice". The overall pilot phase ended with the upload of the statement to the Austrian parliament's website[71].

Phase V. Evaluation. We evaluated the Austrian Pilot by using an evaluation method based on the framework described by Loukis and Xenakis (2008). The framework takes into account four perspectives: process, system, context and outcomes. We based the overall evaluation method on several aspects:

[71] http://www.parlament.gv.at/PAKT/VHG/XXIII/ME/ME_00231_63/imfname_146442.pdf (in German, last accessed 2015-12-07)

- online end user surveys for students and moderators investigating if the user is reached or not, and if he or she is reached, to identify if the platform could attract his or her interest regularly
- website and user statistics starting with the pilot
- interviews with students and moderators and the discussions during the initial workshops
- analysis of the quantity and quality of the users' contributions.

To sum up, key figures of the Austrian pilot (with a duration of about one month) were:

- approx. 120 registered and active young citizens (pupils), aged 14 to 19
- eight teachers, one student and two participants from LEX-IS who acted as moderators
- 253 posts (of which about 230 stem from the students)
- ten discussion threads (eight of which contain postings)
- one official final statement delivered to the Austrian parliament's portal
- about 12000 visits.

By combining all these aspects, we analysed the following aspects of the Austrian pilot: (1) use of the argumentation support system, (2) participation, and (3) the impact on policy making. The evaluation showed rather critical results. For example, the forum structure was criticised as inflexible and the high number of comments in the forum made it difficult to sum up the threads in the final statement. These challenges could be a result of the negligence of relationships between different architecture viewpoints and the absence of a comprehensive methodical approach.

The following subsection summarises the experience gained during the implementation and design of e-participation in the VoicE project and the VoiceS project.

5.5.3 VoicE & VoiceS

Phase I. Initiation. The initiation phase corresponded to the proposal preparation phase, which resulted in a submission of the project proposal to the EC call of the eParticipation Preparation Action. VoicE aimed at enabling citizens to have a voice in EU legislation. In terms of content, it focused on the consumer protection policies. This fulfilled the recommendation to choose an interesting and important topic, because consumer protection issues have a direct effect on each citizen. Furthermore, we based VoicE on the principles of a regional focus, i.e. making or keeping information as simple as possible, ensuring credibility, fostering personal opinions and making sure that the citizens' participation has a value.

Phase II. Design. The design phase in the VoicE project was similar to the one in the LEX-IS project. One difference was the focus on usability. The design of the electronic participation means (i.e. the VoicE Platform) involved the real users in order to analyse requirements and design user-friendly services. We identified easy communication as essential for e-participation. The VoicE platform was based on widely established tools and user paradigms to make participation easier for users. In this regard, the VoicE usability engineering lifecycle (see Scherer, Karamagioli et al., 2009) proved to be able to improve the system by iterative design of the systems' features, the interaction design and the user interface. The VoicE platform used a web content management system. In the beginning of

the VoicE project, the team selected some general participation features. In fact, they agreed on the list of platform features before they concretised how discussions and activities on the VoicE Platform could have an impact in EU politics. Later in the project lifecycle, i.e. after pilot tests, the team decided to remove a number of platform features. The most important remaining tools were the forum, the opinion polls, and the tools for visualising the European policy-making processes. Two important experiences were that the design should start with planning the participation processes without considering technical features and few but effective features simplified the user interface.

Eventually, similar challenges emerged in the LEX-IS project and the VoicE project: the software engineering team designed and implemented the VoicE Platform before the participation processes were finally agreed upon. Because of this experience, we changed the approach in the successor project VoiceS. One challenge in the VoicE and VoiceS projects was that the participation possibilities in the European Parliament were limited and not transparent, at least not at the time. Therefore, we planned that the VoicE project should operate as a mediator between citizens and MEPs. The project team decided to forward the opinions of citizens expressed in the forum directly to the politicians (and not to wait until they read the posts in the forum). In the beginning of the VoiceS project, we conducted a detailed analysis of the policy-making processes (legislation processes in the EU) and participation possibilities. We modelled the legislative processes, decided on participation techniques, and modelled the participation processes (Scherer, Wimmer, & Ventzke, 2009b). Modelling notation was BPMN. The resulting models were useful for discussing and deciding on the participation processes. The team identified two participation possibilities from the analysis of the policy-making processes (petitioning and Letter2Brussels[72]), from which one (the Letter2Brussels) was selected (details are available in Scherer et al., 2009b). Accordingly, the project team planned the participation processes and adapted the features of the VoicE platform.

Phase III. Preparation. On the one hand, the project team prepared background information on the policies under consideration, i.e. the selection of current European legislative proposals in the area of consumer protection and the review of content for use in the project. The proposals should be easily accessible for consumers with little or no knowledge of European politics and be a low-threshold starting point for participation. Furthermore, the legislative proposals should have a direct impact on citizens' everyday life. The careful preparation of information helped the launch of the platform to be on time and to be able to update the contents for new developments. We experienced that it was necessary to follow a well-structured process for information preparation in this phase. We therefore focussed on the questions: What do you want to prepare? Why and how do you want to prepare it? Another recommendation was to prepare questions for discussion in advance in order to stimulate discussions. This does not mean that we posted all questions at the

[72] The project team started a Letter2Brussels initiative each time the EC published a new proposal related to the policy under consideration. First, we prepared information on the proposal (e.g., What will change?). Afterwards, we published the information on the VoicE Platform and opened a discussion thread. In a predefined period, the citizens and MEPs could discuss the topics of the proposal in the forum. We summarised the discussions in an official statement, which we published in the news section and the forum. To make sure that all participants agreed with the statement, they could give their opinion again for one or two weeks. Eventually, we finalised the Letter2Brussels, published it on the VoicE Platform, and sent it to the MEPs, requesting a response.

outset, but at regular timeframes, e.g. one new question each week. This preparation allowed the editorial team to quickly respond, e.g. in case little discussion took place in the forum.

Besides the preparation of background information, it turned out to be of particular importance to prepare information about the participation process and the expectations of the participants. Such information should answer the following questions: How does the participation process proceed (period, activities)? What can participants contribute to the process? What are the expectations and the goals of the participation process? How will the offer achieve these expectations and goals?

Phase IV. Participation. Extensive marketing was an ongoing and important task in coordination with updating the platform and constantly publishing news. The project team started the marketing activities before launching the VoicE Platform. After its launch, the project team followed a marketing strategy integrating activities such as:

- posing simple questions in the form of polls (Question of the Month) to stimulate initial participation
- posting recent news about the topic and giving the possibility to comment on them.
- offering video interviews with important stakeholders
- advertising the platform in on- and offline networks.

Moderation activities are activities necessary to keep the platform alive, to monitor the forum, to support the users, to publish news, etc. The effort for doing so should not be underestimated. It was an ongoing task throughout the whole project lifecycle.

To make participation easier for citizens, VoicE minimized the barriers in the registration procedure. First, we simplified the registration by reducing requested data (only an anonymous user name, email, and password were necessary to register). In a subsequent step, we deactivated the whole registration procedure for the VoicE forum to see if this increases the number of discussions. Since VoicE allowed unregistered people to write in the forum, the number of posts increased. Therefore, our experience was that a registration feature has to be well thought through and reasons for the registration data should be made transparent to the participants. Privacy of the users and minimization of access barriers for participation is important in e-participation.

Evaluation. We based the evaluation of the VoicE Platform on the framework by Macintosh and Whyte (2008). We evaluated the project at different stages of its lifecycle: in the design and planning phase, in the implementation phase, during the participation phase, and after participation with a focus on the results. At the same time, we involved different stakeholders and used different methods:

- requirements were based on surveys with citizens and politicians in an early project phase
- field observations were collected with different platform versions
- website statistics were traced since the launch of the platform
- analysis of the political decision-making processes were performed
- an online end user evaluation questionnaire was distributed among citizens
- analysis of the quantity and quality of users' contributions.

Each perspective evaluation framework by Macintosh and Whyte (2008) was evaluated and lessons learned were derived. The evaluation of numbers of visits and unique visitors showed that, because of extensive dissemination activities, the VoicE platform was widely recognised. However, the website statistics also illustrated that the majority of users only visited the platforms for a short time. The analysis showed that regionalised information and up-to-date news provide a proper means to inform and attract citizens. Most platform visitors appreciated the information that we provided. Even though the wider target group was not very interested in active participation, some visitors discussed EU legislation and the impact on the VoicE platform. The interest of decision makers was lacking and as a result, the inputs of participants have received little attention in policy making. The focus should have been on the official participation possibilities determined by law, such as petitioning to have a better connection to the policy-making processes.

In the following, the findings from this chapter, which explored commonalities and variations around architecture frameworks and e-participation design and implementation, are discussed.

5.6 Discussion of Findings

Section 5.3 identified the challenges driving this research from the standpoint of the practical design and implementation of e-participation. The following investigation in Section 5.4 and Section 5.5 leads to the assumption that architecture frameworks are supportive for the comprehensive design of e-participation services and to align the different factors, which constitute an EE. The analysis furthermore supports the hypothesis that architecture frameworks can guide the development of an EEA description. For example, an EE could use the Zachman Framework's perspectives to address relevant aspects in *Phase I Initiation* and *Phase II Design*. The planner's perspective is appropriate to analyse the constraints and objectives of e-participation. It should start with the formulation of the motivation (*why*) based on the vision of the e-participation. The other viewpoints, i.e. *time (when)*, *network (where)*, *people (who)*, *function (how)* and *data (what)* are influenced by the motivation. Starting e-participation as described in the Zachman Framework with lists describing the relevant entities seems to be an intuitive task.

In general, it is necessary for an enterprise to make a key decision to the scope of its architecture effort (TOG, 2011a, p. 56). This research aims to support EEs in this matter. Caused by their generality, EA frameworks do not consider activities and entities specific to e-participation. Hence, their application needs customisation to minimise the learning curve of e-participation experts. Lindström, Johnson, Johansson, Ekstedt, and Simonsson (2006, p. 90) use similar arguments to state that the focus of an EA framework should be aligned with the concerns of the stakeholders who intent to use it. Starting from the study of architecture frameworks, the analysis identified a set of viewpoints to frame the concerns of e-participation stakeholders and relevant architecture models. Overall, the supported methods should be adapted for e-participation design and implementation to ease their application. The enterprise architecture effort should be minimised to a healthy level. Best

practices in the form of reference architecture models can be a solution to support e-participation. Until now, no comprehensive library of this kind exist for e-participation. From these considerations, the following requirements are derived:

Requirement 17. E-participation orientation: The EPART-Framework must be tailored to e-participation, i.e. use the terminology of the discipline and address the specific goals, stakeholders, concerns, and processes.

Requirement 18. Detailed method descriptions: The EPART-Framework must provide detailed descriptions of activities specific to e-participation.

Requirement 19. Reference models: Reference models for e-participation must be developed and integrated into the EPART-Framework.

The benefit of developing the EPART-Framework is seen in providing an environment, which helps to optimise e-participation to its objectives and integrate the objectives in the organisational setting (on different levels). Even though EAs focus on technical aspects, they scope organisational issues as well (Janssen, 2012, p. 26), and are therefore useful in e-participation context.

Nevertheless, use of the EPART-Framework is no guarantee for successful e-participation. Rather, it can serve as a means to support the sustainable and comprehensive design and implementation of e-participation.

After having explored commonalities and variations around enterprise architecture frameworks and e-participation design and implementation, the next part moves on introducing the EPART-Framework.

Part III. DESIGN OF THE E-PARTICIPATION ARCHITECTURE FRAMEWORK

6. The E-Participation Architecture Framework

The target group of the EPART-Framework is the body of stakeholders responsible for providing participation services to the public and organised within an EE. The framework aims to assist this target group in the design and implementation of these services so that they enable the success of the EE with optimised processes and ICT, and a lower total cost of ownership. Therefore, the framework

- provides a common language for organisations involved in the delivery of participation services,
- provides a basis for the design, development and review of ICT investments, and
- enables more cost-effective and improved delivery of participation services through a repository of reference models, such as principles, catalogues, and process models.

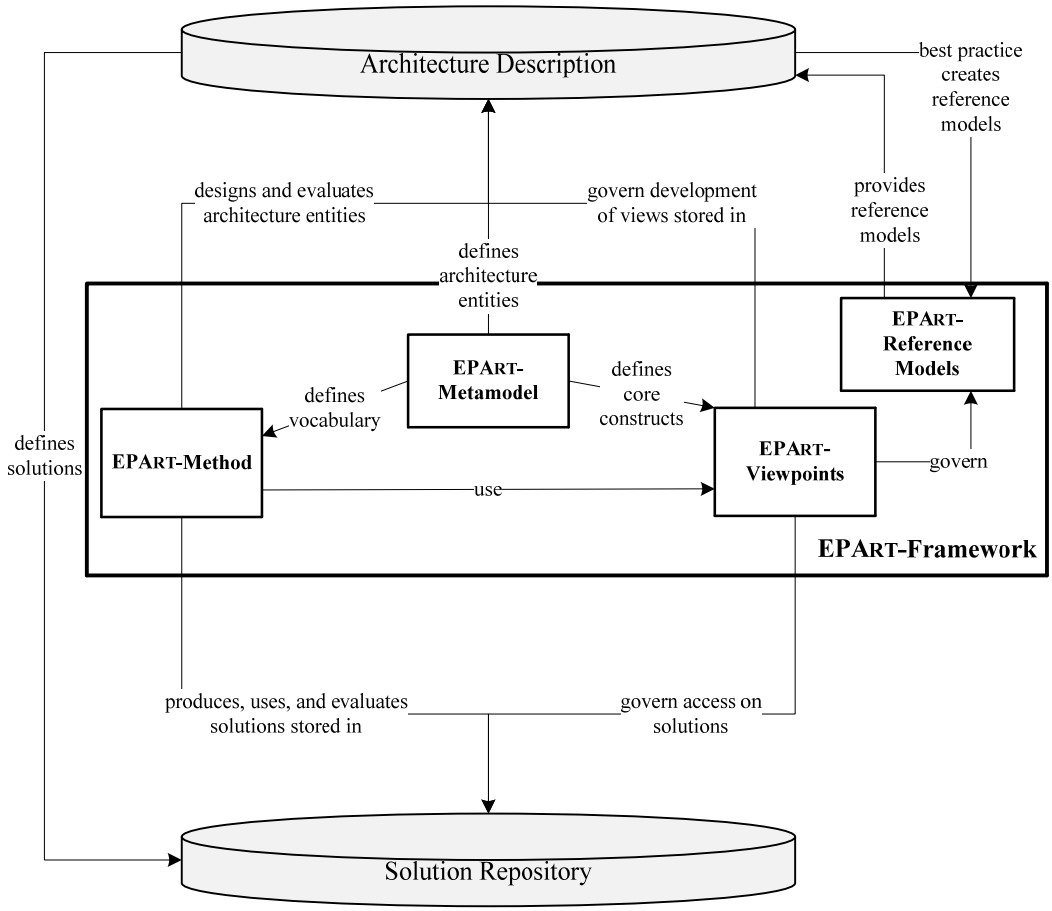
The strategic, top-down perspective on the EE enables stakeholders such as operational management, initiators, owners, executives and decision makers to plan, organise, and combine their activities in a comprehensive way. The EPART-Framework aims to enable these stakeholders to consider the interoperability of (participation and other) services within the EE, between other EEs as well as the further environment (i.e. the political and social context).

The remainder of this chapter starts with an overview of the EPART-Framework in Section 6.1; it introduces the components of the framework, i.e. the EPART-Viewpoints, the EPART-Metamodel, the EPART-Method, and the EPART-Reference Models, and their interrelationships. The relevant stakeholders are introduced in Section 6.2. EPART-Viewpoints grouping the concerns of these stakeholders and the underlying EPART -Metamodel are introduced in Section 6.3. A set of reference models facilitating the application of the EPART-Framework is presented for each viewpoint in Section 6.4. Finally, the EPART-Framework is exemplified in Section 6.5 with an instantiation.

6.1 Overview

The major contribution of this dissertation is the EPART-Framework. Its structure is visualised in Figure 25. The *participation vision* constitutes the EE. It feeds into the *EPART-Method* and identifies the problems to be addressed by the EE. The method refines the understanding of the participation vision. It defines the activities that *guide the EE design operation with a focus on the planning, implementation and evaluation of participation services* according to the vision. Because of these activities, the method produces views on the architecture of the EE (i.e. the EEA). The *Architecture Description* stores these views, each consisting of a set of interrelated *architecture models*. An architecture model is an artefact/architectural work that describes an aspect of the EE in the form of catalogues, matrices, and diagrams (TOG, 2011a, p. 11). The *EPART-Viewpoints* govern the development of views on an EEA by depicting the concerns of the stakeholders. These viewpoints also govern the access to solutions in the Solution Repository. The *EPART-Metamodel* describes a vocabulary and glossary tailored to the architecture of the EE. The EPART-Viewpoints are based on this metamodel, which defines the architecture entities of an EE

and their relationships. The *EPART-Reference Models* provide reference models usable in future undertakings and supportive for applying the EPART-Method. The EPART-Method furthermore guides the implementation of participation services and, thus, produces *solutions* to be stored in the **Solution Repository**. *Solutions* are the products and components that the method produces, e.g. a data entity or application component, which are potentially reusable and combinable. Accordingly, they are defined in the Architecture Description.



Legend: Boxes show the components. Arrows indicate their relationships.

Figure 25. EPART-Framework Structure (based on TOG, 2011a, p. 4).

The next section identifies the stakeholders.

6.2 Stakeholders

Architecture stakeholders have interests in, or concerns relative to, the outcome of the EE (TOG, 2011a, p. 31). They may be individuals (e.g., "Mr. John Doe, the mayor of our city"), groups (e.g., "young people in our region"), governmental organisations (e.g., "the German parliament"), NGOs (e.g., "Greenpeace"), private companies (e.g., consultancy companies), universities (e.g., involved into evaluation), or classes thereof. On the one side, there are the individuals/organisations that the policy under consideration affects directly or indirectly: stakeholders external from the EE. On the other side, there are the members of the EE from different organisations responsible for carrying out the participation services: internal stakeholders. All of them can carry different roles, and thus can have different related

concerns in e-participation (cf. Table 31, p. 111). The following list defines the stakeholders in e-participation (cf. Table 37 for definitions of the concrete stakeholders):

- The *supporters* approve and encourage the e-participation activities; they take an active interest in the success of the EE. *Administrators* are responsible for implementing decisions and executing policies. *Decision makers* are responsible for incorporating the participation result into the policy (Kalampokis et al., 2008, p. 27). *Initiators* of the e-participation services are usually governmental officials or elected representatives. However, it is also possible for a group of citizens to initiate e-participation services. Furthermore, this group encompasses the internal stakeholders.
- The *participants* are engaged in the participation processes actively or passively. They can be citizens, politicians, decision makers, etc. divided into two groups: *Input providers* are those participants who actively provide participation input in any form; *lurkers* are those participants who are affected by the e-participation and should be informed but not actively engaged. However, they may take an active role in the future.
- The *operating team* is responsible for the operational management of the EE. The *owners* are responsible for the overall e-participation. The *project managers* are responsible for operating, controlling, and governing the EE. The *consultants* support responsible organisations in the implementation of e-participation. *Evaluators* are responsible for evaluating the e-participation against its objectives.
- The *stakeholder engagement team* is responsible for stakeholder analysis and determining the appropriate participation techniques and marketing strategy. The *marketing* is responsible for promoting the project. Public servants and officials, but also private companies can play this role. The *participation analysts* contribute with their knowledge of participation services and techniques, while the experts add their knowledge of the domain and the stakeholders.
- The *participation management team* knows the decision-making processes and designs the participation services. *Participation analysts* are responsible for analysing policy-making processes as well as analysing, planning, and integrating participation processes based on the objectives. *Experts* in the particular policy under consideration or the relevant decision-making process support the project with their knowledge and experience.
- The *facilitator team* enables the participation. *Moderators* are responsible for moderating the discourse. It makes sense to give this role to parties that are not involved in the policy-making process in order to ensure a neutral moderation. *Facilitators* are responsible for maintaining the flow of the proceedings and keeping everyone on time and on track. *Support Staff* is responsible for helping people to use the e-participation tool and to participate.
- The *e-participation engineering team* is responsible for designing and implementing the e-participation tools. Public servants and officials but also private companies can play this role. *E-participation architects* are responsible for designing the e-participation tool architecture, i.e. the models of the E-Participation Viewpoint. *ICT administrators* are responsible for properly running of the e-participation tool. They are also responsible for the deployment environment. *ICT developers* are responsible for programming the e-participation tools. *ICT suppliers* provide

ICT solutions for the e-participation services. Typically, they are also responsible for administrating these ICT solutions.

Public servants, officials, and private companies can play the roles responsible for management, operation, design and architecture. Having discussed the stakeholders of the EPART-Framework, the next section describes the EPART-Viewpoints that group their concerns.

Table 37. Overview of stakeholders

Role	Description
Administrator	Actors who are responsible to implement the decisions and execute policies.
Advisory Board Member	Actor who is member of an advisory board giving advice to the project.
Consultant	Actors who consult and support responsible organisations in the implementation of e-participation.
Decision Maker	Actors who are "responsible for incorporating the results of the participation process into policy" (Kalampokis et al., 2008, p. 27).
Evaluator	Actors who are responsible for the evaluation of the project.
Policy Expert	Actors who are experts in the particular policy and support the project with their knowledge. Public servants and officials, but also private companies can play this role.
Facilitator	Actors who are responsible for maintaining the flow of the proceedings and keeping everyone on time and on track. Public servants and officials, but also private companies can play this role.
Initiator	Actors who initiate the participation process. Usually initiators of such a project are governmental officials or elected representatives. It is also possible for a group of citizens to initiate a project using existing processes and tools.
Input Provider	Actors who provide input in the participation process by either traditional channels or ICT tools. Input providers can be citizens, citizen groups, politicians, decision makers, etc.
E-Participation Architects	Actors who are responsible for designing the e-participation tools that support the participation services.
ICT Administrator	Actors who are responsible for properly running the IKT system. They resolve and fix the system. They are also responsible for the deployment environment.
ICT Developer	Actors who are responsible for the design and development of the IKT system.
ICT Supplier	Actors who provide the electronic tools and platforms for the e-participation. Typically, these stakeholders are also responsible for administrating the e-participation system. Public servants and officials, but also private companies can play this role.
Lurker	Actors who passively participate as opposed to input providers who actively participate.
Moderator	Actors who are responsible for moderating the discourse. Public servants and officials, but also private companies can play this role. It makes sense to give this role to parties that are not involved in the policy-making process to ensure a neutral moderation.
Marketing; Promotion	Actors who are responsible for promoting the project. Public servants and officials, but also private companies can play this role.
Owner	Actors who are responsible for the participation project. Sometimes the same stakeholder has the role *owner* and *initiator*.
Participant	Actors who actively or passively participate in the participation process (cf. roles lurker and input provider).
Participation Analyst	Actors who are responsible for analysing policy-making processes as well as analysing, planning, and integrating participation processes based on the objectives.
Manager	Actors who are responsible for operating the EE.
Requirements Manager	Actors who are responsible for elicitation and management of requirements.
Support Staff	Actors who are responsible for helping people to use the system.

6.3 Viewpoints and Metamodel

The EPART-Framework recommends a collection of viewpoints to structure the Architecture Description and the Solution Repository according to architecture stakeholder concerns. The six viewpoints and the related main concerns are:

- *Participation Scope Viewpoint:* Why do we want e-participation?
- *Implementation & Governance Viewpoint:* How do we get it done?
- *Participant Viewpoint*: Who will be involved?
- *Participation Viewpoint*: How should the e-participation work?
- *Data & Information Viewpoint*: What should the e-participation give us?
- *E-Participation Viewpoint*: With what is the e-participation built?

The collection of viewpoints is designated for adaption, i.e. it is possible to add, remove or customise them, if necessary. Figure 26 shows an overview of the viewpoints with their main entities defined in the EPART-Metamodel.

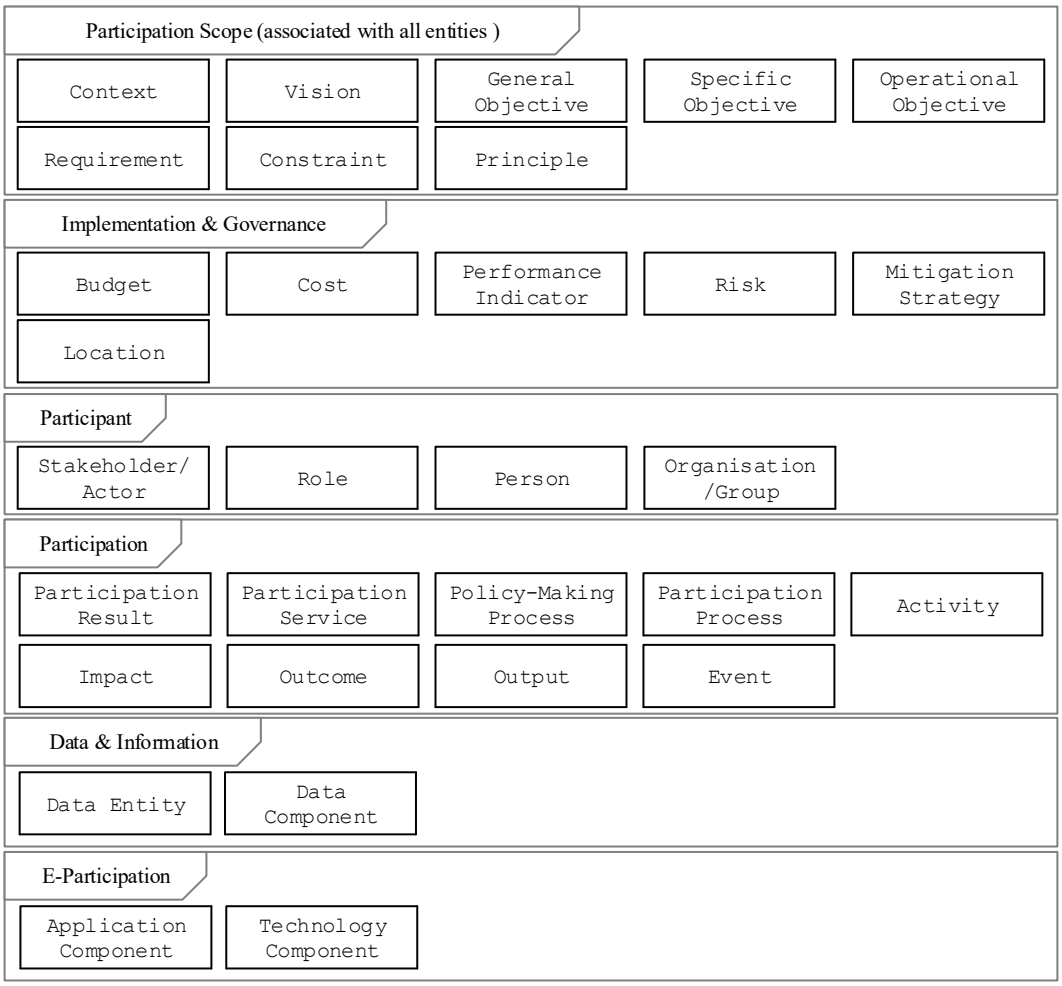


Figure 26. Overview of EPART-Viewpoints and their main entities

The Participation Scope Viewpoint focuses on the concerns of the supporters and participants, the Implementation & Governance Viewpoint on the operating team, the Participant Viewpoint on the stakeholder engagement team, the Participation Viewpoint on the participation management team, the data & information viewpoint on the facilitator team, and the E-Participation Viewpoint on the e-participation engineering team. However, the

groups are not strictly separated as there are relationships between the viewpoints. Each viewpoint describes the principles for creation, interpretation and usage of the corresponding view. A view is a work product that describes a part of the EEA with a collection of architecture models. The viewpoints specify the architecture models to be used within the views. In the EPART-Framework, a model kind can be a:

- *diagram*, i.e. a visualisation of entity instances and relationships (TOG, 2011a)
- *matrix*, i.e. a visualisation of the relationships "between two (or more) architectural elements in a grid format" (TOG, 2011a), e.g. a table where rows show one type of entity instances and columns the second type
- *catalogue*, i.e. a list of entity instances (TOG, 2011a)

One architecture view can share architecture models with different views. Table 38 shows an overview of viewpoints and the architecture models they specify (++) or are useful for stakeholders (+).

Figure 27 shows the details of the EPART-Metamodel on which the viewpoints are based with the entities and their relationships. Italic fonts indicate the abstract entities and relationships. The EPART-Metamodel structures the architectural information in a way that it can be easily processed (according to TOG, 2011a, p. 335). The entities including examples, their attributes and relationships are described in Appendix B, Appendix C, and Appendix D.

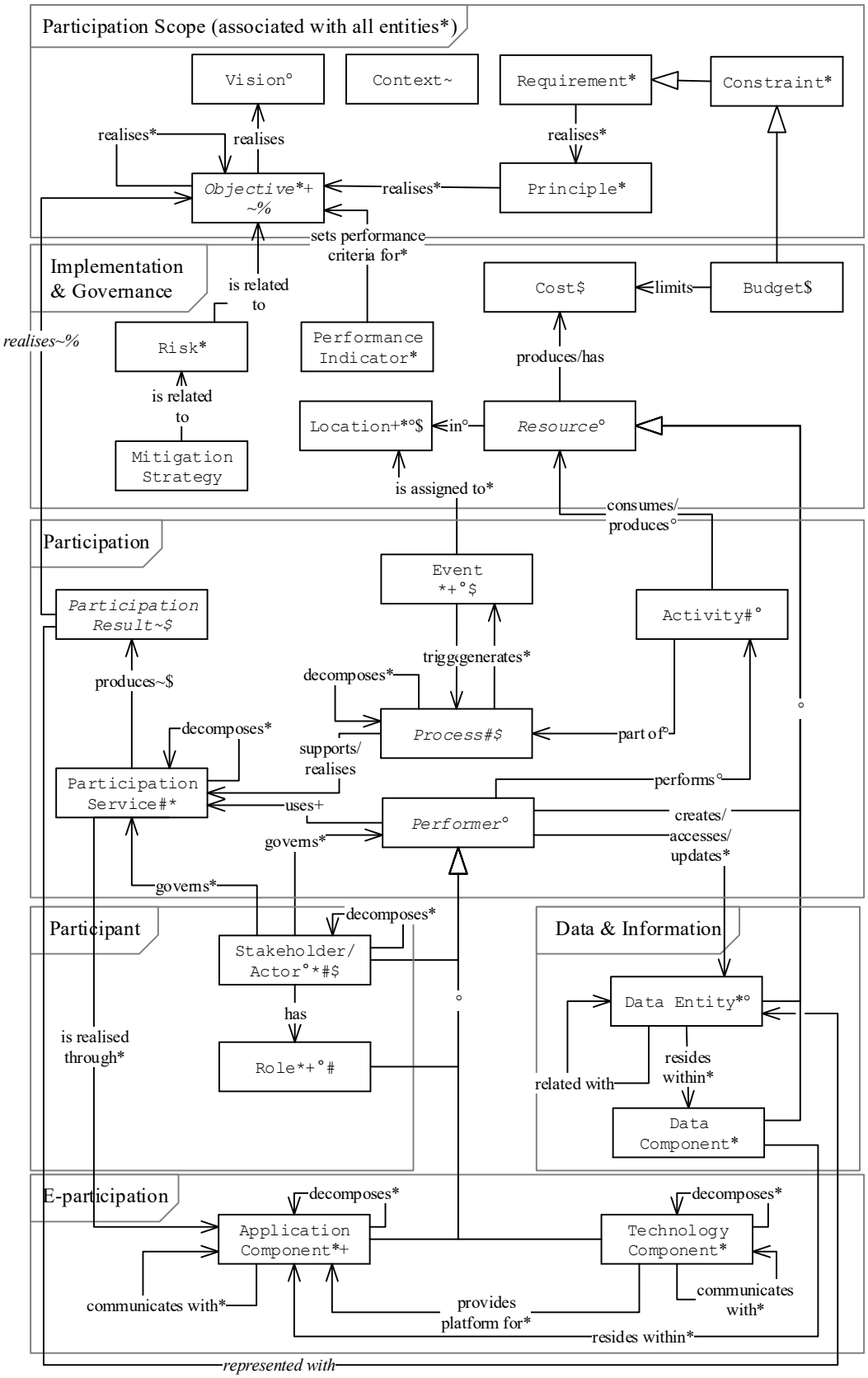
The style of the following viewpoint descriptions is based on Clements et al. (2011, p. 404) and Hilliard (2014). For each viewpoint the following is described:

a) *Concerns and stakeholders* that the viewpoint frames.
b) *Core constructs*, i.e. the metamodel entities and relationships on which the viewpoint is based on.
c) *Architecture models* i.e. specifications of the architecture models, which the corresponding view should include. Examples of architecture models are provided as part of the EPArt-Reference Models in Section 6.4.

Table 38. Overview of viewpoints and the architecture models, they govern

Note: ++: The viewpoint specifies the architecture model. +: The viewpoint makes use of this architecture model

Viewpoint / Architecture Model	Participation Scope	Implementation & Governance	Participant	Participation	Data & Information	E-Participation
Scenario	++		+	+	+	+
Participation Concept Diagram	++		+	+	+	+
Principle Catalogue	++		+	+	+	+
Project Schedule Diagram		++				
Budget Plan Matrix		++				
Organisation/Actor Catalogue		++		+		
Risk/Mitigation Strategy Catalogue		++				
Evaluation Catalogue		++				
Participant Onion Diagram			++	+		
Stakeholder Engagement Catalogue			++	+	+	
Role Catalogue			++		+	+
Participation Schedule				++		
Event Catalogue		+		++		
Participation Planning Matrix				++	+	
Objective/Participation Service Diagram				++		
Participation Service Catalogue				++		+
Process Flow Diagram				++	+	+
Data Entity/Data Component Catalogue					++	
Data Entity/Role Matrix				+	++	+
Conceptual Data Diagram				+	++	
Application Use Case Diagram				+		++
Requirement Catalogue		+	+	+	+	++
Application/Participation Service Catalogue				+	+	++
Application/Technology Diagram						++



Legend: UML class diagram. Symbols represent sources: * TOGAF, + ArchiMate, ° DoDAF, ~ Smith et al. 2011, # Kalampokis et al. 2008, § Phang et Kankanhalli 2008, $ Porwol et al. 2016.

Figure 27. Overview of the main entities and relationships of the metamodel (EPART-Metamodel) on which the viewpoints are based

6.3.1 Participation Scope Viewpoint

a) Concerns and stakeholders

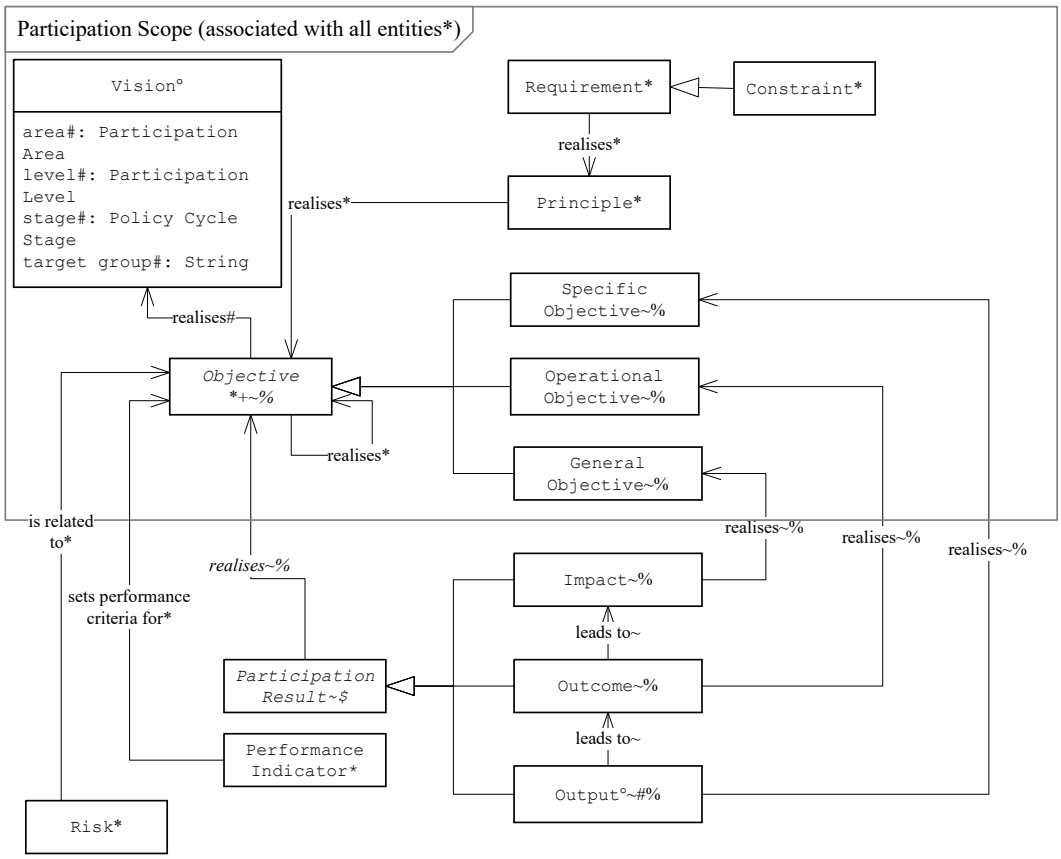
The purpose of the Participation Scope Viewpoint is to capture the objectives of e-participation and link them with the strategies to achieve them. Furthermore, it provides information needed by the owners to decide if they will carry out the e-participation or not. Using this viewpoint makes it possible to determine the purpose of e-participation. It is also feasible to estimate the potential impacts of e-participation throughout its lifecycle through a high-level view on how the objectives can be achieved. This viewpoint builds the basis for further developments after a positive decision. Furthermore, the viewpoint is used to describe the participation principles.

Main stakeholders may be the initiators, owners, project management and participation analysts as they shape this viewpoint. However, all stakeholders wishing to understand the purposes of participation may have an interest.

b) Core constructs

The Participation Scope Viewpoint employs scenario building to describe the participation vision and the SMART system[73] to specify objectives. The analysis begins by determining which objectives support the vision, cf. Figure 28. A `Vision` is a mental image of the intended future (cp. inputs in DoD, 2011, p. 26) with regards to what the EE aims to achieve and the context. It tackles participation levels, a policy cycle stage and participation areas and defines the needs, problems, and issues addressed by the EE. An `Objective` is a goal of the EE. Objectives can be defined on different levels: An `Operational Objective` describes a direct goal for the design, implementation and operation of the EE (Smith et al., 2011, p. 308). A `Specific Objective` describes a benefit for stakeholders (Smith et al., 2011, p. 308). A `General Objective` is a societal objective or public value that describes an overall goal (Millard, 2008; Smith et al., 2011, p. 308). On the one hand, `Participation Results` realise these `Objectives` as a result of operating the EE. An example for an operational objective in this regard is to carry out an awareness raising campaign (Millard, 2008, p. 9). On the other hand, the EE has objectives for its design and implementation. For example, such an operational objective could be to re-engineer the back-office business processes (Millard, 2008, p. 9). A solution for achieving objectives is defined on a high level in this viewpoint. Therefore, any entities of other viewpoints can be associated with entities from the Participation Scope Viewpoint. Furthermore, it is necessary to model `Requirements`, which aim to realise `Principles`. A *`Principle`* is "a qualitative statement of intent that should be met by" (TOG, 2011a, p. 22, p. 22) the e-participation architecture. Principles are "general rules and guidelines […] that inform and support the way in which an organisation sets about fulfilling its mission" (TOG, 2011a, p. 235, p. 235). A `Requirement` is "a statement of need that must be realised" (TOG, 2013, p. 120, p. 120). A `Constraint` is an external factor or restriction influencing the way in which the project can be realised (TOG, 2011a, p. 24, 2013, p. 122). The `Context` (i.e. external factors, drivers, barriers) influence the way in which the EE can be designed, implemented, and operated (Smith et al., 2011).

[73] A SMART objective is Specific, Measurable, Achievable, Realistic, and Time-bound. See, e.g. http://ec.europa.eu/smart-regulation/guidelines/tool_13_en.htm (access: 2016-05-16)



Legend: UML class diagram. Symbols represent sources: * TOGAF Framework 9.1 (TOG, 2011a), + ArchiMate Specification 2.0 (TOG, 2013), ° DoDAF 2.02 (DoD, 2011), ~ Smith et al. 2011, # Kalampokis et al. 2008, § Phang et Kankanhalli 2008, $ Porwol et al. 2016, % Millard, 2008.

Figure 28. The Participation Scope Viewpoint

c) Architecture models

The Participation Scope Viewpoint specifies four architecture models: Scenario, Participation Concept Diagram, and Principle Catalogue.

Scenario. A Scenario describes the `Vision` and `Objectives`, the `Context` the target groups and identifies boundaries. It is a written text and a rich picture that describes these aspects. A Scenario may describe all relevant instances of metamodel entities.

Participation Concept Diagram. The Participation Concept Diagram (based on Solution Concept Diagram in DoD, 2011, p. 117; TOG, 2011a, p. 382) describes the potential participation solution on a high-level. It addresses the participation concerns with regards to the overall idea and defines the strategic context (DoD, 2011). It furthermore identifies relationships among objectives. It describes how the EE meets its vision through its objectives. The breakdown of objectives in outputs, outcomes, and impacts allows the architects and planners to identify synergies across the EE and to detail the strategy. The diagram is visualised as an UML class diagram that presents entities as nodes and relationships as lines.

The Solution Concept Diagram contains the following EPART-Metamodel entities and relationships:

- `Vision`
- `Objective`
- `Objective` *realises* `Vision` relationship
- `Objective` *realises* `Objective` relationship
- *associated with* relationship to other entities

Principle Catalogue. Principles are qualitative statements of intent that the e-participation should meet. They offer general rules and guidelines (TOG, 2011a, p. 22). Participation principles should be an important fundament of every e-participation and can support the development of (e-)participation guidelines (cf. Subsection 4.1.9). The Principle Catalogue (The Open Group (TOG), 2011b, 2011a, p. 382) identifies the principles that shape the EE. Table 39 proposes a template from TOGAF. The Principle Catalogue contains the following EPART-Metamodel entities and relationships:

- `Principle`
- `Requirement`
- `Requirement` *realises* `Principle` relationship
- *associated with* relationship to other entities

Table 39. Principle template (TOG, 2011a)

Name	Easy to remember name representing the essence of the rule
Statement	Communication of the fundamental rule.
Rationale	Highlight the "benefits of adhering to the principle".
Implications	Highlight the "requirements, both for the business and ICT, for carrying out the principle – in terms of resources, costs, and activities/tasks".

6.3.2 Implementation & Governance Viewpoint

a) Stakeholders and concerns

The purpose of the Implementation & Governance Viewpoint is the operational management of the EE and governance of architecture implementation. The viewpoint addresses the concern of determining the managerial constraints of carrying out participation services and evaluating the outcomes. It answers questions such as

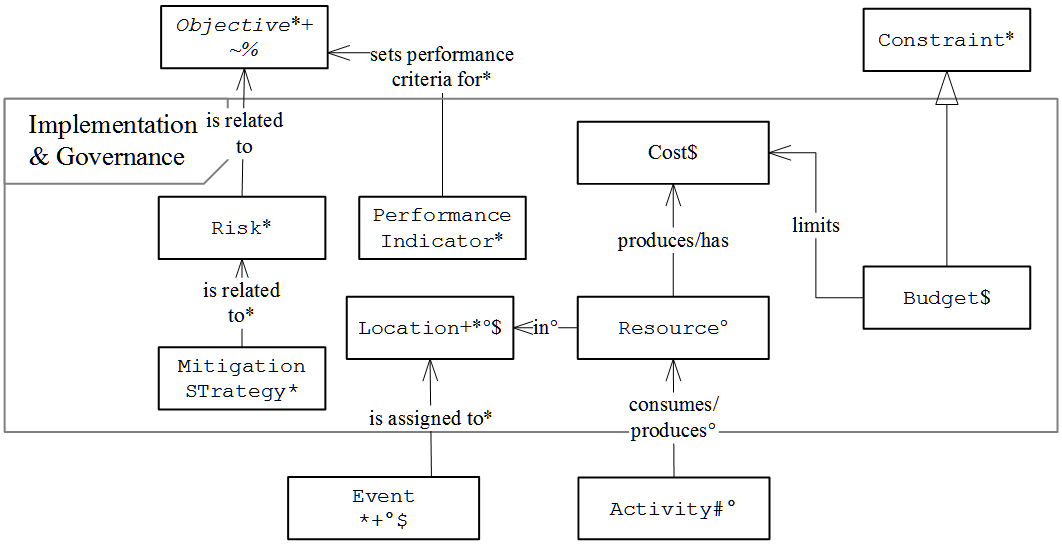
- What personal, financial and other resources are available?
- What are the costs?
- What is the budget?
- What are the responsibilities of the actors and organisations involved?
- What is the schedule?
- What are key performance indicators?
- How can the e-participation be evaluated?

Some likely stakeholder for the viewpoint are is the operating team, in particular the owners and the project managers.

b) Core constructs

The viewpoint employs (project) management techniques such as PRINCE2 (see Linssen & Rachman, 2008), SCRUM (Schwaber & Sutherland, 2014), *V-Model XT* (Bundesstelle für Informationstechnik (BIT), 2006), or PMBoK (PMI, 2000). Figure 29 shows the core

constructs. The managers need to model the budget by estimating the Costs of Resources and define a project plan. Furthermore, Performance Indicators are defined for Objectives consolidated for evaluation. The viewpoint employs risk management (a risk management framework is e.g. described in TOG, 2011a, pp. 313–317); Mitigation Strategies are developed for Risks identified.



Legend: UML class diagram. Symbols represent sources: * TOGAF Framework 9.1, + ArchiMate Specification 2.0, ° DoDAF 2.02, ~ Smith et al. 2011, # Kalampokis et al. 2008, § Phang et Kankanhalli 2008, $ Porwol et al. 2016.

Figure 29. The Implementation & Governance Viewpoint

c) Architecture models

The Implementation & Governance Viewpoint comprises of six architecture models: Project Schedule Diagram, Budget Plan Matrix, Organisation/Actor Catalogue, Risk Mitigation Strategy, and Evaluation Catalogue. Further relevant architecture models are the Event Catalogue and the Requirements Catalogue.

Project Schedule Diagram. The *Project Schedule Diagram* identifies the activities needed to operate the EE. Usually, work packages structure activities and can, e.g., be represented as a Gantt Chart (PMI, 2000, p. 77). The Project Plan Diagram contains the following EPART-Metamodel entities and their interrelationships:

- Role
- Actor
- Activity
- Event
- Process

Budget Plan Matrix. The *Budget Plan Matrix* identifies costs of the project as specific constraints. A budget spreadsheet is used. The Budget contains the following EPART-Metamodel entities and relationships:

- Resource
- Cost
- Budget

- `Resource` *produces/has* `Cost` relationship
- `Budget` *limits* `Cost` relationship

Organisation/Actor Catalogue. The Organisation/Actor Catalogue (TOG, 2011a, p. 383) lists all stakeholders that interact with the EE. The Organisation/Actor Catalogue furthermore lists all locations where the EE carries out participation operations or organisation or relevant assets (e.g. data centres) are located. The Organisation/Actor Catalogue contains the following EPART-Metamodel entities and relationships:

- `Stakeholder/Actor`
- `Organisation`
- `Stakeholder/Actor` *belongs to* `Organisation` relationship
- `Stakeholder/Actor` *decomposes* `Stakeholder/Actor` relationship
- `Location`
- `Resource` *in* `Location` relationship

Risk Mitigation Strategy Catalogue. The Risk Mitigation Strategy Catalogue addresses the risks hindering the achievement of project goals and the identification of mitigation measures. A table with risks and mitigation strategies is used. The Budget contains the following EPART-Metamodel entities and their interrelationships:

- `Risk`
- `Objective`
- `Mitigation Strategy`

Evaluation Catalogue. The Evaluation Catalogue maps the evaluation objectives and questions with the participation vision and objectives, evaluation methods, and tools used and develops a schedule (Bicking et al., 2013). A table with objectives and corresponding evaluation subjects, key evaluation criteria, detailed evaluation questions, methods, tools, and results in rows (Table 40). The Evaluation Strategy Catalogue contains the following EPART-Metamodel entities and their interrealtionships:

- `Objective`
- `Activity`
- `Performance Indicator`
- `Application Component`
- `Requirement`

Table 40. Evaluation Catalogue template (derived from Bicking et al., 2013)

Evaluation subject	Key evaluation criteria	Detailed evaluation question/indicators	Evaluation method/tool	Related requirements	Result
What is evaluated? Corresponding to an `Objective`.	What are the evaluation criteria? Corresponding to a `Performance Indicator`	What are the detailed evaluation questions or the indicators. E.g. information is accurately, completely and reliably.	What methods are applied? For example, expert or stakeholder assessment, participant survey. It should also link relevant `Application Components`, if applicable.	Link to a relevant `Requirement` in the catalogue, if existent.	What is the result of evaluation?

6.3.3 Participant Viewpoint

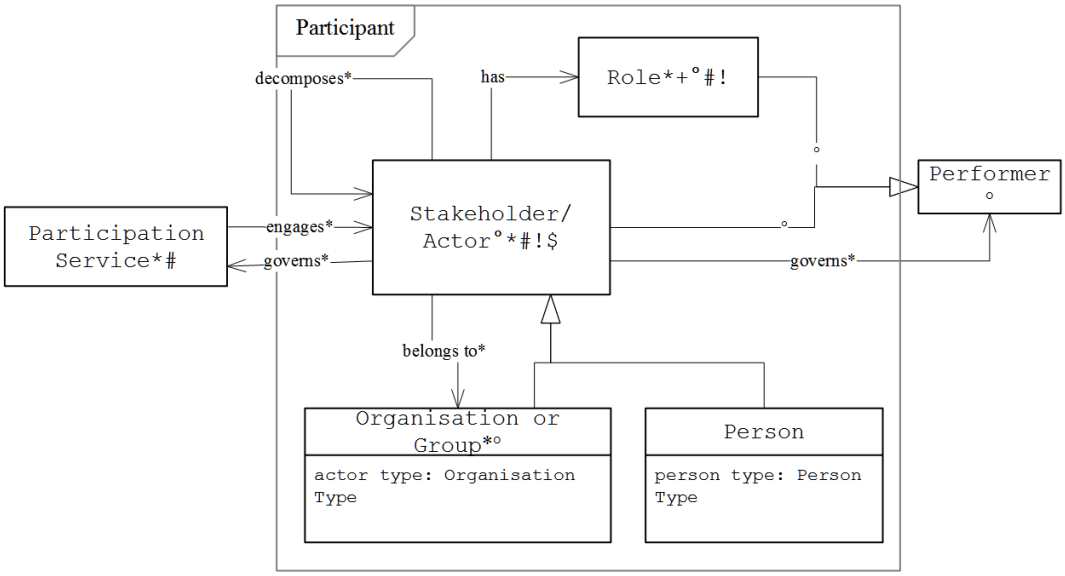
a) Concerns and stakeholders

The purpose of the *Participant Viewpoint* is to identify, manage and engage the stakeholders actively and passively engaged in or affected by e-participation. It provides information needed to allocated roles to stakeholders.

Stakeholder may be the stakeholder engagement team, the owner and project management, as well as participation analysts. Nevertheless, it is also for e-participation architects to derive access rights and Marketing to derive an appropriate marketing strategy.

b) Core constructs

The *Participant Viewpoint* employs stakeholder analysis (see e.g. Bryson, 2004). It needs to model `Stakeholder/Actor`, `Role`, `Organisation/Group`, `Person`, cf. Figure 30. The enumeration `Person Type` specifies the kind of stakeholder/actor, while the enumeration `Organisation Type` defines the kind of organisations. A `Stakeholder` is "an individual, team, or organization (or classes thereof) with interests in, or concerns relative to, the outcome of the architecture" (TOG, 2011a, p. 31). Stakeholder can be seen as "a motivational role […] that an actor may fulfil" (TOG, 2013, p. 130). An `Actor` is an organisational entity that is capable of performing behaviour (TOG, 2013, p. 14). Not each stakeholder/actor may have an active role. A `Person Type` is a particular kind of actor: citizen, elected representative, government executive, employee, policy maker, decision maker, politician, lobbyist, other (cf. Table 41). An `Organisation or Group` (short `Organisation` in the following) is a **s**elf-contained unit of people and other resources with objectives (DoD, 2011, p. 25; TOG, 2011a, p. 333). An `Organisation Type` is a particular kind of organisation: academia, government, industry, political party, non-governmental organisation, media, and advisory board (cf. Table 42). A `Role` is the part and the contribution an actor plays in the e-participation project (TOG, 2011a, p. 30), as e.g. administrator, decision maker, policy expert, facilitator, moderator, input provider, lurker.



Legend: UML class diagram. Symbols represent sources: * TOGAF Framework 9.1, + ArchiMate Specification 2.0, ° DoDAF 2.02, ~ Smith et al. 2011, # Kalampokis et al. 2008, § Phang et Kankanhalli 2008, $ Porwol et al. 2016.

Figure 30. The Participant Viewpoint

Table 41. EPArt-Metamodel enumeration `Person Type`

Name	Description
Citizen	Actor living in the area of interest effected by the policy; mostly the target group to be engaged in e-participation. They should be actively engaged by providing input (in different forms related to the participation techniques used). However, some citizens might prefer a silent role and not actively participate but observe the participation (Cruickshank et al., 2010).
Elected Representative	Actor elected in a democratic voting procedure for an official position. Elected representatives are important as supporters of the e-participation. They should be asked to give their commitment to engage in the e-participation endeavour. Thereby the type of engagement needs to be agreed upon.
Government Executive	Actor working in a government agency, department or ministry. Government executives play a major role as being responsible for the implementation of policies. As such they can provide insights relevant to inform participants.
Employee	Actor working in a company engaged in the EE.
Policy Maker/ Decision Maker	Actor with competency in policy making.
Politician	Actor "professionally involved in politics, especially as a holder of an elected office"[74] (see elected representative).
Lobbyist	Actor taking "part in an organized attempt to influence legislators"[75].
Other	Any other actor or stakeholder type not included before.

Table 42. EPArt-Metamodel enumeration `Organisation Type`

Name	Description
Academia	Organisation of institutes whose major objective is research as e.g. a university or any other research institute.
Government	Organisation of agencies and departments, which belong or relate to the government.
Industry	Organisation of people and companies with commercial interests.
Political party	Organisation of people with particular political objectives that takes part in elections with the aim to win positions in the government76.
Non-governmental organisation (NGO)	Not governmental controlled organisation with social or political objectives77.
Citizen society organisation (CSO)	Organisation of citizens with social or political objectives.
Media	Organisation with the aim to publish news through different channels.
Advisory board	Organisation of people and institutions with the aim to support the participation project.

c) Architecture models

A Participant View governed by this viewpoint comprises three architecture models: Role Catalogue, Participant Onion Diagram, and a Participant Catalogue. Scenario, Participation Concept Diagram, Principle Catalogue, and Requirement Catalogue determine this viewpoint as well.

Role Catalogue. The Role Catalogue (TOG, 2011a, p. 383) provides a listing of all responsibilities within the EE and supports definition, understanding and alignment of roles across organisations and applications. Application security or behaviour can be defined against the roles what supports the security definition (TOG, 2011a, p. 383). The Role Catalogue can be derived based on the stakeholders described in Section 6.2 (see Table 37). The Role Catalogue contains the following EPArt-Metamodel entity:

[74] Definition in Oxford dictionary, see http://www.oxforddictionaries.com/definition/english/politician (last accessed 2015-11-13)

[75] Definition in Oxford dictionary, seehttp://www.oxforddictionaries.com/definition/english/lobbyist (last accessed 2015-11-13)

[76] Based on the definition in Cambridge Dictionary, see http://dictionary.cambridge.org/dictionary/english/party (last accessed 2015-11-04)

[77] Based on the definition in Cambridge Dictionary, see http://dictionary.cambridge.org/dictionary/english/non-governmental-organization (last accessed 2015-11-04)

- Role

Participant Onion Diagram. The Participant Onion Diagram (Alexander & Robertson, 2004; Sudevan, Bhasi, & Pramod, 2014) identifies different types of people e.g. who operate the equipment (Alexander & Robertson, 2004) or who participate. It is represented as an onion model e.g. with slots for other stakeholders, key stakeholders and participants. The Stakeholder Diagram contains the following EPART-Metamodel entities:

- Actor
- Organisation
- Role

Stakeholder Engagement Catalogue. The Stakeholder Engagement Catalogue (TOG, 2011a, p. 256) identifies participants and plans their involvement. Table 43 proposes a template. It aims to ensure that the EE considers all relevant stakeholders to be engaged in and informed about the e-participation. The Participant Catalogue contains the following EPART-Metamodel entities and relationships:

- Actor
- Organisation
- Role
- Stakeholder/Actor has Role relationship
- Stakeholder/Actor in Organisation relationship
- Stakeholder/Actor decomposes Stakeholder/Actor relationship

Table 43. Participant Catalogue template

Column of the template	Description
Name	Name of the stakeholder/actor.
Description	Short information describing the stakeholder if necessary.
Organisation	Names of the organisation the stakeholder belongs to (if applicable).
URL/Source/Link	Information where to find the more information (e.g. the home page if available).
Involvement (Role)	Description of involvement in the EE.
Comment	A comment if necessary providing relevant information with regards to the involvement of the stakeholder as e.g. who can contact it.
Actor/Organisation Type	Type of stakeholder: academia, industry or business, elected representative, government executive, policy maker, political party/politician, citizen/citizen group, NGO/CSO, Media, others
Status:	Status of involvement: contacted, not contacted, others.
Project team	IF the stakeholder/stakeholder group is part of the internal project team or external: Internal, external, others.

6.3.4 Participation Viewpoint

a) Stakeholders and concerns

The purpose of the *Participation Viewpoint* is to link the objectives with the strategies to achieve them. Therefore, it aims at planning of participation techniques, services, processes and activities necessary to carry out the participation undertaking. It considers the policy-making processes and plans how to integrate participation processes in a meaningful way.

Participation analysts who are interested in designing/planning the participation procedures are obvious stakeholders. In addition, the owners, project managers, experts,

and others who can contribute to design and want to see how participation is carried out are stakeholders. E-participation architects to analyse ICT support.

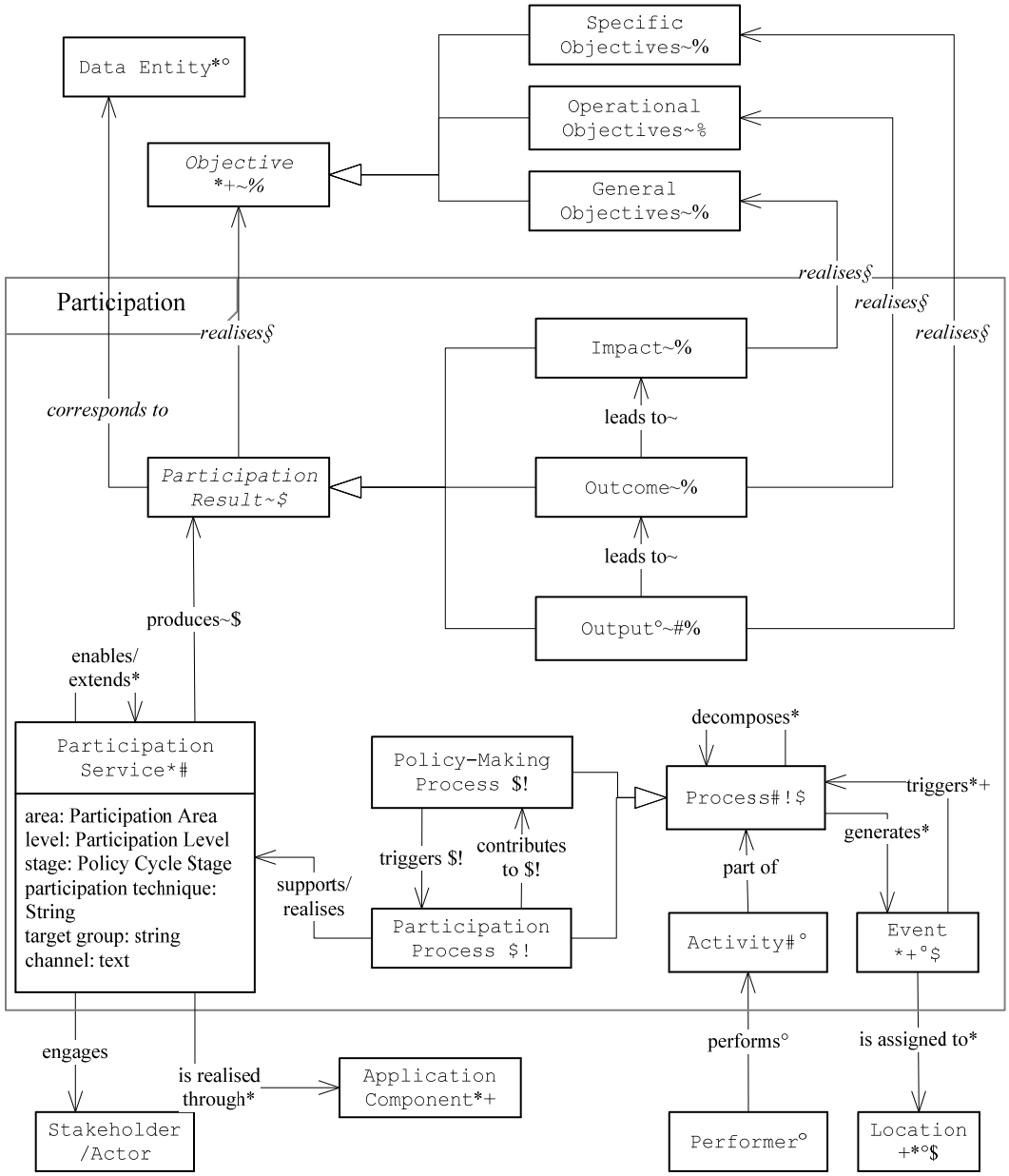
b) Core constructs

This viewpoint employs process analysis and management. The analysis is performed in two steps. First, the relevant policy-making processes and, if necessary, administrative processes are analysed. Then appropriate participation techniques are determined. Then the participation services and processes are planned. The planning needs to consider the stakeholders that perform activities in the processes. There is a need to model `Event`, `Performer`, `Process`, `Activity`, `Participation Service`, `Channel`, `Event`, `Participation Result`, cf. Figure 31. Furthermore, it is necessary to link `Objectives` of the Participation Scope ViewpointA `Participation Result` describes what the Participation Service produces. . An `Output` is generated directly through the `Participation Service` (Smith et al., 2011, p. 308). An `Outcome` describes a benefit for stakeholders (Smith et al., 2011, p. 308). An `Impact` is a public value (Smith et al., 2011, p. 308). A `Performer` is any entity or complex of entities responsible to perform an activity and provide a capability (DoD, 2011, p. 33). A `Participation Service` is a specific service to involve or engage target groups based on participation techniques employed. A participation technique is a method or instrument applied to involve or engage individuals or groups in the participation process (Kalampokis et al., 2008, p. 28). Area, level, and stage refer to the corresponding attributes of the Vision as defined in the Participation Scope Viewpoint. A `Process` is an entity that groups behaviour based on an ordering of activities (TOG, 2013). Processes are differentiated in policy-making and participation processes. However, modelling of other processes, e.g. administrative processes, is possible with this entity. A `Policy-Making Process` is a set of coordinated activities with certain start and end points that are performed by a government with the aim to set a policy on the political agenda, formulate a policy, decide a policy, implement a policy and/or evaluate a policy (Anderson, 2010, p. 3; Birkland, 2004, p. 221; Howlett et al., 1995). The `Policy-Making Process` entity in the metamodel may also represent any other political process, in which the EE aims to enable citizen participation. A `Participation Process` presents the activities to engage stakeholders in policy-making processes. It may have the following specialisations:

- `Information Process`: A procedure, which intends to inform stakeholders on the participation topic.
- `Input Provisioning Process`: A procedure, which intends to inform stakeholders on the participation topic.
- `Reporting Process`: A procedure, which intends to report stakeholders on the results of participation, the decisions made, and the impact reached and get their feedback.
- `Result-Processing Process`: A part of the participation process when the participation inputs are processed to be considered in the `Policy-Making Processes`.

An `Activity` transforms input resources into output resources or changes the states of resources (DoD, 2011, p. 25). An ***`Event`*** is a state change, inside or outside the EE, which

triggers Activities or Processes (TOG, 2011a, p. 357). A Channel describes an interface through which participants are engaged, e.g. a traditional channel or by ICT (Kalampokis et al., 2008, p. 29).



Legend: UML class diagram. Symbols represent sources: * TOGAF Framework 9.1, + ArchiMate Specification 2.0, ° DoDAF 2.02, ~ Smith et al. 2011, # Kalampokis et al. 2008, § Phang et Kankanhalli 2008, $ Porwol et al. 2016.

Figure 31. The Participation Viewpoint

c) Architecture models

The Participation Viewpoint specifies six architecture models: Participation Schedule, Event Catalogue, Participation Planning Matrix, Participation Service Diagram, Process Landscape Diagram, and Process Flow Diagram.

Scenario, Participation Concept Diagram, Principle Catalogue, Organisation/Actor Catalogue, Participant Onion Diagram, Stakeholder Engagement Catalogue, and Requirement Catalogue determine this viewpoint as well.

Participation Schedule. The Participation Schedule is an overview on different time slots during political decision-making and used to rate the time available for participation. Relevant entities are

- `Data Entity`
- `Actor/Stakeholder`
- `Participation Result`
- `Process`
- `Activity`
- `Resource`
- `Performer`
- `Event`

Event Catalogue. The Event Catalogue (Inmon et al., 1997) identifies important events to be considered for designing participation. Important events are influenced by the policy-making processes and the participation processes. Vacations and official holidays should be considered as well. The Event Catalogue contains the following EPART-Metamodel entities and relationships:

- `Location`
- `Event` is assigned to `Location` relationship

Participation Planning Matrix. The Participation Planning Matrix (based on Acland's Engagement Planning Grid (Acland, 2008, p. 26)) is used for first planning the participation services. Acland (2008, p. 26) proposes to develop the model with sticky notes at a wall and underlines its use for identifying the relationships between different parts of the work and with the schedule. The Participation Planning Matrix contains the following EPART-Metamodel entities:

- `Data Entity`
- `Actor/Stakeholder`
- `Participation Result`
- `Process`
- `Activity`
- `Resource`
- `Performer`
- `Event`

Table 44. Participation Planning Matrix (slightly adapted from Acland, 2008, p. 26)

Participation Result *What will be produced?*					
People *Who will be engaged?*					
Decision-making What stage is relevant at this date?					
Process *What participation techniques will be used? What activities should be organised?*					
Resources *What resources are needed? What resources can be spend?*					
Performer *Who will do the work?*					
Pace *When it will happen?*	January	February	March	April	…

Objective/Participation Service Diagram. The Objective/Participation Service Diagram mm (TOG, 2011a, p. 387) links objectives and participation results with participation services. It is represented as a class diagram mapping objectives with participation services.

The designers must ensure that the participation objectives are realised through participation services. The Objective/Participation Service Diagram contains the following EPART-Metamodel entities and relationships:

- `Objective`
- `Participation Service`
- `Participation Result`
- `Participation Service` produces `Participation Result` relationship
- `Participation Result` realises `Objective` relationship

Participation Service Catalogue. The Participation Service Catalogue lists the participation services to be employed as result from the Participation Planning Matrix. Table 45 shows a template for this catalogue. The Participation Service Catalogue contains the following EPART-Metamodel entities and relationships:

- `Participation Service`
- `Participation Result`
- `Participation Service` produces `Participation Result` relationship

Table 45. Participation Service Catalogue template.

Name	Identifier of the service.
Description	Description of the service
Participation Technique	Description of the participation technique employed by this service. A participation technique is a method or instrument applied to engage individuals or groups in the policy-making process (Kalampokis et al., 2008).
Participation Area	The democratic field in which participation takes place. The participation areas that apply are presented in Table 8 (p. 53).
Participation Level	The power that is put in the hands of the participants. The participation levels that apply are presented in Subsection 4.1.4 (p. 51).
Policy Cycle Stage	The stage in the policy-making process. The policy cycle stages that apply are presented in Subsection 4.1.1 (p. 47).
Target group	Description of the target group(s) to be involved and engaged.
Channel	The interface through which the service is provided
Participation Result	The result of the participation service

Process Flow Diagram. The Process Flow Diagram (Scherer et al., 2009b; Scherer & Wimmer, 2012b; TOG, 2011a, p. 387) identifies activities, actors, their outcomes and inputs. It is visualised as a BPMN Diagram. It is a detailed description of the Participation Planning Matrix. The Process Flow Diagram contains the following EPART-Metamodel entities:

- `Process`
- `Activity`
- `Activity` part of `Process` relationship
- `Performer`
- `Activity` is performed by `Performer` relationship
- `Event`
- `Process` generates `Event` relationship
- `Event` triggers `Process` relationship
- `Resource`
- `Activity` consumes or produces `Resource`

6.3.5 Data & Information Viewpoint

a) Stakeholders and concerns

The *Data and Information Viewpoint* describes the data, which performers produce or consume within e-participation. The purpose of the *Data & Information Viewpoint* is the development of a data and information architecture answering questions such as:

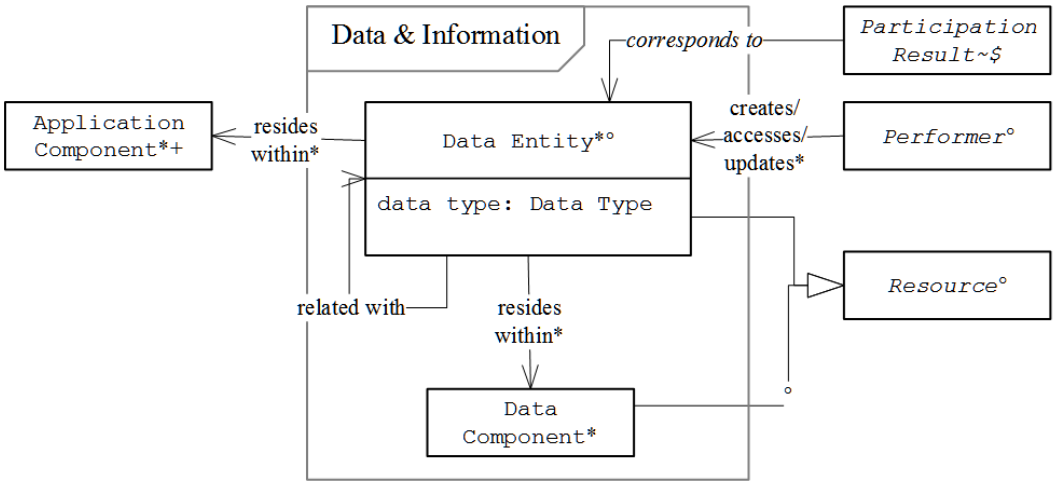
- What data and information are needed?
- What data and information are necessary?
- How can data be represented?
- What kinds of documents are created and used (e.g. draft of law, proposal, etc.)?
- Are the documents communicated in the traditional official way or via electronic means (e.g. traditional, electronic, both)?
- Which style sheets or predefined structures are used (if any) for this kind of document (on paper or electronic)?
- Are these documents obligatory or optional (e.g. templates, forms, etc.)?
- Is this document available in different languages (e.g. national language, English, etc.)?

The Data & Information Viewpoint aims to ensure that only those information, which is relevant for EE operations is managed (according to the Data and Information Viewpoint in DoD, 2011).Using this viewpoint makes it possible to conceptualise the data and information.

Owners, project management, participation analysts, editorial team, marketing, and e-participation architects/developers are interested in these views to communicate what are the input and output data. Editorial Team and Marketing to identify participation data and information, which are to be provided, e-participation architects and developers to design appropriate applications.

b) Core constructs

The *Data & Information Viewpoint* describes the `Resources`, which performers produce or consume within e-participation. The entities are `Data Entity` representing data and information, `Data Component` to store data entities, and `Data Type`, cf. Figure 32. The Data & Information Viewpoint describes the Resources, which performers produce or consume within e-participation. A `Data Entity` is a specific encapsulation (TOG, 2011a, p. 356) or information that is materialised in any medium or form and communicated or received (DoD, 2011, p. 25). It is represented in a formalised manner suitable for communication, interpretation, or processing by humans or by automatic means (DoD, 2011, p. 25). A `Data Component` is an “encapsulation of data abstract data entities into units that can be governed and deployed into applications” (TOG, 2011a, p. 350). A `Data Type` is a particular kind of `Data Entity` (Table 46). A `Data Entity` may have multiple types.



Legend: UML class diagram. Symbols represent sources: * TOGAF Framework 9.1, + ArchiMate Specification 2.0, ° DoDAF 2.02, ~ Smith et al. 2011, # Kalampokis et al. 2008, § Phang et Kankanhalli 2008, $ Porwol et al. 2016.

Figure 32. The Data & Information Viewpoint

Table 46. EPART-Metamodel enumeration `Data Type`

Name	Description
Participation Topic	A data entity describing the matter of the participation.
Participation Input	A particular data entity submitted by a participant.
Participation Output	A particular data entity summarising information on the results of participation.
Participation Information	A particular piece of data intended to inform the participants.
Legal Text/ Policy	A data entity that contains the statutory provisions relevant for participation.
Contract	A "formal or informal specification of an agreement that specifies the rights and obligations associated with a product" (TOG, 2013, p. 32).
Participation Procedure	A particular piece of information to inform stakeholders on procedure guidelines, data protection rules, or moderation rules.

c) Architecture models

The Data & Information Viewpoint specifies three architecture models: Data Entity/Data Component Catalogue, Data Entity/Participation Service Matrix, Conceptual Data Diagram. A data & information view further can encompass the Scenario, the Principle Catalogue, the Role Catalogue, the Requirement Catalogue, and the Application/Participation Service Catalogue.

Data Entity/Data Component Catalogue. The *Data Entity/Data Component Catalogue* (TOG, 2011a, p. 388) identifies and maintains a list of all data, information and documents relevant in or for the EE and the Data Components where the data are stored. A template for this catalogue is provided in Table 47.

Table 47. Data Entity/Data Component Catalogue template

Column of the template	Description	Type
Name	Name of the document/data/information.	Text
Description	Short information describing the document/data/information if necessary. <Text>	Text
Data Component (URL/Source/Link)	Information where to find the document/data/information.	Text
Type	Types of the document as defined in the meta model,	Multiple choices
Status:	Status of the document. Not existent. Draft. Pre-final. Final.	One choice

The Data Entity/Data Component Catalogue contains the following EPART-Metamodel entities and relationships:

- `Data Entity`
- `Data Component`
- `Data Entity` stored at `Data Component` relationship

Data Entity/Role Matrix. The *Data Entity/Role Matrix* depicts the relationships between `Data Entities` and `Roles` within the EE. It shows the following entities and relationships:

- `Data Entity`
- `Roles`
- `Role` creates/accesses/updates `Data Entity` relationship

Conceptual Data Diagram. The *Conceptual Data Diagram* (DoD, 2011, p. 133; TOG, 2011a, p. 389) identifies relationships among data within the e-participation. It represents the data consumed and produced by the e-participation on the participation level. The Conceptual Data Diagram is a simplified UML class diagram or an entity relationship model. It contains the following EPART-Metamodel entities and relationships:

- `Data Entity`
- `Data Entity` related with `Data Entity` relationship
- `Data Entity` resides within `Data Component` relationship
- `Participation Result`

6.3.6 E-Participation Viewpoint

a) Stakeholders and concerns

The purpose of the E-Participation Viewpoint is the technical representation of the applications required to implement the participation architecture, its deployment and operation:

- What applications exist and can be reused?
- What applications are to be implemented?
- What technologies are used?
- What hardware is required?
- What functional and non-functional requirements exist?
- How to design and implement or integrate applications into an e-participation platform?
- What do the implementation structure and infrastructure look like?

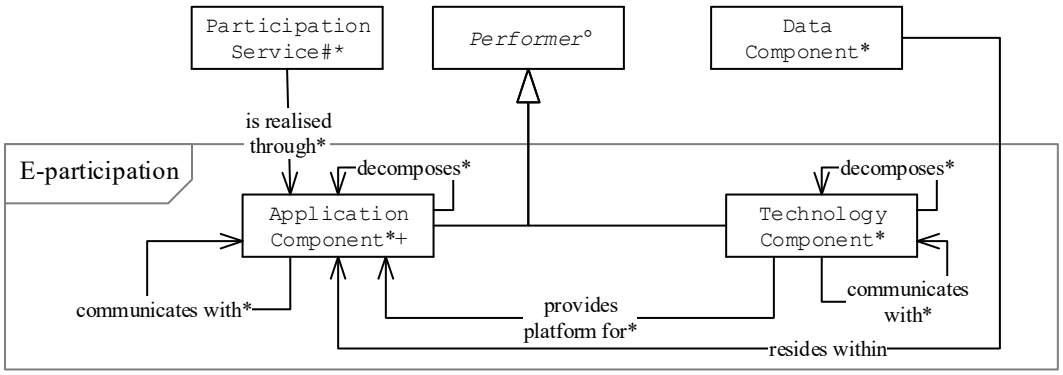
It therefore describes the general architecture of the applications: their structure, distributions and how they are interconnected, and a technical description of the applications. However, it does not detail the whole software or hardware architecture as it focuses to enable the communication between different stakeholder groups. The need for software engineering related architecture models may emerge and can be added.

Stakeholders are the e-participation engineer team and the participation analysts, i.e. those who are responsible for designing and implementing the e-participation tools and processes supporting the participation services. In addition, the users are stakeholder who want to know how to use these solutions.

b) Core constructs

The viewpoint models the e-participation platform and components used to facilitate participation by ICT.

When employing the viewpoint, the requirements manager analyses the `Requirements` considering input by all stakeholders. The e-participation architects and participation analysts in charge decide on the `Application Components` supporting the `Participation Services` and `Requirements`. Next, the e-participation architects select appropriate `Technology Components`, which provide the platform for the `Application Components`. Afterwards, they develop the software architecture.



Legend: UML class diagram. Symbols represent sources: * TOGAF Framework 9.1, + ArchiMate Specification 2.0, ° DoDAF 2.02, ~ Smith et al. 2011, # Kalampokis et al. 2008, § Phang et Kankanhalli 2008, $ Porwol et al. 2016.

Figure 33. The E-Participation Viewpoint

c) Architecture models

The viewpoint includes four architecture model specifications: Application Use Case Diagram, Requirement Catalogue, Application/Participation Service Diagram, and Application/Technology Diagram. Furthermore, the Participation Service Catalogue, and the Role Catalogue are interesting.

Application Use Case Diagram. The *Application Use Case Diagram* (TOG, 2011a, p. 394) shows the relationship between actors or roles and the applications. It supports the description and validation of user interactions with applications (TOG, 2011a, p. 394). The Application Use Case Diagram shows the following EPART-Metamodel entities:

- `Application Component`
- `Actor`
- `Role`

Furthermore, the relationships between these entities are a composite of a number of EPART-Metamodel relationships:

- `Activity` consumes or produces relationship `Resource`

Requirement Catalogue. The *Requirement Catalogue* (Eeles & Cripps, 2010; TOG, 2011a; Versteegen, Heinold, & Salomon, 2001) identifies the requirements that shape the project. The requirements catalogue differentiates between functional requirements and non-functional requirements: *Functional requirements* focus on the functionalities provided by an ICT system. *Non-functional requirements* are quality requirements such as usability, maintainability, performance, and reliability. Use cases for detailing functional requirements, tables detailing non-functional requirements. The Requirement Catalogue shows the following EPART-Metamodel entity:

- `Requirement`

Application/Participation Service Diagram. The *Application/Participation Service Diagram* (DoD, 2011, p. 209) shows the relationships between application components with participation services. The Application/Participation Service Diagram contains the following EPART-Metamodel entities and relationships

- `Application Component`
- `Participation Service`
- `Application Component` is realised through `Participation Service` relationship
- `Stakeholder/Actor`
- `Stakeholder/Actor` governs `Application Component` relationship

Application/Technology Diagram. The Application/Technology Diagram (TOG, 2011a, p. 397) depicts the technologies used to implement applications. Furthermore, it identifies and maintains the list of application and technology components in use across the EE. The diagram depicts the relationship between applications, technologies, the governing stakeholder/actor, and locations. The Application/Technology Matrix contains the following EPART-Metamodel entities and relationships

- `Application Component`
- `Technology Component`
- `Technology Component` provides platform for `Application Component`
- `Stakeholder/Actor` governs `Application Component` relationship
- `Resource` in `Location` relationship

After the introduction of the EPART-Viewpoints and the EPART-Metamodel, the following section presents the EPART-Reference Models. These models provide a reference point for an EE to develop an architecture description. They show good practices and, at the same time, exemplify architecture models, which are specified above.

6.4 Reference Models

The EPART-Reference Models provide guidelines, templates, patterns, and other forms of reference material that can be leveraged in order to accelerate the creation of a new EEA. The purpose is to be usable by the target group of the EPART-Framework to design the

architecture of their EE and plan and implement the e-participation. The following collection of reference views provides a starting point for an EE in applying the EPART-Framework. It synthesises results from literature review and action research to model parts of a reference architecture. The collection of reference views is not a complete reference EEA. It presents general, but interrelated reference models, which the architects need to extend and/or adapt for their particular EE, i.e. use as a reference point for future developments. For example, online participatory budgeting projects use this kind of participation services. This architecture can be adapted for participation areas such as participatory budgeting, spatial planning, and petitioning.

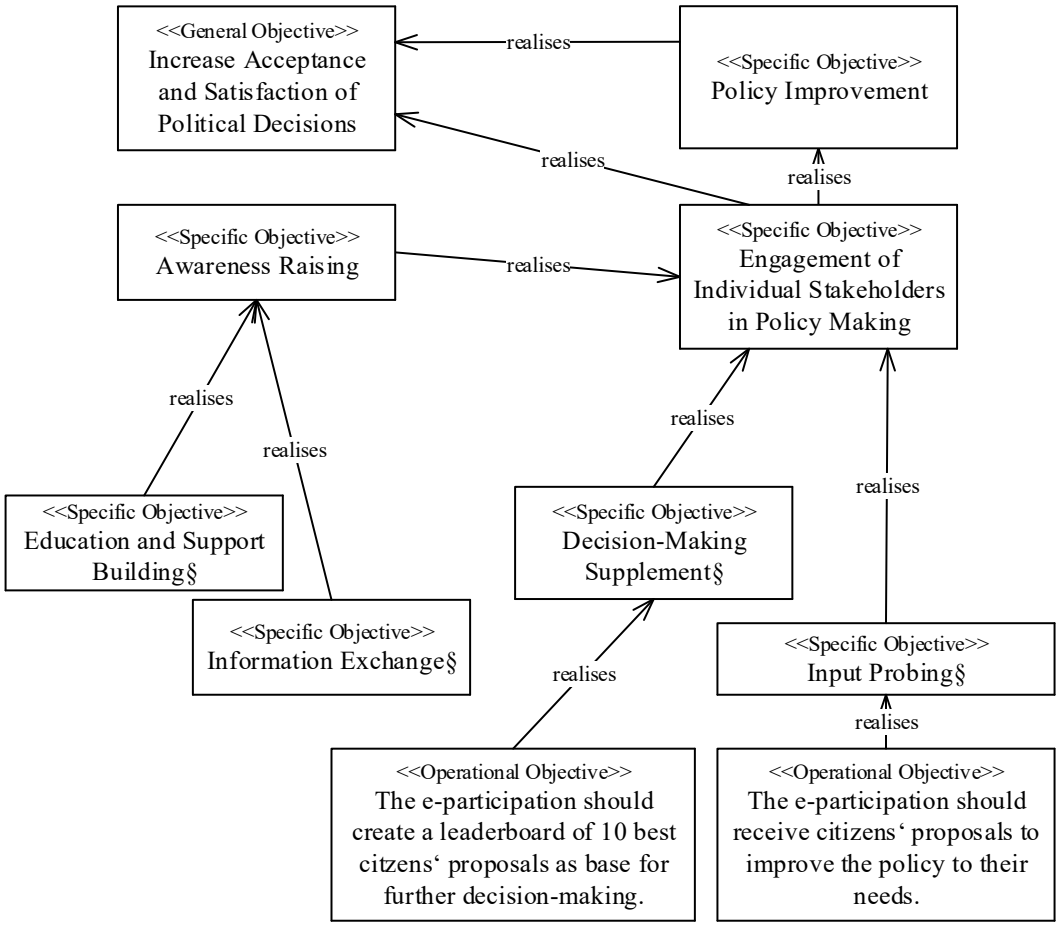
6.4.1 Participation Scope View

a) Scenario

The main objectives of the EE are (1) to make stakeholders aware of the policy under consideration, (2) to enable individual stakeholders (i.e. the citizens) to contribute to the policy, and (3) to improve the policy. The EE uses different participation services to inform and involve stakeholders. Input providers can bring in own proposals for a solution and finally decide on their implementation by vote. The 10 proposals with the most votes are the basis for decision making. However, the final decision stays with the official decision makers. The participation process consists of two stages. During the first stage, input providers can submit new proposals or comment existing proposals online. Submissions of proposals is possible via different channels: online, e-mail, post, call centre an on public hearings. All proposals are collected online. Moderators continuously moderate proposals and comments. This phase could for example last for three weeks. After this stage, editorial management staff processes the proposals and finalises the list of proposals for the second stage. During the second stage, input providers can comment and vote the proposals online.

b) Participation Concept Diagram

Participation objectives are e.g. discussed in Phang and Kankanhalli (2008), Creighton (2005), Bayley and French (2008). The EPART-Reference Models include a diagram based on the objectives described in the scenario and sub-objectives based on Phang and Kankanhalli (2008). However, the objectives need to be adapted to the SMART criteria, as they are formulated in a general matter for the reference model.



Legend: UML class diagram, classes represent objectives. Symbols represent sources: § Phang et Kankanhalli 2008.

Figure 34. Reference Participation Conceptual Diagram.

c) Principle Catalogue

The TOGAF template (TOG, 2011a) for business principles is the base to prepare a list of relevant principles for e-participation. The Participation Scope Viewpoint proposes a reference Principle Catalogue consisting of 25 participation principles (The principles are described in detail below.
). In the following, the specific principles for participation are described using the known viewpoints *Participation Scope*, *Implementation & Governance*, *Participant*, *Participation*, *Data and Information, and E-Participation*. Furthermore, relevant TOGAF principles are mentioned. The principle catalogue includes the following principles:

- Principle 1. Scope for decision making
- Principle 2. Outset with clear objectives
- Principle 3. ICT and participation alignment
- Principle 4. Evaluation during all participation processes
- Principle 5. Stakeholders are those who are affected by the policies or the decisions
- Principle 6. Hard accessible target groups are actively engaged
- Principle 7. Commitment of decision makers

- Principle 8. Presentation of participation possibilities and limitations in a comprehensible way
- Principle 9. Careful and transparent design of participation services
- Principle 10. High responsiveness of the participation services
- Principle 11. Easy access to participation
- Principle 12. Anonymous participation
- Principle 13. Fair moderation
- Principle 14. Neutral, comprehensible, traceable and timely provided participation results
- Principle 15. Continuous feedback is provided
- Principle 16. Timely implementation of decisions
- Principle 17. Interactivity
- Principle 18. Participants can design or influence participation process
- Principle 19. Public relations
- Principle 20. Compliance with law
- Principle 21. Information on the topic
- Principle 22. Data minimisation applied to user data
- Principle 23. Data minimisation applied to information
- Principle 24. Accessibility according to WAI guidelines

The principles are described in detail below.

Participation Scope Principles. Participation scope principles focus on the motivational background of e-participation.

Principle 1. Scope for decision making

Statement	There is some scope for decision making and there is something to decide or influence (Bonnemann, 2010; Darmstadt, 2015; IAP2; Lindenberg, 2011; Ruesch & Märker, 2013; Zebralog).
Rationale	Participation services, which give participants no real voice, frustrate participants and cost resources (particularly the time of participants). The participation results must be integrated into administrative and political processes and decisions (Zebralog). Related agreements are binding for all actors (KJR, 2013).
Implications	– Principle 2. Outset with clear objectives – Principle 8. Presentation of participation possibilities and limitations in a comprehensible way – The decision makers "must genuinely aim to integrate the results into decision-making processes" (Ruesch & Märker, 2013). Such ommitment needs to be obtained in the beginning.

Principle 2. Outset with clear objectives

Statement	When the EE starts its operation, it must be clear how and by whom the participation results will be used. (Ruesch & Märker, 2013).
Rationale	Objectives for, and limits to participation during political decision making should be well defined from the outset. (OECD, 2001, p. 85).
Implications	– Outlining and clear communication of objectives in the beginning. – Studying if objectives are realistic considering the current situation.

Principle 3. ICT and participation alignment

Statement	All ICT management decisions are made under the participation alignment perspective.
Rationale	Using the electronic tools or channels as e.g. the internet should not be an objective in itself (Ruesch & Märker, 2013)
Implications	– "The channels [and technical means] of participation [must be] chosen according to the citizens' media habits." (Ruesch & Märker, 2013) – See Principle 9. Careful and transparent design of participation

Implementation and Governance Principles. Implementation and governance principles settle the way the project managers manage and control the overall EE.

Principle 4. Evaluation during all participation processes

Statement	The EE will be evaluated during all processes and consider different viewpoints.
Rationale	"Evaluation is essential in order to adapt to new requirements and changing conditions for policy making." (OECD, 2001, p. 88).
Implications	– Governments need tools, information and capacity to evaluate their performance in strengthening their relations with citizens. (OECD, 2001, p. 88) – Documentation of the overall participation process (Darmstadt, 2015)

Participant Principles. Participant principles settle who the participants are and the way they are to be engaged.

Principle 5. Stakeholders are those who are affected by the policies or the decisions

Statement	All who are affected by or interested in the policies or the decisions are potential stakeholders of the participation services.
Rationale	"Those who are affected by a policy or a decision have a right to be involved in the decision-making process" (Bonnemann, 2010).
Implications	– Analysis of affected persons and person groups and how they can be integrated in the e-participation.

Principle 6. Hard accessible target groups are actively engaged

Statement	Stakeholders who are hard to access are actively engaged in the participation services (Darmstadt, 2015).
Rationale	E-participation may not result in an underrepresentation of target groups in policy making.
Implications	– Co-ordination of online and offline activities.

Principle 7. Commitment of decision makers

Statement	Commitment of decision makers to contribute to or consider the results should be ensured from the beginning.
Rationale	Public participation is seen "as a process to make better decisions that incorporate the interests and concerns of all affected stakeholders and meet the needs of the decisions-making body." (IAP2) Leadership and strong commitment to the participation is needed at all levels, from politicians, senior managers and public officials. (OECD, 2001, p. 84)
Implications	– Assistance of decision makers in "being responsive to the public's concerns and suggestions" (IAP2)

Participation Principles. Participation principles settle the way how the participation objectives are to be achieved.

Principle 8. Presentation of participation possibilities and limitations in a comprehensible way

Statement	The possibilities and limitations of participation must be presented in a comprehensible way (Zebralog).
Rationale	The binding rules and procedures of the participation services must be clearly communicated in order to have a transparent participation procedure (KJR, 2013; Lindenberg, 2011; Ruesch & Märker, 2013). For example, citizens must be informed if final decision-making power rests with a political body (Ruesch & Märker, 2013). "The respective roles and responsibilities of citizens (in providing input) and government (in making decisions for which they are accountable) must be clear to all." (OECD, 2001, p. 85) It is necessary to "undertake and encourage actions that build trust and credibility for the process among all the participants" (IAP2).
Implications	– Integration of a description and/or visualisation of decision-making processes to argue the possibilities and limitations.

Principle 9. Careful and transparent design of participation services

Statement	The procedures of participation are to be planned carefully under consideration of possibilities and limits and be presented to the stakeholders in a comprehensible way (Darmstadt, 2015).
Rationale	Good participation needs time and trust between the actors (Darmstadt, 2015).
Implications	– Description of the participation services with topic of participation, deadlines, procedure of the participation, current status of political decision-making, envisaged use of participation results, existing limitations (Darmstadt, 2015).

Principle 10. High responsiveness of the participation services

Statement	The responsiveness of the EE team is high. The organising actors (administration, politics, moderation) consider themselves as an active part of participation services and respond to questions and suggestions (Zebralog) quickly.
Rationale	The participation timespan is limited. The same applies to the time of stakeholders. A bad responsiveness may limit the overall success of the EE.
Implications	– It must be ensured that a part of the team is available 24h, 7 days a week for responding to questions and suggestions. – Responsiveness of ICT must be high.

Principle 11. Easy access to participation

Statement	"The access to participation must be easy." (Ruesch & Märker, 2013). The access to the participation offer must have minimal technical, linguistic and structural barriers (Zebralog).
Rationale	"The channels of participation must be chosen according to the […] media habits" (Ruesch & Märker, 2013) of participants in order to not exclude particular target groups. The same applies for the language used.
Implications	– Multiple channels must be used for participation (OECD, 2001, p. 86). – Human, clear and straightforward language must be used (Lindenberg, 2011; OECD, 2001, p. 86).

Principle 12. Anonymous participation

Statement	The architecture is based on anonymous participation.
Rationale	Participation must be possible without providing real names or personal data (Lindenberg, 2011; Ruesch & Märker, 2013; Zebralog) as it should be possible to give an opinion without an identification (Lindenberg, 2011). Otherwise providers show that they distrust participants (Lindenberg, 2011).
Implications	– Technical mechanisms that are ensuring privacy.

Principle 13. Fair moderation

Statement	The participation procedure has a neutral moderation with defined and traceable competencies.
Rationale	A fair participation procedure has a neutral moderation with defined and traceable competencies (Zebralog). The participatory space should be "neutral ground" (Ruesch & Märker, 2013). A moderation can help ensure this (Ruesch & Märker, 2013).
Implications	– Team of neutral moderators

Principle 14. Neutral, comprehensible, traceable and timely provided participation results

Statement	Results are prepared in a neutral and comprehensible/traceable form and published timely (Zebralog).
Rationale	Results are to be prepared in a neutral form in order to represent the view of participants, not of the persons who write the summary or the owner of the project. Traceability needs to be ensured in order to establish the neutrality and correctness of results. Timely publication is necessary in order to keep the project and its result interesting and be in time for the political decision-making process.
Implications	– Ensure that results are prepared in a neutral manner e.g. by assign this to an external organisation. – Ensure that the results are prepared timely, by already planning this from the beginning and allocate resources. – Ensure traceability by providing technical means that allow participants to trace formation of results.

Principle 15. Continuous feedback is provided

Statement	Feedback on how results are used in political decision making is provided continuously.
Rationale	"Public participation communicates to participants how their input affected the decision" (Bonnemann, 2010). "Citizens must receive continuous feedback regarding how results are handled and the implementation process" (Ruesch & Märker, 2013). "Governments have an obligation to account for the use they make of citizens' inputs received – be it through feedback, public consultation or active participation." (OECD, 2001, p. 87) If necessary, barriers, obstacles and delays are to be clearly mentioned (KJR, 2013).
Implications	– "To increase this accountability, governments need to ensure an open and transparent policy-making process amenable to external scrutiny and review." (OECD, 2001, p. 87)

Principle 16. Timely implementation of decisions

Statement	The decisions must be implemented timely (KJR, 2013).
Rationale	If decisions are implemented timely, participation is experienced by participants (KJR, 2013).
Implications	– The participation process must be aligned with political decision-making processes.

Principle 17. Interactivity

Statement	The set up must be interactive (Ruesch & Märker, 2013).
Rationale	There must be interaction between participants and organisers Ruesch and Märker. The willingness of all parties to be part of an open dialog is necessary (Darmstadt, 2015, p. 9).
Implications	– Provide organisational and technical mechanism to support interaction between participants. – Ask parties for their consent in the e-participation in the beginning.

Principle 18. Participants can design or influence participation process

Statement	Public participation seeks input from participants in designing how they participate (Bonnemann, 2010; Darmstadt, 2015; Lindenberg, 2011).
Rationale	By participating in the design of the participation procedures, the acceptance can be encouraged. Good participation is not only organised top-down but also bottom-up (Darmstadt, 2015).
Implications	– Bring in stakeholders in the planning of the participation procedures.

Principle 19. Public relations

Statement	The participation services will be promoted actively and cross-media so that the target group has a realistic chance to get informed about it (Zebralog). Promotion activities are to be recorded (Zebralog).
Rationale	Only the active promotion of the service can ensure that target groups are reached and the participation is more representative.
Implications	– Promotion activities will use different channels and media. – Resources (financial, personal) are to be planned and provided for actively promotion – Organisational and technical mechanisms to record promotion activities are to be provided.

Principle 20. Compliance with law

Statement	The services will be implemented in compliance with relevant laws, policies and regulations as e.g. data and privacy protection laws.
Rationale	Participation is to abide by relevant laws, policies and regulations.
Implications	– Identifying and studying relevant laws, policies and regulations for their influence on the project. – Educating project members on these laws.

Data and Information Principles. Data and Information principles include the following principles described in TOGAF 9.1: Principle 10: Data is an Asset, Principle 11: Data is Shared, Principle 12: Data is Accessible, Principle 13: Data Trustee, Principle 14: Common Vocabulary and Data Definitions and Principle 15: Data Security (TOG, 2011a, pp. 243–247). In addition, the following principles are applicable:

Principle 21. Information on the topic

Statement	Comprehensible information will be provided on the topic of policy making.
Rationale	The "disclosure of all information relevant to the public's understanding and evaluation of a decision" (IAP2) should be encouraged in order to ensure that all citizens […] have equal treatment when exercising their rights of access to information and participation" (OECD, 2001, p. 86). Hence, "information provided by government during policy making should be objective, complete and accessible" (OECD, 2001, p. 86).
Implications	– The information needs to be processed for different target groups.

Principle 22. Data minimisation applied to user data

Statement	Minimisation principle when user data are collected (Scherer & Wimmer, 2015).
Rationale	In correspondence with laws and regulations (e.g. the Telemediengesetz[78]), only information necessary for the participation are questioned. Information collected in interest with the participation process must be balanced with the against the need to restrict the availability and access to data.
Implications	– This principle includes that the user is informed about how data are used. It must be ensured that a privacy statement is easily accessible by the users to every time. – To inform users about data use, the explicit agreement to a privacy statement is required.

Principle 23. Data minimisation applied to information

Statement	When system information are provided, it must be balanced between the usefulness and the best possible support of users and the protection against attacks (Bundesamt für Sicherheit in der Informationstechnik (BSI), 2006, p. 2).
Rationale	It is recommended to provide only that information necessary for the application. Any further information could provide unnecessary starting points for attacking the web application (BSI, 2006, p. 2).
Implications	– Registration data are to be minimalised.

E-Participation Principles. E-participation principles include the following application principles described in TOGAF 9.1: Principle 16: Technology Independence (TOG, 2011a, p. 247) and Principle 17: Ease-of-Use (TOG, 2011a, p. 248) and the following technology principles TOGAF Principle 18: Requirements-Based Change. TOGAF Principle 19: Responsive Change Management, TOGAF Principle 20: Control Technical Diversity, and TOGAF Principle 21: Interoperability (TOG, 2011a, pp. 248–250). In addition, the following principle is applicable:

Principle 24. Accessibility according to WAI guidelines

Statement	The user interface must be accessible according to guidelines of the Web Accessibility Initiative[79] (WAI).
Rationale	Participation may not exclude particular target groups.
Implications	– Depending on the type of application and user interface, Web Content Accessibility Guidelines (WCAG) and Accessible Rich Internet Applications (WAI-ARIA) are applicable.

6.4.2 Implementation & Governance View

No reference models can be provided as they are to be adapted specifically to the organisation of the EE. However, the following example for the Risks Mitigation Strategy Catalogue shows some risks of the e-participation tools (Table 48).

[78] http://www.gesetze-im-internet.de/tmg/__13.html (last accessed 2015-04-01)

[79] http://www.w3.org/WAI/guid-tech.html (last accessed 2015-04-01)

Table 48. Examples for risks affecting the platform (Schepers & Holzner, 2008, pp. 13–14)

Risk	Potential impact	Mitigation strategy
Breakdown of the server	See R17	Choose a supplier, who offers high system stability
Low usability, non-compatibility of different browsers (Platform might not run properly on some browsers)	Frustration among users will lead to low user numbers	Build the platform on an established tool/technology, efficient development of alpha, beta, and final versions avoid serious mistakes, tests on different operating systems and browsers ensure compatibility
Data theft	Trust in platform will be undermined	Use of different encrypting protocols and firewall ensures security of the platform. Secure password handling. Users do not specify security-relevant data. Back-up procedures are established.
Hacking/spam attacks	Effective functioning of the platform impeded	Use of different encrypting protocols and firewall shields platform files from alterations or code theft. Secure password handling.

6.4.3 Participant View

a) Role Catalogue

Table 37. Overview of stakeholders (p. 134) in Section 6.2 (see Table 37) serves as reference Role Catalogue. The role catalogue indicates different stakeholders, which can serve as roles in an EE.

b) Participant Onion Diagram

Participation architects need to derive the Participant Onion Diagram for the particular e-participation. The participation analysts can base the participant onion diagram on the *Role Catalogue* and identify a stakeholder/actor or organisation for each role. The Reference Participant Onion Diagram proposes a classification for roles. The involvement of actors need to be detailed in the participant catalogue.

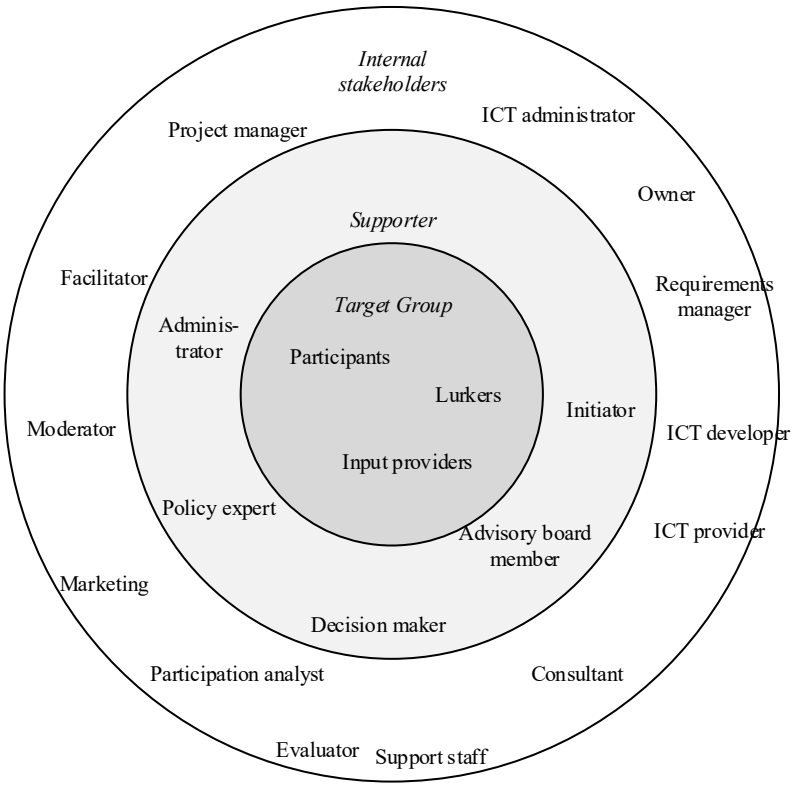


Figure 35. Reference Participant Onion Diagram

c) Stakeholder Engagement Catalogue

A reference Stakeholder Engagement Catalogue cannot be provided as a reference point because it needs to be adapted to the specific EE and its objectives.

6.4.4 Participation View

a) Participation Schedule

The following pace is provided as a reference for the process defined later on in this subsection.

Start: The draft policy is submitted.

1 month: The proposals by administrations are prepared and uploaded to the e-participation platform.

2 months: The proposals can be commented by participants and the participants can create new proposals.

3 months: The voting procedure starts, when participants can vote for proposals.

3,5 months: The leader board is created.

4 months: The results are summarised in an improved policy and submitted to the decision makers.

b) Event Catalogue

An Event Catalogue cannot be provided as a reference point because it needs to be adapted to the specific EE.

c) Participation Planning Matrix

The reference Participation Planning Matrix is visualised in Table 44

Table 49. Reference Participation Planning Matrix (adapted from Acland, 2008, p. 26)

Product/Data *What is the input?*	Draft policy	Background information	Background information			
Product/Data *What will be produced?*		Proposals by Administrations	Proposals, Commented proposals	Vote	Proposals leader board	Improved policy
People *Who will be engaged?*		Administrations	Citizens, Administrations	Citizens	Facilitators	Facilitators
Decision-making *What stage is relevant at this date?*	When the draft policy is submitted.					Before decision-making
Process *What techniques/ methods will be used?*		Submission of proposals, Fact sheets	Submission of proposals, Comment proposals	Voting	Evaluation of voting	
Resources *What resources are needed for what?*	Summarise policy		Depending on the number of participants and proposals		Depending of the number of proposals	
Pace *When will it happen?*	Start of participation		1 month	…	…	End of participation

d) Objective/Participation Service Diagram

Figure 36 shows the reference Objective/Participation Service Diagram.

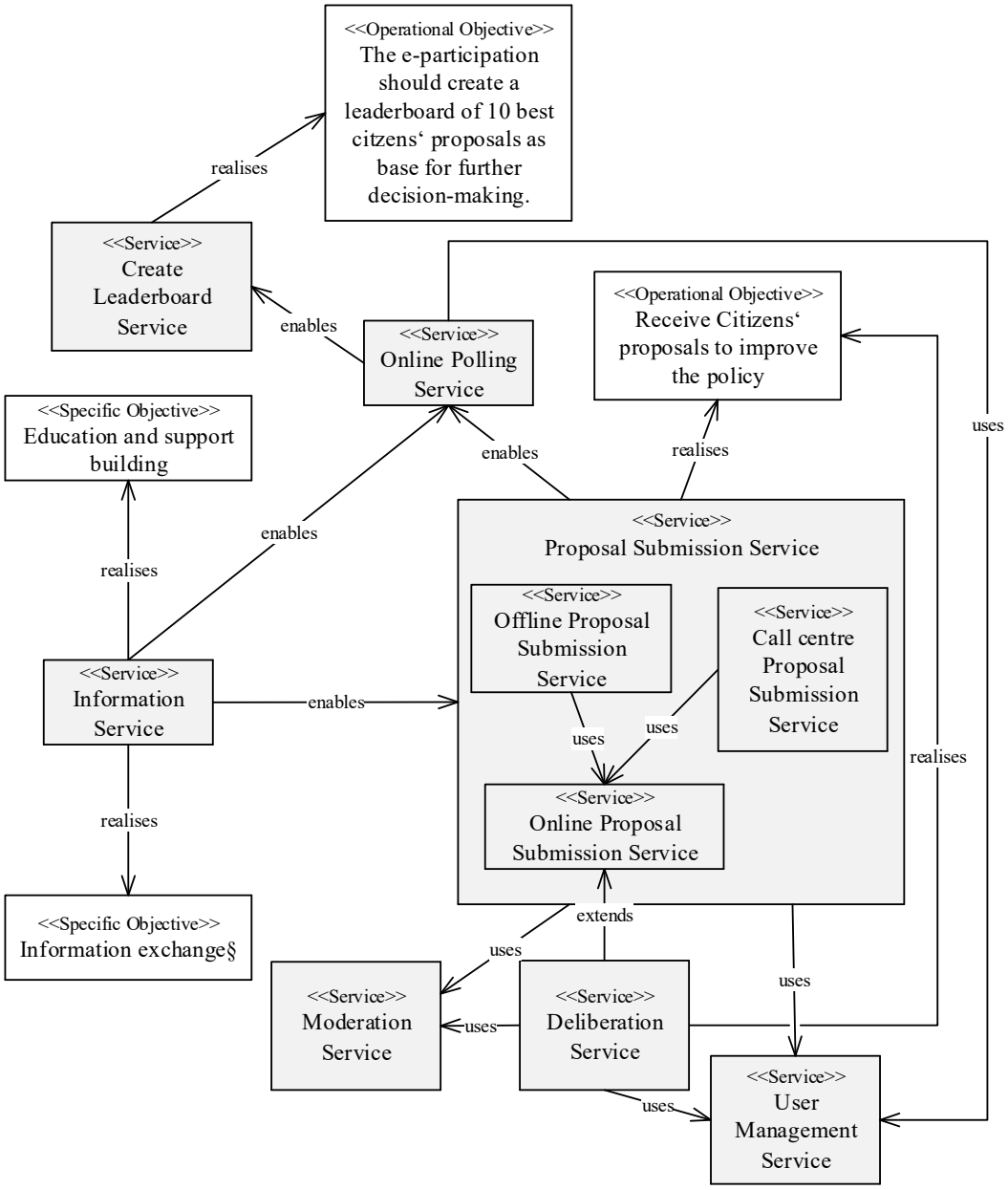


Figure 36. Reference Objective/Participation Service Diagram

e) Participation Service Catalogue

Table 50 presents the reference Participation Service Catalogue.

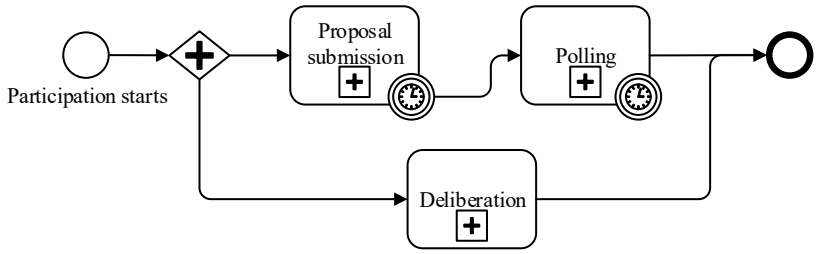
Table 50. Reference Participation Service Catalogue

Name	Description	Channel	Input	Output
Information Service	The service is used to inform the stakeholders on the policy, the aims of the e-participation, the results of e-participation etc.	Internet, Events, Call centre	Information on policy, e-participation objectives and procedures, as well as guidelines	Informed stakeholders
Proposal Submission Service	The service enables the stakeholders to deliberate on the policy and commonly develop ideas.	Internet, Events, Call centre, Letter	Information	Proposals
Call centre Proposal Service	The service enables stakeholders to submit proposals per telephone call.	Call centre	See Proposal Submission Service	
Online Proposal Submission Service	The online information service provides ICT tools to allow stakeholder to inform via the internet.	Internet	See Proposal Submission Service	
Offline Proposal Submission Service	During official consultation hours e.g. offered by the owner, stakeholders are able to inform about the project and have a view on documents. Consultation hours can take place offline and/or online. They should provide the possibility to stakeholders to hand in proposals. It is also possible to hand in services by letter. Events are not only used to inform stakeholders but also to provide them the possibility to participate with proposals.	Events, Letter	See Proposal Submission Service	
Deliberation Service	The service enables the stakeholders to deliberate on the proposals and commonly develop ideas.	Internet	Information, Proposals	Comments to proposals
Online Polling Service	The service enables the stakeholders to vote on the proposals	Internet	Proposals	Rated proposals
Moderation Service	The service ensures to remove any undesired content based on the participation principles.	Internet	Proposals, Comments, Participation Principles	Removed undesired contents
Prepare leader board service	The service creates the leader board of best ranked proposals to be given to decision makers.	Internet	Rated proposals	A leader board of 10 best voted proposals
Registration Service	The service handles user registration	Internet	Participation principles, E-participation principles, Participant principles	Registered users

f) Process Flow Diagram

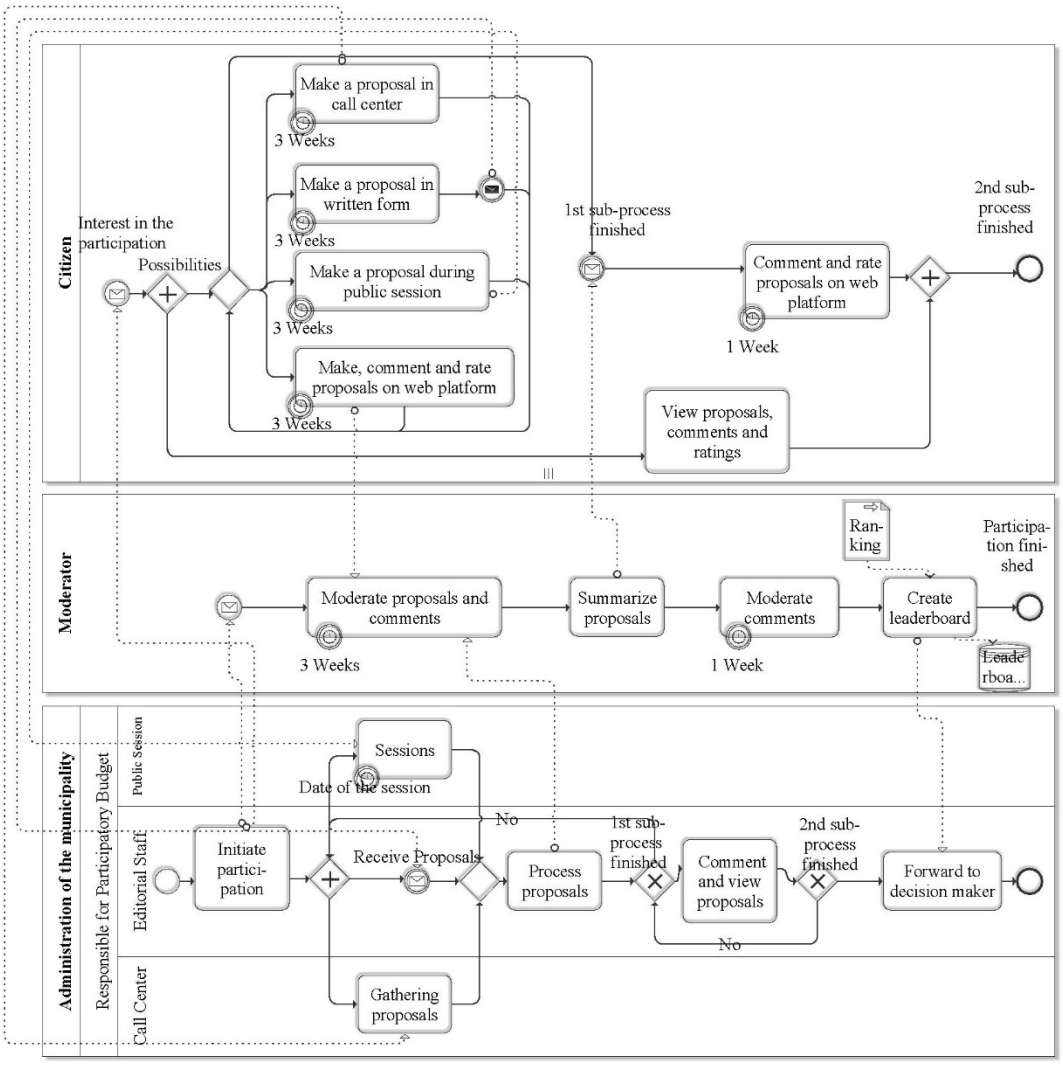
Figure 9 (p. 57) sketches activities of the traditional and participatory budgeting process, which can be used as a reference Process Flow Diagram for this participation area. The participation process can be built on the reference Process Flow Diagram in Figure 37. It

shows a two stage participation process consisting of 1) an input provision phase in which stakeholders can submit proposals to a given policy (Proposal submission) and 2) a polling process where stakeholders can vote on proposals (Polling). Figure 38 shows the details.



Legend: BPMN 2.0 diagram.

Figure 37. Reference Participation Process Flow Diagram (Overview)



Legend: BPMN 2.0 diagram.

Figure 38. Reference Two-Stage Participation Process (Detail)

6.4.5 Data & Information View

a) Data Entity/Data Component Catalogue

Based on the vision, ten relevant data entities exist (Table 51).

Table 51. Reference Data Entity/Data Component Catalogue

Name	Description	Type	Data Component
User	Information on the user	Operation data	User data
User group	Information on the user groups	Operation data	User data
Stakeholder proposal	A solution proposed by a stakeholder	Participation input	Participation data
Administration proposal	A solution proposed by an administration.	Participation input	Participation data
Vote	A pro or contra vote for a proposal. Each registered user has one vote per proposal. Votes are anonymised.	Participation input	Participation data
Proposals leaderboard	List of 10 best voted proposals.	Participation output	Participation data
Draft policy	Current draft of the policy.	Participation topic, legal text	Policy data
Background information on the policy	Detailed or more information on the policy.	Participation information	Policy data
Data protection and privacy rules	Information for stakeholders on data protection and privacy rules.	Participation rule	Participation rule data
Participation guideline	Information describing how one can participate.	Participation rule	Participation rule data
Moderation principles	Merging of similar proposals, moderation and dialogue rules	Participation rule	Participation rule data
Event overview	A calendar overview of important events.	Participation information	Policy data
Comment	A comment can be given to a particular proposal or comment.	Participation input	Participation data

b) Data Entity/Role Matrix

Table 52 shows the reference Data Entity/Participation Service Matrix

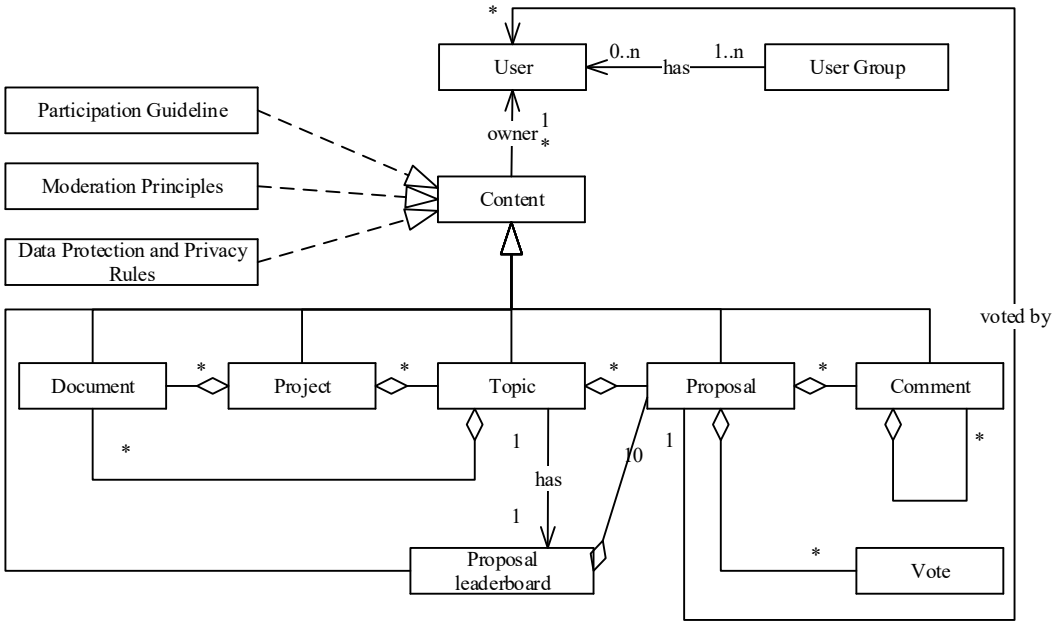
Table 52. Reference Data Entity/Participation Service Matrix

Note. C: create, U: update, R: read, D: delete

Participation Service / Data Entity	Input provider (registered user)	Lurker (unregistered user)	Administrator	Moderator	Administrator
Own user	CURD			CUR	CUR
Other users	R		CURD	R	R
User group			CURD		
Content			CURD	CURD	CURD
Proposal	CR	R	CURD	CURD	CR
Vote	C				
Proposals leaderboard	R		CURD	CURD	R
Draft policy	R		CURD		CURD
Event overview	R		CURD	CURD	
Comment	CR	R	CURD	CURD	CR

c) Conceptual Data Diagram

The Conceptual Data Diagram describes data entities (Figure 39). The data entities of the e-participation can be a document a project or a topic within a project. User access rights are managed on the user group level. Participation Guideline, Moderation Principles, and Data and Protection and Privacy Rules are necessary documents as defined earlier and instantiations of the Content.



Legend: BPMN 2.0 diagram.

Figure 39. Reference Conceptual Data Diagram

6.4.6 E-Participation View

The Application Components of the reference architecture mainly consist of an e-participation platform with a web application server and a database.

a) Application Use Case Diagram

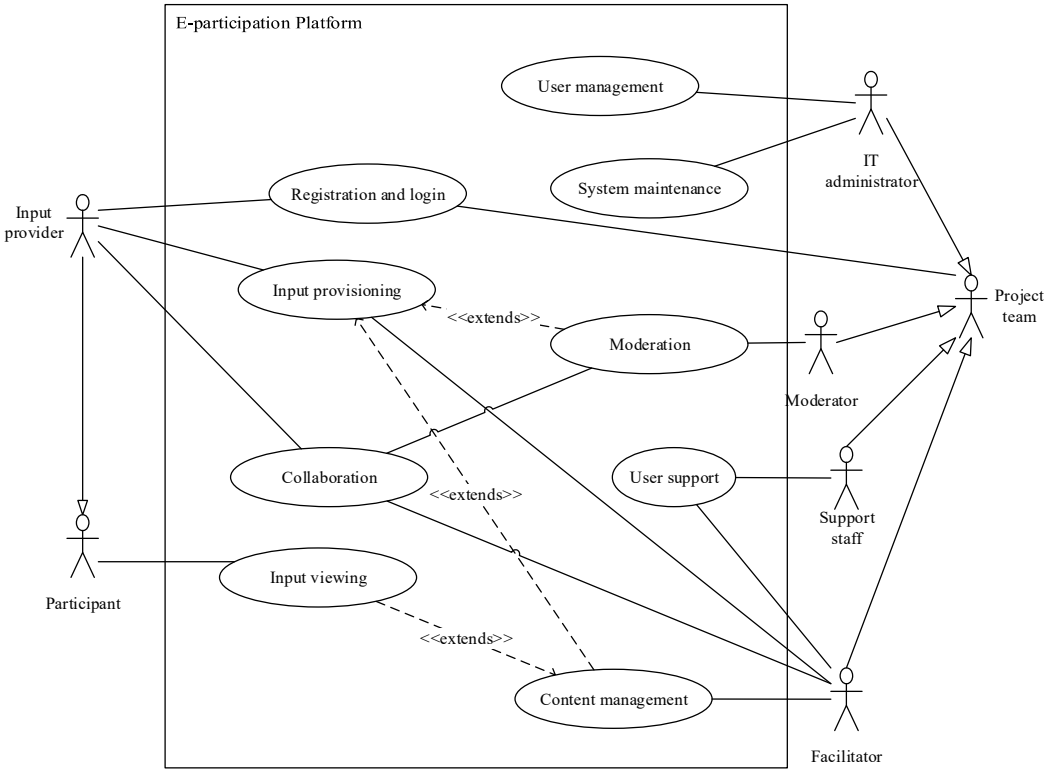
Through marketing activities, potential participants may have gained interest in the e-participation platform. To ensure sustainable participation of target groups, careful selection of adequate tools is important. Without a need to register, interested parties should have access to a large pool of detailed information on current legislative affairs in policy making and the possibility to view ongoing debates and statements by politicians. Important is to speak the language of the participants: i.e. using simple paraphrases and considering regional languages.

If citizens want to get involved in debating, they should not necessarily need to create a user account. Most of the informative and participative areas of the site are to be open to everybody. Citizens shall be able to give their opinion on policy issues under discussion, and they shall easily connect to the policy-makers through the platform's participation portal. Functionalities, which can be offered are:

- Citizens can give their views on the topics launched by policy-makers and directly interact with them, e.g. via discussion fora, comment functionality, chat features or in social networks.
- Citizens can participate in opinion polls.
- Citizens will be able to request the inclusion of different issues in the policy under discussion. This can be achieved in two separate ways: directly (through online petitions) or indirectly (by the semantic interpretation of their comments in forums and other similar tools).
- Citizens will have the option to communicate and collaborate around services (for example to draft a petition before publishing it on the website).

– A calendar function alerts citizens about events in their region as well as on upcoming legislative issues.
– Moderators and content administrators have to be supported in summarising conclusions of discussions in a simple and effective way.

Information is usually open for all stakeholders without limitations. This circumstance might differentiate if participation is limited to particular target groups such as a smaller group of citizens. Information channels are ICT tool, press, and event. For each channel particular use cases exist



Legend: UML use case diagram.

Figure 40: Reference Application Use Case Diagram

Input providers have the opportunity to submit proposals via different channels as described earlier. Support staff notes such proposals and adds them to the e-participation system. It is possible to create a proposal, to comment existing proposals and to vote on proposals. Each user has one vote per proposal; voting is anonymised. The e-participation tools provide information via the internet. The facilitators submit information the e-participation tools. The main participation entry is a web CMS. First, facilitators choose the location to upload new content. They define a title, a description and create the content in a WYSIWYG[80] editor. After the content is available, it can be saved by clicking a button. As long as the content is not published, it is only visible for facilitators.

[80] What You See Is What You Get

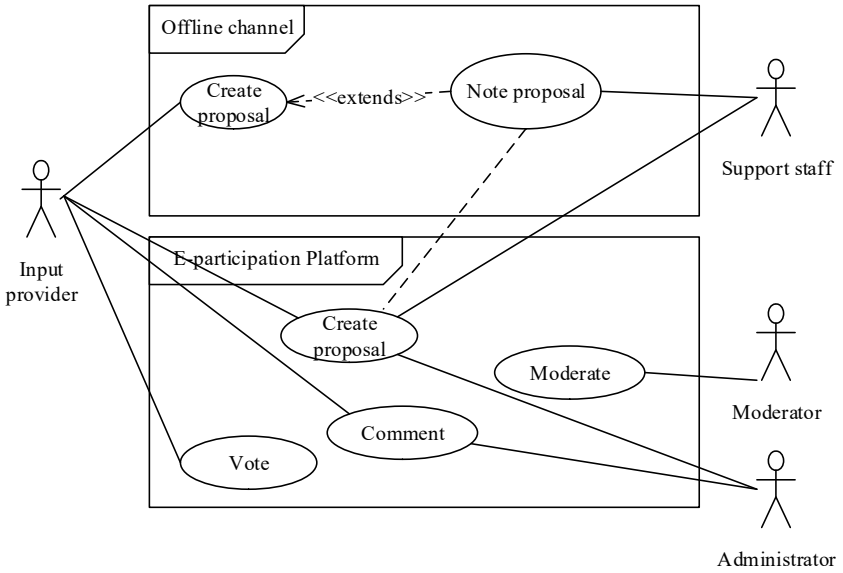


Figure 41. Reference Application Use Case diagram for Participation Services

Detailed requirements for these use cases need to be integrated in the catalogue of reference requirements.

b) Requirement Catalogue

The requirements management phase (see Section 7.7) identifies, prioritises and decides on requirements. The evaluation phase looks if requirements are fulfilled. Hence, a consistent documentation of requirements is necessary as done in the requirements catalogue of the E-Participation Viewpoint. This passage proposes a number of requirements to be usable for e-participation. The reference requirements catalogue is not meant to be complete or a universally valid list of requirements for e-participation tools. It is to be understood as a starting point from which an EE can start further elaborations. The requirements are derived from different sources as follows:

– Involvement in several e-participation included the identification of ICT requirements as documented in different publications and project reports (Agnoloni et al., 2009; Bicking et al., 2010; Scherer et al., 2008; Scherer et al., 2009c; Scherer et al., 2011)
– An analysis of risk potentials and security requirements to increase trust in e-participation (Scherer & Wimmer, 2015)

The catalogue differentiates between functional and non-functional requirements. They are categorised according to the services defined in the Participation View.

User management service. This use case covers the functional e-participation tools requirements starting from user registration over login to remove of accounts. Users start registration when they want to actively participate in and contribute to the e-participation. Type and extent of registration data depend on authentication and data minimisation principles. The requirements need to consider Principle 12. Anonymous participation, Principle 22. Data minimisation applied to user data.

Table 53. Registration and login requirements

ID Name	Description
Login	The ICT system must provide e-mail and password login. After registration, members can login each time they wish to use the site to take part actively. For login users give their email and password. E-mail is preferred to user name because otherwise the users need to recall also the user name they have used.
Single-sign-on	The ICT system must provide single-sign-on to all integrated participation offerings.
Personalised profile	The ICT system must include personalised profiles with information about the user. This requirement does make no sense for anonymised participation offers.
Privacy statement	The ICT system must provide a privacy statement. The privacy statement must be linked in the user profile.
Agreement to privacy statement	The ICT system must ask the user to agree to the privacy statement during registration.
Removable account	The ICT system must provide a 'remove my account' button in the user profile: If registered users want to delete their profiles, they must be able do this in the system. If the users are logged-in, they need to press the 'remove my account' button and confirm their decision afterwards to remove the profile. It is necessary to define a strategy, which describes what happens with content created by the user. The EE needs to agree on this strategy. The e-participation tools need to publish the strategy.

System administrators are responsible to manage the users and their rights in the ICT system. User management is done by roles. Roles can be assigned to user groups for particular areas or entities in the ICT system

Table 54. User and rights management requirements

ID Name	Description
User and rights management	The e-participation tools must functionalities to manage user rights based on user groups.
User groups	User and rights management functionalities include to create, maintain, and delete user groups as well as edit access rights for user groups as well as to organise users in groups.
Users	User and rights management functionalities include the functionalities to create, update, find, lock, unlock, and delete users as well as edit access rights for users.

Information Service. One importance functionality of ICT systems in e-participation is content management. Accordingly, web content management systems (WCMS) are often used in e-participation as they already provide most of the necessary functionality (Scherer et al., 2011). A detailed requirements catalogue for WCMS in governmental area is e.g. provided by United States Federal Government Agency (2009). Users should be able to see at least some information without registration (Table 55). To support transparency, the participation inputs provided should also be freely available. Most Web CMS support these functionalities and as such they are considered e.g. in the requirements catalogue provided by United States Federal Government Agency (2009). Relevant principles are Principle 21. Information on the topic

Table 55. Input viewing requirements

ID Name	Description
View information	The e-participation tools provides information without the need for registration and login.
Search functionality	The e-participation tools includes a full text search engine. The user can select how many search results they want to see at one result page.
Filter functionality	The system includes a filter for particular content types.

Online Participation Service. An input provider actively participates by providing input in the form of contents to the e-participation. The ICT system can provide different functionalities as to comment content, rate, or poll for ideas. These functionalities have to be associated with concrete objectives (see Design phase). The following input provisioning requirements provide examples describing comment, rate, and poll functionalities (Table 56). However, the requirements do not only regard the technical tools. There need to be requirements corresponding to the participation principles.

Table 56. Input provisioning requirements

ID Name	Description
Comment functionality	The e-participation tools must provide a commenting functionality: Authorized users (e.g. facilitator in case of the scenario generation) can decide whether the content in the system can be commented upon. Commenting should have always the same style, does not matter what is commented. Users are able to comment most of the sources within the system.
Poll functionality	The ICT system must provide a polling functionality. "To feature this functionality, the WCMS must be able to integrate a survey which can be answered by click, by a free answer or by choosing a given answer. "

Deliberation Service. Based on the participation architecture developed, the ICT system should include different collaboration functionalities. Online meetings and chats, moderated discussion forums, e-mail delivery, notifications, calendars, blogs, wikis, and newsletter delivery are popular functionalities (Table 57) in e-participation (Tambouris et al., 2008).

Table 57. Collaboration requirements

ID Name	Description
Online meetings and chats	The e-participation tools must integrate online meetings and chats. "This functionality requires the possibility, to integrate a chat program. Further on, there has to be the possibility to hold a video conference."
Moderated discussion forum	The e-participation tools must include a moderated forum. "Discussion is about providing forum functionalities. Therefore we have to differentiate between moderated and not moderated forums. The discussion forum needs to be customisable in order to support needed functionalities. Multiple instances of a forum means that several forums are possible in the CMS. Rating of contributions and contributors is important for the analysis of discussions."
E-mail delivery	The e-participation tools must allow specified users to send e-mails to all or particular users.
Notification	The e-participation tools must provide a notification functionality using different channels. Users should be able choose how often they want to receive notifications.
Calendar	The e-participation tools must include a calendar. "The calendar should provide different views, like a daily, weekly and yearly diagram. There should also be an import and export function. This function will afford the ex-change of appointments with local calendar programs like outlook."
Blogging	The e-participation tools must include a blogging functionality and allow assigned users to blog contents.
Wiki	The e-participation tools must include a wiki functionality.
Newsletter delivery	The system must provide a functionality that allows users to register with e-mail to a newsletter and to send newsletters to these registered users. The system must allow users to cancel their registration.

Non-functional requirements. Non-functional requirements consider integrity, originality, authenticity, trustworthiness, reliability, availability, privacy, transparency, moderation, fairness, moderation, multilingualism, usability, accessibility, response time, and device (Table 58).

Table 58. Non-functional requirements

Name	Description
Integrity (manipulation)	The offering must be internally coherent and trustworthy. It must not be tampered with by third parties.
Integrity (data use)	Dealing with the participation data, personal data and the information provided must be integer (i.e. precautions to prevent manipulation and loss must be implemented).
Originality (user registration)	Multiple registration of the same actor must be prevented.
Originality (software bots)	Registration and participation by software bots must be prevented.
Originality (copying user data)	Plausibility tests must prevent that participation data are copied several times in the system.
Authenticity (identity)	The authenticity of the identity of users must be able to be checked. This requirement must be checked with participation principles. If anonymous participation should be allowed, this requirement is not applicable. Also usability needs to be regarded.
Trustworthiness (personal data)	The system must keep personal data collected confidentially. Third parties cannot tap it.
Trustworthiness (personal opinions)	Personal settings/opinions of individual participants to political contents cannot be evaluated and cannot be taped by third parties.
Trustworthiness (participation data)	Allocation of participation data to users may only be applicable to review participation rules. Data security and privacy rules must be strictly adhered to.
Trustworthiness (detail data use)	During registration, it must be declared transparent whether, and if so, what evaluations are carried out with personal data mappings. This information must be on the participation platform to every time.
Reliability	The e-participation tools must be highly available during participation phase (e.g. 99.9% failure).
Availability (denial of service)	The e-participation tools must be protected against denial-of-service attacks.
Privacy (law)	Applicable data protection laws are to be observed.
Privacy (minimisation)	Principle of data minimisation is to be applied.
Privacy (user account)	The sovereignty over its own account and the data provided must remain with the user.
Transparency (registration)	Registration procedures and participation conditions must be disclosed and explained user-friendly.
Transparency (participation)	The services must make clear how participation results are considered in the policy-making process.
Transparency (feedback)	The services must provide feedback to the users how participation results have been used.
Transparency (evaluation)	The evaluation procedures of the participation must be clearly explained and disclosed.
Moderation (rules)	The participation offer must have clear and easy to understand moderation rules.
Moderation (comprehension)	Interventions by the moderation must be comprehensible and transparent.
Falsified information	The system must prevent opinion manipulation by third parties based on falsified information by protective measures. Quality assurance and ICT security measures must prevent dissemination of false and unlawful content.
Fairness	The services must implement participation process fair and equitable (balanced).
Multilingualism	The services must support different languages if the target groups speak different languages.
Usability	Users with no computer experience must be able to use the system without training courses.

Accessibility	The user interface must be accessible according to guidelines of the Web Accessibility Initiative81 (WAI). Depending on the type of application and user interface, Web Content Accessibility Guidelines (WCAG) and Accessible Rich Internet Applications (WAI-ARIA) are applicable.
Response Time	The client user interface should be responsive to users when the bandwidth is low.
Device	The e-participation tools must be usable with the following devices and operating systems: <list to be included>.

c) Application/Participation Service Diagram

Figure 42 shows the reference Application/Participation Service Diagram. It indicates which application components realise which participation services

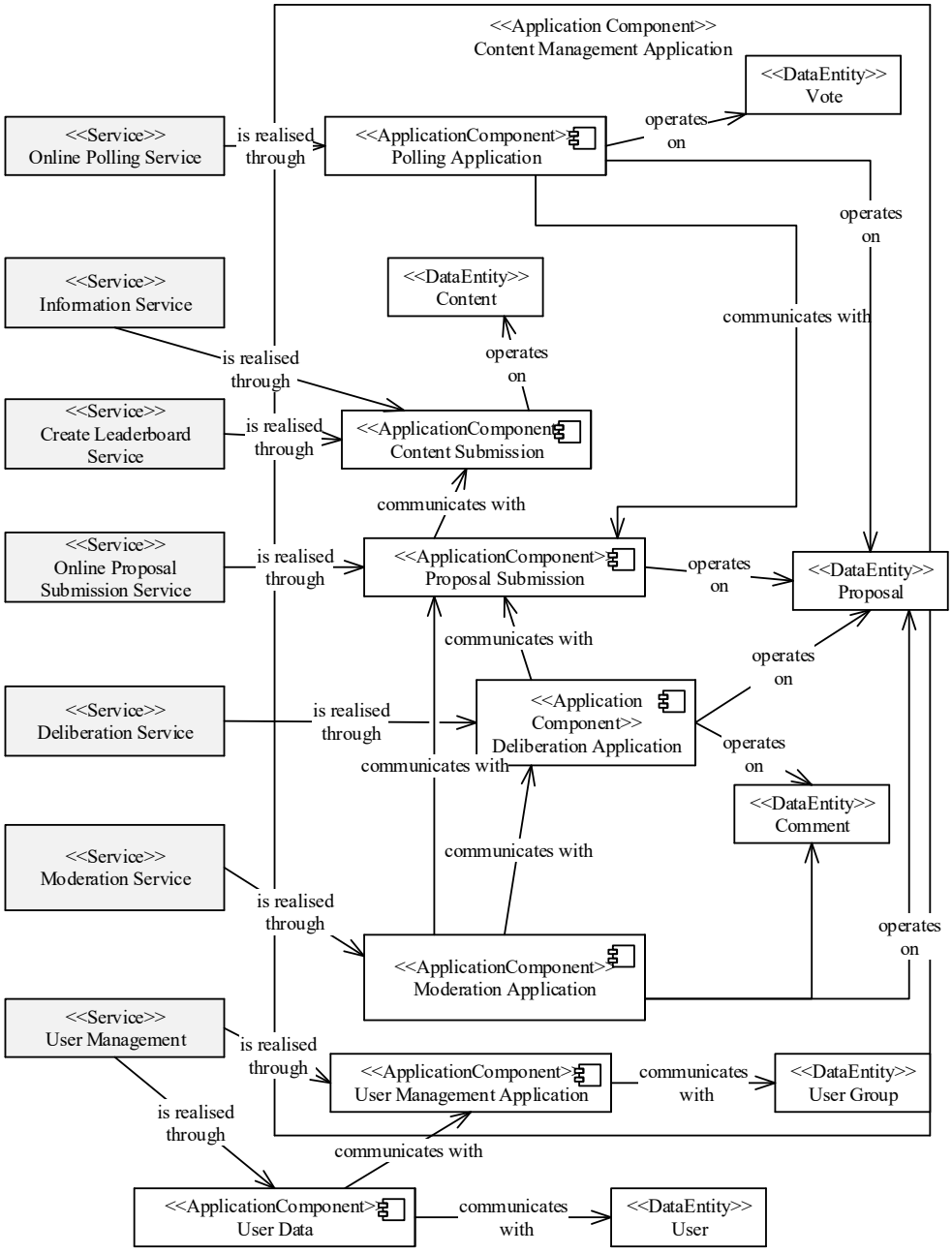


Figure 42. Reference Application/Participation Service Diagram

[81] http://www.w3.org/WAI/guid-tech.html (last accessed 2015-04-01)

d) Application/Technology Diagram

An Application/Technology Diagram is not provided as a reference point because it needs to be adapted to the specific EE. However, Figure 43 presents an example Application/Technology Diagram. For example, this architecture seperates the user data from the participation data to ensure the anonymity of participants.

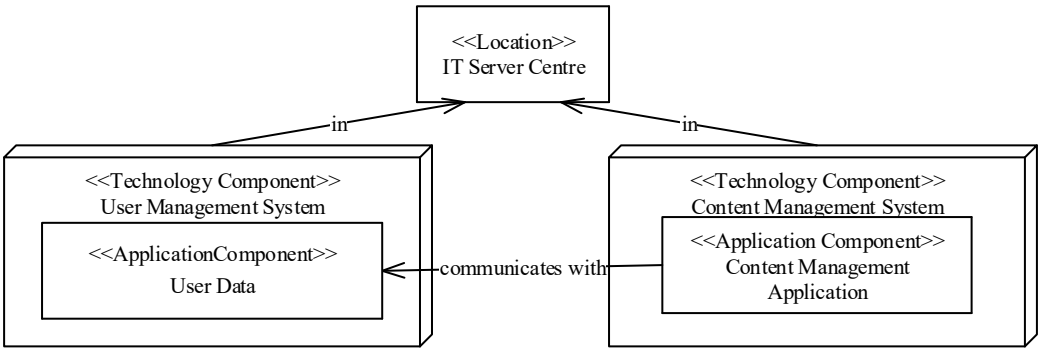


Figure 43. Example Application/Technology Diagram

Before this chapter concludes, the next section exemplifies the EPART-Framework with an instantiation of its components.

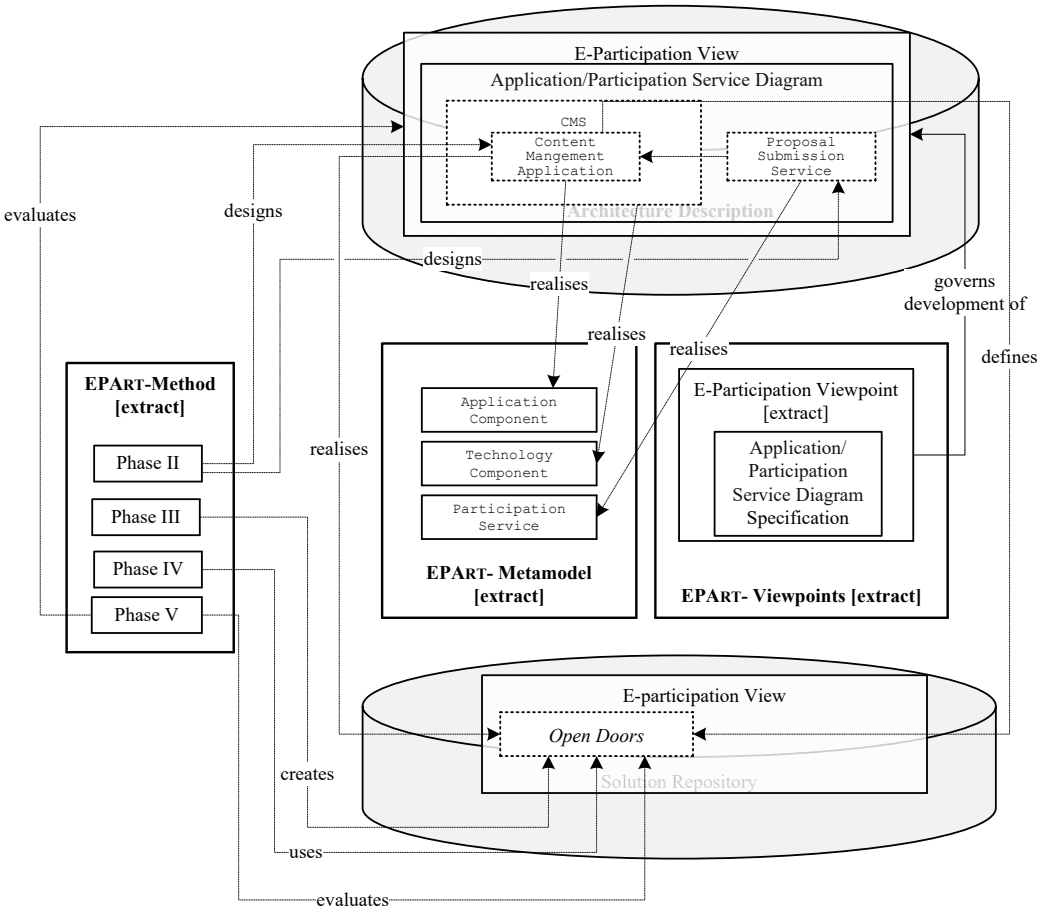
6.5 Exemplary Instantiation

In order to support the applicability of the EPART-Framework, this section demonstrates how an architecture description and a solution repository can look like. The example uses three EPART-Metamodel entities (`Application Component`, `Technology Component`, and `Participation Service`). An overview of the whole example is provided in Figure 44. The example is based on the EPART-Reference models. Hence, it shows the state of an EE, which aims to provide a participation service to citizens that enables them to submit proposals for improving an existing policy.

The example focusses on *Phase II. Design* (*Activity II-6. Design e-participation architecture*, see p. 189). It expects that the Architecture Description includes the architecture models of the other viewpoints. Accordingly, the design of the `Proposal Submission Service` is there. During *Activity II-6*, the e-participation engineering team designs the appropriate e-participation tools to support the services. The E-Participation Viewpoint provides them a view on the architecture models. In the example, they design an e-participation architecture consisting of a `Content Management Application` to realise the service, which is part of a `Content Management System`. These architecture instances realise entities defined in the EPART-Metamodel. The Application/Participation Service Diagram models the links between the `Proposal Submission Service` with the `Content Management Application`. The Requirements Catalogue and the Application Use Case Diagram specify the functionalities.

During Phase III (*Activity III-1. Implement application and technology components* and *Activity III-4. Set up the e-participation tools,* see p. 192ff) the ICT developers produce these components, either by programming or by purchasing them. In the example, the Open

Source CMS OpenDoors[82] realises the `CMS Technology Component`. The solution, which is configured for set-up, is stored in the Solution Repository. During Phase IV, the e-participation tools use this solution. Phase V evaluates the solutions with designed components.



Legend: The dotted lines indicate the examples. Solid lines show components or entities of the EPART-Framework.

Figure 44. Exemplification of the EPART-Framework

After introducing the EPART-Framework with the EPART-Viewpoints and the EPART-Reference models in this chapter, the following chapter moves on with an introduction of the EPART-Method. The EPART-Method guides the application of the EPART-Framework to develop the architecture artefacts as well as solutions and carry out and evaluate the participation.

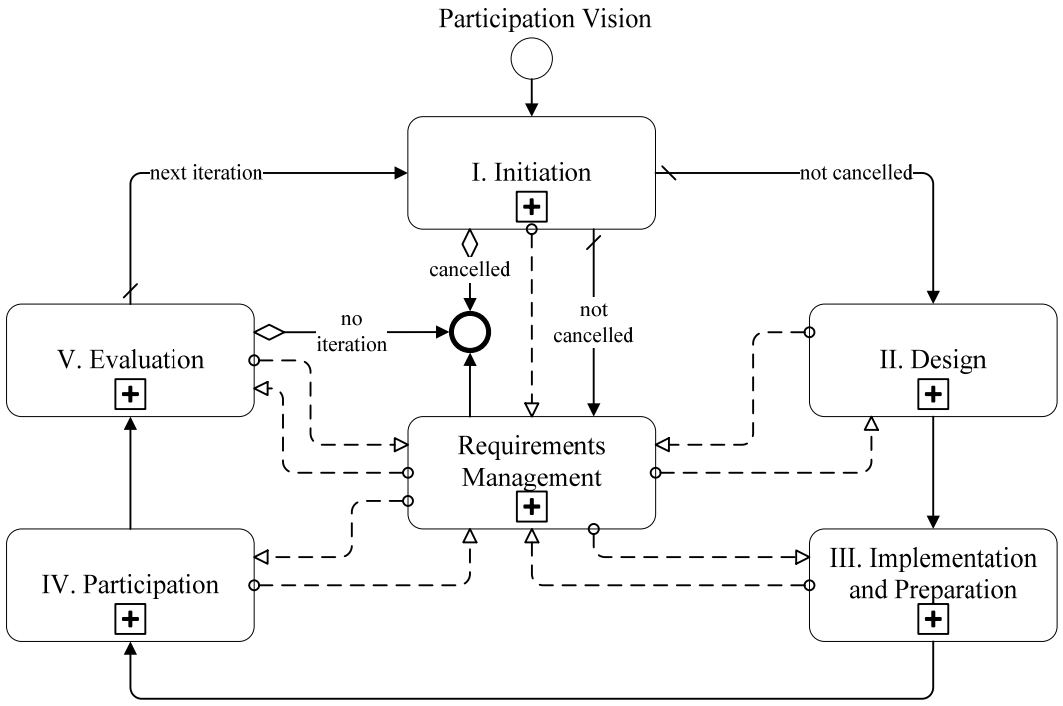
[82] https://www.opendoors.de/ (access 2016-05-20)

7. The E-Participation Design & Implementation Method

This chapter introduces the EPART-Method, which purpose is to guide the procedure for approaching and accomplishing e-participation based on the EPART-Framework. It structures and guides (i) the EEA design and operation as well as (ii) the design, implementation and evaluation of the e-participation services. The chapter starts with an overview of the EPART-Method in Section 7.1: the phases of the method and their interrelationships, the outputs and the stakeholders. Section 7.2 – Section 7.7 describe the phases of the EPART-Method in detail.

7.1 Overview

The EPART-Method starts when the Participation Vision and a need to provide e-participation services to realise the vision, emerges. The method comprises five main phases (Figure 45).



Legend: BPMN 2.0 process diagram.

Figure 45: EPART-Method cycle.

Phase I. Initiation starts the e-participation by defining the models of the *Participation Scope Viewpoint* and clarifying the feasibility of e-participation to achieve its objectives (*Implementation & Governance Viewpoint*). Phase I can result in cancelling the whole endeavour when the owners cannot ensure its feasibility in a meaningful way; for example,

the participation could be meaningless, it cannot reach the expected impact or that the necessary resources are not available. *Phase II. Design* selects and plans the participation techniques and activities with the models of the *Participation Viewpoint,* and the e-participation tools with the models of the *E-Participation Viewpoint*. *Phase III. Implementation and Preparation* implements the ICT solutions, prepares relevant documents, participation and marketing activities and creates the set-up for the participation services. *Phase IV. Participation* carries out the participation activities, informs and engages the participants, forwards the participation result to the decision makers and summaries the outcome and impact. *Phase V. Evaluation* compares the impact, outcomes, and outputs of the EE with the principles and objectives defined in the *Participation Scope Viewpoint*. Continuous *Requirements Management* accompanies these phases: objectives definition in Phase I, requirements specification in Phase II, implementation and preparation based on requirements in Phase III, participation based on requirements and objectives in Phase IV and documentation of realisation plus evaluation of results against the requirements in Phase V. The EPART-Method is supposed to be *iterative*, i.e. results from Phase V are used for Phase I of the next cycle to ensure the sustainability of the EE and the e-participation. Moreover, although the phases and activities are shown as sequential, there are iterations within and between the phases in order to refine results if necessary. Each phase of the EPART-Method produces a number of artefacts (architecture models and solutions). The consecutive phases use these artefacts as inputs and detail or revise them, if necessary. Architectural outputs are stored in the Architecture Description. Solutions produced by each phase are stored in the Solution Repository.

The EPART-Method operationalises the EPART-Framework as follows. During Phase I to Phase II, the architects design the EEA by developing the models of the Participant Viewpoint, the Participation Viewpoint, the E-Participation Viewpoint, the Data & Information Viewpoint, and the Implementation & Governance Viewpoint. The EPART-Framework proposes the architecture models, which the architects should develop during the different activities of this EPART-Method. The EPART-Reference Models ease the development of an e-participation architecture by proposing interrelated reference models for the different viewpoints. Both, the EPART-Framework and the EPART-Method, however, need to be adapted to the specific EE and to its specific conditions. Each EPART-Method phase involves one or more stakeholders (cf. Section 6.2). The following sections specify how the phases integrate these stakeholders. For the practical implementation of this operationalisation, it is helpful to specify the details of the procedure in activities. This facilitates capturing the procedure within one phase as well as interactions and relationships between the phases. As notation for modelling the phases and activities, the BPMN is used to show the flow of activities. Figure 46 shows an overview of all activities.

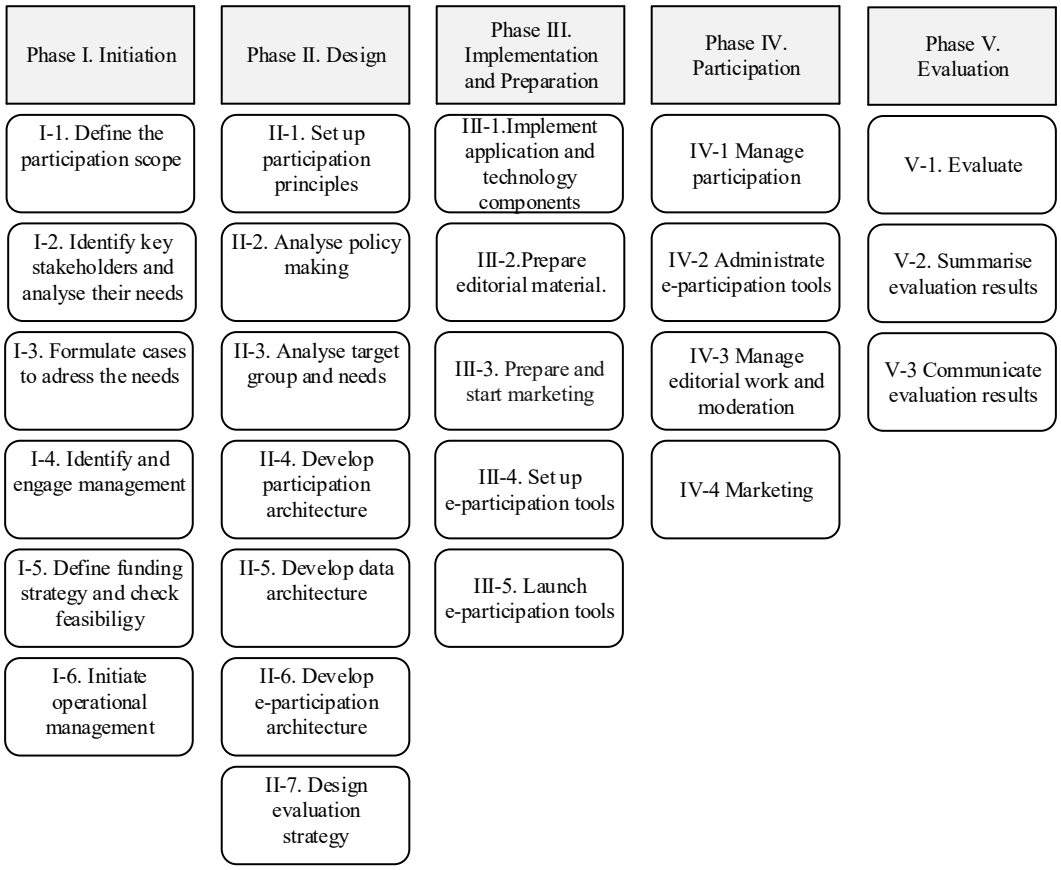


Figure 46. Overview of phases and activities.

Following, the operationalisation of the six phases of the EPART-Method is presented. The presentation of each phase uses a structured scheme derived from TOGAF (TOG, 2009, p. 67):

- Objectives: Which objectives should the phase achieve?
- Inputs: What are the inputs of this phase?
- Approach and Activities: What is the approach and acuities to achieve these objectives?
- Outputs: What are the outputs of this phase?

Descriptions of Phase I and Phase II are more extensive than of the consecutive phases, because those must first be designed during the both first phases.

7.2 Phase I. Initiation

7.2.1 Objectives

The key of Phase I is to identify and assess what the e-participation services need to achieve, understand the major drivers to provide the e-participation services, and then define, validate and prioritise the objectives with the target groups (participants and decision makers) and operational staff (administration, owner). It is necessary to understand the context surrounding the EE to make effective and informed decisions. Accordingly, its purpose is to define the EE and the boundaries. Overall, the phase is based on generally answering the following key questions:

- Why is the participation important?
- Who should be involved/engaged and what are their needs?
- What is an interesting and important topic?
- How can we get it done?
- Where is it done?

An additional purpose is to define a funding strategy and the preparation and conduct of a feasibility check. At the end of Phase I, the Owners decide if they will put the e-participation into practice. If this is the case, the owner does initial steps to start the operational management for the next phases.

7.2.2 Inputs

The inputs of Phase I are:

- EPART Framework
- Legal frameworks and regulations
- Any documentation about related initiatives
- Any guideline, standards, strategies for the EE
- Any architectural work already existent
- Project management standards
- Any constraints as e.g. budget and resources
- Relevant partnership and contract agreements
- Privacy and data protection guidelines

7.2.3 Approach and Activities

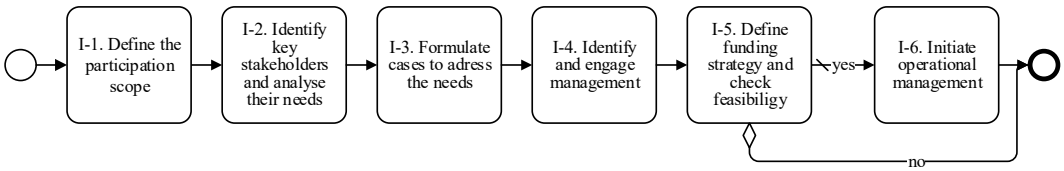
Before the e-participation services can be designed, prepared and implemented, preparatory activities are necessary to prove if the owner is able to carry it out in a reasonable way (Märker et al., 2009). The agreement upon the objectives is seen by Glass (1979, p. 180) as an "important element of any participatory program" and supported by Phang and Kankanhalli (2008). It is necessary to start the collection of relevant background information related to the topic of participation, the procedures (legislative, administrative and participation), legal requirements and specification, the stakeholders etc. The catalogues proposed in the EPART-Framework can support this. The management team may revisit this phase from the *Design* phase if unexpected challenges emerge. A revisit aims to ensure that the EE has the capabilities to address these specific challenges.

In the case of a successful feasibility check, the owner needs to specify the governance and implementation. Therefore, the owner should apply its existing management strategies. In e-participation, different project management approaches are used, such as the *Projects IN Controlled Environments 2* (PRINCE2)[83] method and agile development methods[84]. Many other approaches exist such the *V-Model XT* (BIT, 2006), a standard for German administrations, or the *Project Management Body of Knowledge* (PMI, 2000). It is important for the EPART-Method to extend and support but not to replace such approaches.

[83] PRINCE2 is a process-based project management method used by the UK Government offering non-proprietorial guidance, see https://www.prince2.com/eur/what-is-prince2 (last accessed 2015-12-03).

[84] Agile development methods promise to integrate rapidly changing requirements better in the process Chin (2004), an example is SCRUM Schwaber and Sutherland (2014).

Accordingly, the EPART-Method is open for different project management methods used in the organisations. Figure 47 shows the six activities of Phase I.



Legend: BPMN 2.0 process diagram.

Figure 47. Activities in Phase I. Initiation

The activities of Phase I. Initiation are:

I-1. Define the participation scope. A key challenge of an e-participation undertaking is to define its scope. The Participation Scope determines the objectives, the key stakeholders (participants and decision makers), the legal and organisational regulations, the participation topic, and the other elements in the EE context. Furthermore, the scope identifies the owners and appoints the relevant decision makers. The initiators and the owners identify the need for participation and the general participation objectives in the Participation Vision. The Scenario, which highlights the vision and objectives, the target groups, and the boundaries, can be supportive. Based on the Participation Vision, the initiators and owners specify the context of the undertaking in the Scenario, such as the expected outputs, outcomes, impact, inputs, and existing constraints. The literature review shows a number of important questions for defining the participation scope (Table 59). Activity I-1 produces the Scenario, the Participation Concept Diagram, and the Principle Catalogue

Table 59. Questions to define the Participation Scope from different viewpoints

Viewpoints	Question
Participation Scope	– What are the participation goals and objectives? – Are there any legal regulations to be considered? – What is the decision being made or the problem being answered (Creighton, 2005)?
Implementation & Governance	– Is the time frame available (Märker et al., 2009, p. 38) and how to use the time available? (Acland, 2008, p. 26)? – What resources are necessary and available (Märker et al., 2009, p. 38)? – Are there any institutional constraints and special circumstances (Creighton, 2005)? – Who needs to be in the EE?
Participant	– Who needs to be involved and who are the decision makers (Creighton, 2005)?
Participation	– Is public participation needed (Creighton, 2005; Märker et al., 2009)? – What are the stages in the policy-making process and what is the schedule for those stages (Creighton, 2005)? – What level of participation is required (CEAA, 2008; Creighton, 2005)? – What local network is affected?
Data & Information	– What is the topic of participation? – Is it possible to prepare the topic in a citizen-oriented way (Märker et al., 2009, p. 38)?
E-Participation	– What applications and technologies are available?

I-2. Identify contact key stakeholders and analyse their needs. Planners engage with key stakeholders and bring key interested parties (in particular decision makers but also participants) into the planning from the beginning. The objective in Phase I is to get their commitment either to decide positively on realising the undertaking and later on to participate, to give feedback on participation results or to consider participation results during

policy making. Another purpose is to analyse their needs for the planning in later activities. This activity uses the Participant Onion Diagram and the Participant Catalogue to plan stakeholder involvement and uses stakeholder identification and analysis techniques (see e.g. Bryson, 2004). Activity I-2 produces the following artefacts: Participant Onion Diagram, Stakeholder Engagement Catalogue

I-3. Formulate cases to address the needs Planners work with stakeholders to tailor the Participation Scope for the stakeholder needs. In addition, planners engage stakeholders to initiate planning of participation services. This is necessary to enable the planners to prepare necessary documentation for a feasibility check. The activity utilises the Participation Schedule and the Participation Planning Matrix.

I-4. Identify and engage management. The owners start with the identification of the project managers. The task of both EE members is to identify key drivers and elements in the owner's organisational context (TOG, 2011a, p. 59). It is necessary to understand the context surrounding the EE to make effective and informed decisions. Specific areas to consider, according to TOGAF, include:

- The budgetary plans to determine the available financial resources[85]
- The intentions and culture of the owner; for example, if the organisation already carried out this kind of e-participation
- Any architecture frameworks already used
- The current architecture landscape
- The skills and capabilities of the EE

In order to determine the capabilities desired by the EE, Figure 48 gives an overview of capabilities[86] needed in an EE and helps to assess if it can provide them. Table 60 describes these capabilities. The Organisation/Actor Catalogue supports this task. The Project Manager takes over the organisational planning, develops a high-level project plan including budget (Budget Plan Matrix), and a project plan (Project Schedule Diagram).

I-5. Define funding strategy and check feasibility. The owners aim to get official approval to implement the e-participation services. This includes to determine the availability of funding sources. The approval procedure depends on the particular owner organisation and type of e-participation, e.g. if it is international, national, regional or local and if it is a top-down or bottom-up initiative. The result of this activity is a feasibility check and the decision whether the EE (in particular the owner) will carry out the e-participation[87].

I-6. Initiate management. The project managers start the management and governance procedures. This includes tasks for setting up the team (including closing contracts), determining the design and implementation procedure and documentation (i.e. adapting the EPART-Framework and the selected viewpoints to the EE), and implementing the tools for project realisation and guidance. The existing implementation and government plans are refined in this activity. This viewpoint utilises the Project Schedule Diagram, Budget Plan Matrix, Organisation/Actor Catalogue, and the Risk Mitigation Strategy.

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[85] CEAA (2008) describes considerations when developing a budget and how to cope with limited resources.

[86] A Capability describes "the ability to achieve a desired effect" through a combination of activities and resources (U.S. Department of Defense (DoD), 2011, p. 25).

[87] For example, Märker et al. (2009) describe the approval procedure for local top-down e-participation in Germany.

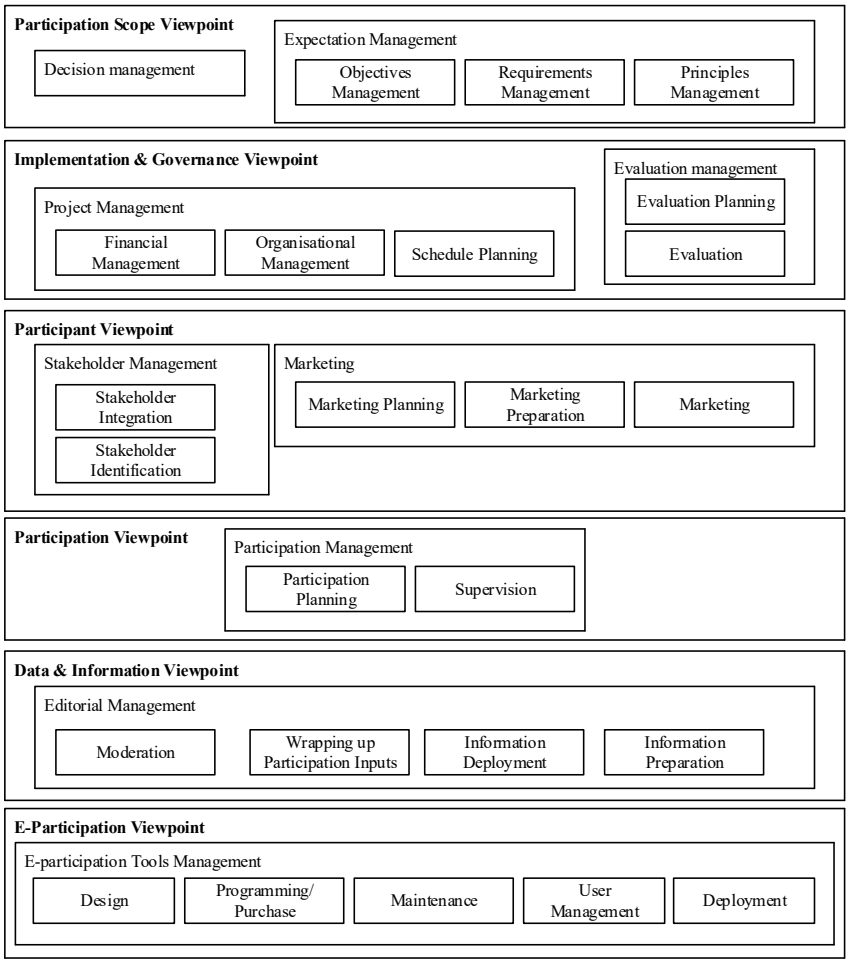
7.2.4 Outputs

The outputs of Phase I are:Participation Scope

- Approval or refusal of the e participation; in the latter case, no further operation
- Implementation & Governance View
- Selected project management method
- Contracts with third party suppliers
- Adapted EPART Framework

Table 60. Capabilities needed in an EE

Capability	Description
Project Management	Manage the implementation of all activities during the whole project lifecycle. It integrates capabilities such as financial management, organisational management, and project management.
Stakeholder Management	Define actors and their roles, engaging relevant stakeholders into the project. It integrates capabilities such as stakeholder identification, ICT tools user management, and stakeholder integration.
Marketing	Promote the e-participation among different stakeholder groups. It integrates capabilities such as marketing planning, marketing preparation, and marketing.
Editorial Management	Prepare information about the topic, the participation process as well as participation results and moderate participants input/ activities. It integrates capabilities such as moderation, information preparation, information deployment, and wrapping up participation results.
ICT Management	Manage the design, implementation and maintenance of the e-participation tools. It integrates capabilities such as software engineering, programming, purchasing, deployment, and maintenance.
Evaluation Management	Evaluate the e-participation against its objectives. It integrates capabilities such as evaluation planning, and evaluation methods.
Expectation Management	Analyse and communicate to all participants beforehand what – if at all – political impact their participation can realistically generate; monitor of decisions made based on participation results. It integrates capabilities such as objectives, principles and requirements management.
Participation Management	Plan and implement participation activities so that they fit into the political processes; ensure traceability of participation results. It integrates capabilities such as participation planning, supervision, and input provisioning.
Decision-making Management	Manage policy-making processes and feedback of participation results during the project lifecycle.



Legend: Each box identifies one capability.

Figure 48. Mapping capabilities necessary for e-participation

7.3 Phase II. Design

7.3.1 Objectives

Phase II aims to plan how to carry out the participation so as to meet the Participation Scope and how to evaluate the impact reached. This includes the design of stakeholder engagement techniques, processes, and the ICT support as the target architecture and the migration planning (how to come from the baseline to the target architecture). Key in this phase is to adapt the design of the e-participation undertaking to its objectives and to the policy-making processes. Key questions are:

- How do the policy-making processes look like, when can participation results have an impact and how should theses participation results look like?
- What is a coherent participation strategy that is supported by electronic means and – if necessary– by different channels (on- and off-line)?
- How can the whole undertaking be evaluated?

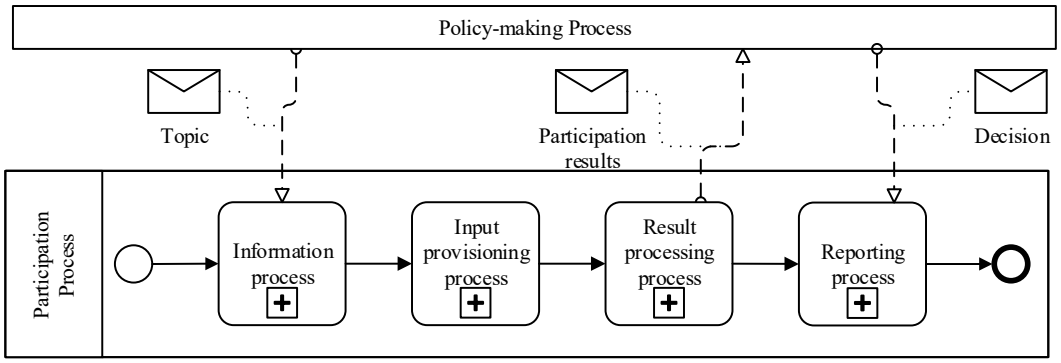
7.3.2 Inputs

The inputs of Phase II are:

- The Participation Scope: the Scenario, the Participation Concept Diagram, and the Principle Catalogue, the Objective/Participation Technique Matrix,
- The project plan defined by the models of the Implementation & Governance Viewpoint and the selected project management method,
- The contracts with third party suppliers,
- The adapted EPART-Framework.

7.3.3 Approach and Activities

In Phase II, the participation analysts are responsible for the design of the participation services. Usually, the political decision-making processes cannot be adapted to the participation processes. Hence, it is important to analyse the policy-making processes in advance. This kind of analysis aims to identify when the topic under consideration is on the political agenda, if, when and how participation results can be considered and when the decisions are taken. Based on these insights and the objectives, the participation analysts select appropriate participation services. The participation processes need to realise and support these services to follow the decision-making process (Figure 49).



Legend: BPMN 2.0 collaboration diagram.

Figure 49. Overview of a participation process

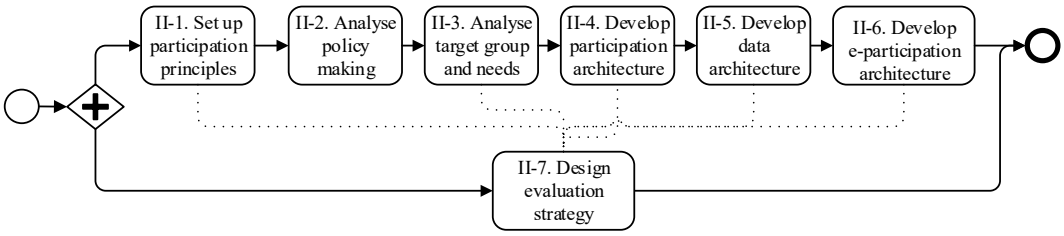
In general, a participation process should consist of four sub-processes:

- Information process: The stakeholders read up on the project, policy making, participation, and expectations regarding the participation results.
- Input provisioning process: The participants actively participate. This process runs in parallel to decision making. However, it should end before the decision makers can consider the participation results.
- Results processing process: The team wraps up participation results and informs stakeholders. The decision makers consider the participation results during the political decision-making process.
- Reporting process: The team informs participants about results of decision making and impact reached.

Participation analysts plan how to involve key stakeholders as part of the front office, and which tasks are necessary in the back office and integrates marketing tasks. They involve the key stakeholders to agree and decide on the participation services and processes. Each

of these participation services needs the availability of appropriate financial and personal resources. For example, the result-processing process needs personal resources to allow the systematic evaluation of participation inputs. Citizen participation can only be meaningful if such resources are available. In top-down approaches, responsible authorities (owners) need to create the space for participation and adapt their own processes. In the case of bottom-up approaches, owners need to understand the decision-making processes in order to find a way to reach impact. Both cases need to consider legal constraints.

The optimal support of participation processes with ICT is key for the e-participation. The e-participation architects design the e-participation tools[88]. E-participation requires easy-to-use ICT to avoid usability flaws that could discourage people from on-line participation. Systematic usability engineering is necessary (Nielsen, 1993). Widely established ICT and user paradigms ease the participation for users (Scherer, Karamagioli et al., 2009). The integration of e-participation tools into the Owner's existent ICT landscape refers to Phase C Information Systems Architecture of TOGAF ADM (TOG, 2009). In the baseline EEA, the E-Participation Viewpoint provides a view to the initial ICT landscape, while the target state architecture shows the future architecture. Figure 50 shows the seven activities of Phase II.



Legend: BPMN 2.0 process diagram.

Figure 50. Activities in Phase II. Design

The EPArt-Reference Models can be understood as a reference EEA, which planners can use as a starting point in this phase. The activities of Phase II are:

II-1. Set up participation principles. The project managers and participation analysts initiate Activity II-2 in order to identify and establish the participation principles. The activity is based on the overall considerations of the previous phase resulting in the Participation Scope, but refines and (if necessary) revises these considerations. Activity II-1 utilises the Participation Catalogue. The EPART-Reference Models provide a catalogue of reference principles to support this activity.

II-2. Analyse policy making. Participation Analysts analyse the relevant political decision-making processes based on existing documents (legal texts) and models, which detail the policy-making process. Process modelling can support the analysis. As a result, the Participation Analysts develop the Participation Schedule. **II-3. Analyse target groups and needs.** The Project Managers and the Participation Analysts initiate Activity II-1 to analyse the target groups and their members as well as to plan their involvement. The Participation Analysts should ensure that members of the target group are involved in the

[88] In order to select suitable ICT tools, Fraser et al. (2006) and Phang and Kankanhalli (2008) provide an overview of electronic tools and their usage for e-participation.

design phase, e.g. by surveying them in the process of defining participation guidelines. The Project Managers and Participation Analysts should answer the following questions during this activity:

- Who is affected directly or indirectly by the policy under consideration? Who are the stakeholders?
- Who is the target group of participation? Is this group representative?
- How should the target group be involved?

Bryson (2004) reviews a number of relevant stakeholder identification and analysis techniques in this respect. As a result, this activity produces the Role Catalogue and further fills the Stakeholder Engagement Catalogue.

II-4. Design participation architecture. The participation architecture designs the participation services and the procedures to support them. The participation analysts start Activity II-3 to plan how the EE can achieve the participation objectives. During this activity, the focus is on the selection of participation services and the design of the participation processes[89]. The first task is to create the overall concept (Participation Planning Matrix) considering the baseline architecture, i.e. the current state. Next, the services are designed according to the objectives defined (Objective/Participation Service Diagram) and specified (Participation Service Catalogue). Modelling of detailed future participation processes (Process Flow Diagram) can help to explain and jointly agree upon the processes within the team (Scherer et al., 2009b). The organisation of stakeholders' involvement is crucial in this activity. Participation analysts should involve decision makers into the design of the participation phase to get their participation commitment and participants to consider their opinion. Literature such as Acland (2008) and websites such as http://www.voicescotland.org.uk[1] or http://eparticipation.eu/[1] provide guidance on the design of participation processes.

II-5. Design data architecture. The participation analyst and the e-participation architect develop the data & information architecture based on the participation architecture defined. Therefore, they map the data entities produced or consumed in the activities with participation services (Data Entity/Data Component Catalogue) and conceptualise them in the Conceptual Data Diagram afterwards. The Data Entity/Role Matrix supports the planners to design a security access control. Questions, such as the following, should be answered during this activity:

- What participation results do the services produce?
- What participation inputs will participants provide?
- What information is necessary to inform service users on the topic?
- What technical documentation is necessary to support service users?

II-6. Design e-participation architecture. The e-participation engineers start Activity II-4 to streamline the ICT developments to the participation services. Developing the e-participation architecture means to analyse the participation services for the selection and design of appropriate application components (Application/Participation Service Diagram). Therefore, participation processes defined in the Process Flow Diagram need to be

[89] Literature such as Acland (2008) and websites such as http://www.voicescotland.org.uk[89] or http://eparticipation.eu/[89] provide guidance on the design of participation processes.

extended, i.e. for relevant tasks of the participation process appropriate application components are to be designed. Based on the participation services and user needs identified in Activity II-2, this activity specifies media and channels and proper application components. Integrating application and technology components and deciding about new implementations leads to the design of the e-participation tools – i.e. the e-participation architecture. It further includes the selection of an appropriate deployment strategy, as this may influence the e-participation architecture. The questions to be answered during this activity are:

– Which electronic means support the participation services best?
– Which functional and usability requirements are to be fulfilled?
– How to build a link between electronic and traditional (non-electronical) participation.

This activity transforms the software components architecture into a hardware components architecture (Application/Technology Diagram). As part of the design of the ICT, this activity defines functional and quality (non-functional) requirements for the electronic means (cf. Phase Requirements Management, the Application Use Case Diagram and the Requirements Catalogue).

II-7. Design evaluation strategy. Activity II-4 develops a coherent evaluation strategy. It aims at considering evaluation phase (Phase V) from the beginning of the e-participation. This ensures that the collection of evaluation data starts together with the participation phase (Phase IV). Roberts (2004, p. 332) lists several standard questions, which could be addressed in evaluation of direct citizen participation. The proposed evaluation approach is based on the layered model of e-participation evaluation by Macintosh and Whyte (2008) as an evaluation approach often applied in the e-participation literature (see e.g. Horelli & Wallin, 2010, p. 66; Karamagioli & Koulolias, 2008, p. 437; Kubicek, 2010, p. 188; Panopoulou, Tambouris, & Tarabanis, 2010; Wimmer & Bicking, 2013, p. 214). The layered model of e-participation integrates the project, socio-technical and democratic perspective on an e-participation exercise. Macintosh and Whyte (2008) describe major criteria relevant for evaluation of the project perspective. Aichholzer, Westholm, and Millard (2009) present methodological activities to evaluate a project according to these criteria. A practical guideline is provided in Nabatchi (2012). It is possible to replace proposed layered model of e-participation by another evaluation strategy. The evaluation activities start with Phase IV. Participation in order to collect information and survey target groups, i.e. collect evaluation data as inputs for evaluation. The activity produces the Evaluation Catalogue, which indicates performance indicators and how the evaluators will assess the fulfilment of objectives. As another result, the activity can inform the requirements management on requirements for evaluation features (e.g. to be integrated into the e-participation tools).

7.3.4 Outputs

The output of Phase II is the target EEA consisting of:

– Participation architecture defined with the models in the Participant Viewpoint and Participation Viewpoint,
– Data & information architecture defined with the models in the Data & Information Viewpoint,
– E-participation architecture defined with the models in the E-Participation Viewpoint, and

– Operational management and evaluation strategy (Implementation & Governance Viewpoint)

7.4 Phase III. Implementation and Preparation

7.4.1 Objectives

Phase III includes the activities to implement the e-participation tools and prepare the e-participation undertaking. It is necessary to control implementation of the e-participation tools with regards to functional and non-functional requirements. Furthermore, it is necessary to start editorial work with preparation of information and data and to develop the marketing strategy. At the end of this phase, the e-participation undertaking can start.

7.4.2 Inputs

The inputs of Phase III are:

– The target groups defined with the models of the Participant Viewpoints
– The participation architecture defined with the models of the Participation Viewpoint,
– The data & information architecture defined with the models in the Data & Information Viewpoint, and
– The e-participation architecture defined with the models in the E-Participation Viewpoint.

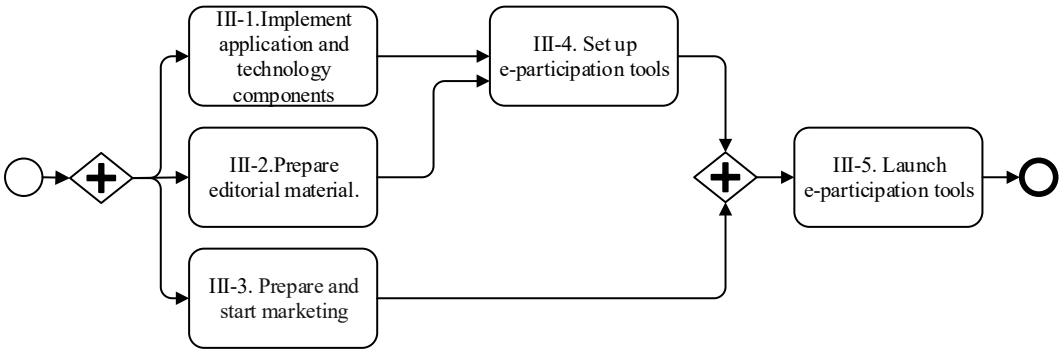
7.4.3 Approach and activities

Phase III implements, prepares and deploys the e-participation based on results of earlier phases. This comprises activities such as support the ICT development and implementation, editorial management and marketing. The result is a running e-participation platform, which meets functional and non-functional requirements from requirements elicitation activity (requirements management phase). Further results are available information texts, conditions of use, moderation and ready marketing material. The main aspects are as follows:

– *Implement and deploy the e-participation tools*: The e-participation engineering team needs to implement the application and technology components. Deployment includes upload of prepared information and setup a user rights management as well as preparation of appropriate documentation.
– *Prepare and disseminate information*: A careful preparation of information aids to deploy ICT in time and update content for new political developments, if needed. In addition to background information about policies and political institutions, it is necessary to prepare information about the participation process and its objectives. Such information makes the initiative transparent. It has to answer the following questions: What is the schedule of the participation process? What activities does it include? What can participants contribute to the process? What are the expectations and the goals of the participation process? How will the project meet them? Another recommendation is to prepare questions for discussion in advance to stimulate deliberation among participants.

– *Prepare and start marketing*: Marketing is key for e-participation to tell potential stakeholders about the project. Preparation of marketing should end before the e-participation is set into place. First marketing activities should start before the participation phase begins to inform stakeholders in advance. Often, e-participation starts with a kick-off event. The aims are to identify and implement the measures to address the relevant target groups.

This phase contributes with its outcomes to the Solution Repository.
The activities of Phase III are shown in Figure 51.



Legend: BPMN 2.0 process diagram.

Figure 51. Activities in Phase III. Implementation and Preparation

The activities of Phase III are:

III-1. Implement application and technology components. E-participation architects, ICT developers, and ICT suppliers are responsible for Activity III-1. The focus is on the implementation and the meaningful integration of the ICT components in the e-participation platform. Implementing an e-participation platform requires well-organised user and systems tests. Scherer, Karamagioli et al. (2009) describe a usability engineering process for e-participation integrating testing and piloting cycles before the e-participation platform is deployed. The usability engineering process for e-participation intends the involvement of users in different stages of e-participation platform design and implementation. It consists of a requirements analysis, a design/testing/development phase, and an installation step. Evaluation accompanies each step to compare results with usability goals defined during the requirement analysis stage. This activity includes the preparation of the following documentation:

– The *migration strategy* illustrates the strategy that will be used if a migration process is required (Rozanski & Woods, 2009, p. 335).
– The *installation and configuration documentation* describes the configuration of the e-participation application components and what needs to be installed (Rozanski & Woods, 2009, pp. 333–337; Vogel, 2011, p. 84).
– The *administration documentation* defines monitoring and control possibilities, required routine procedures, likely error conditions, and performance monitoring possibilities (Rozanski & Woods, 2009, pp. 339–340).
– The *user support documentation* provides support for stakeholders using or operating the Application Components (Rozanski & Woods, 2009, p. 344).

III-2. Prepare editorial material. The facilitators initiate Activity III-2 to prepare information and content in parallel with the implementation of the e-participation platform. Information preparation should follow a well-structured process. It addresses the question: What needs to be prepared, why and how? The data and information view shows important documents identified during the design of the project. This activity also includes planning moderation activities according to a moderation guideline to be prepared during this activity. Acland (2008, p. 40) gives an overview on material requirements to be considered when preparing background information on the topic or the processes:

- Ensure a neutral, user-friendly language and avoid jargon
- Translate into minority languages

Furthermore, Acland (2008, p. 40) recommends to consider to prepare cover letters, specific invitations, or business cards with contact numbers. From positive experiences from the VoicE project, the method recommends the following:

- Describe the content preparation process based on fact sheets including proposals for questions to stimulate discussions.
- Define mitigation activities to ensure neutrality of dossiers.

III-3. Prepare and start marketing. Activity III-3 aims to develop a marketing strategy and marketing materials and plans marketing activities. A marketing strategy should support the aims of the e-participation and disseminate it among the target group. If marketing is successful, the e-participation is well known and relevant actors take part. A vast amount of literature is available about marketing and marketing strategies (see e.g. Payne, Ballantyne, & Christopher, 2005). Some e-participation case studies offer recommendations about marketing, for example Edelmann, Krimmer, and Parycek (2008). It is fundamental to know the target group of the e-participation. Key parameters to be considered in the marketing strategy are e.g. summarised in Scherer et al. (2012). As the experiences from VoicE & VoiceS show (see Scherer et al., 2012), it is thus of crucial importance for the success of an e-participation initiative to define the target group at a very early stage (see Phase I). The "One size fits all"-approach does not work in this case. On- and offline strategies may particularly target different stakeholder groups; these need to be coordinated and harmonised. Yet, it is no longer true that only the young are on the web. More and more older people discover the internet and become fit in surfing on the web. Hence, means to reach target groups have to be selected carefully. Examples are social networks and newsletters. Marketing activities cannot merely focus on the online means. Depending on the age and structure of the target groups, offline means such as road shows, booths at key conferences, letters and so forth are to be integrated in the marketing strategy. Activity III-3 aims to start first marketing activities before the e-participation platform is launched and any participation activities start. For example, the launch of the platform could start with an event involving important decision makers to show their commitment.

III-4. Set up e-participation tools. The ICT administrators are responsible for Activity III-4 to install the platform and set up the initial structure with user groups and access rights. Facilitators and ICT Administrators are responsible for preparing the e-participation platform content to be ready for launch. The facilitators upload and disseminate prepared content.

III-7. Launch e-participation tools. Activity III-4 aims to launch the e-participation platform in accordance with the marketing strategy and the participation processes designed.

7.4.4 Outputs

The outputs of Phase III are

- Prepared data entries and documents (editorial material)
- Marketing strategy, marketing material and marketing activities started
- Running e-participation platform available to the target groups
- Guidelines, Manuals, Program Code

7.5 Phase IV. Participation

7.5.1 Objectives

The purposes of Phase IV are to accompany the engagement processes, systematically wrap-up the participation inputs to create the participation outputs, put them at the decision-making process' disposal, and provide feedback on the decision-making process and the impact reached. This includes activities to maintain the e-participation platform, prepare, update and moderate content, marketing, collect evaluation data. All these activities should be based on the plans designed in Phase II, i.e. the execution of the timeline and the implementation of the participation processes is the focus of this phase.

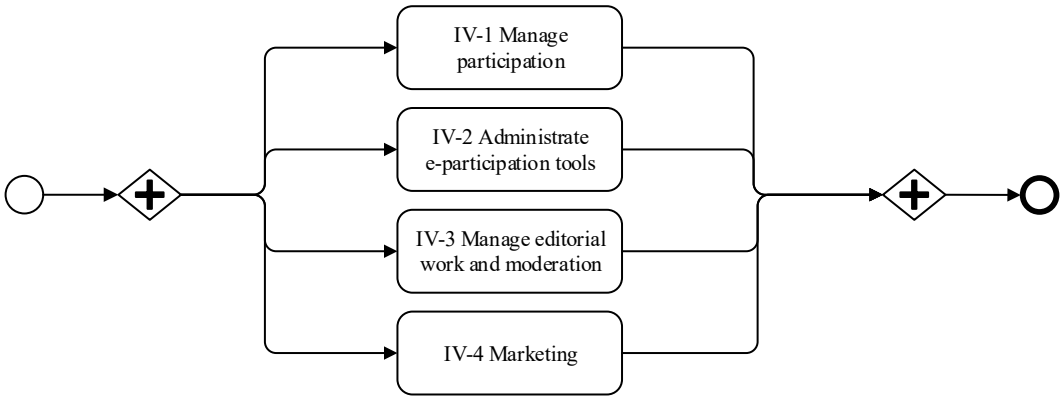
7.5.2 Inputs

The inputs of Phase IV are:

- Prepared data entries and documents
- Marketing strategy, material and marketing started
- Running e-participation platform
- Participation architecture

7.5.3 Approach and Activities

Phase IV aims to execute the e-participation services to engage participants and manage the e-participation. This includes to update content on the e-participation tools (editorial work), to wrap up participation inputs, to promote the e-participation, to moderate discussions, to administrate the e-participation tools etc. The principal activities of Phase IV are shown in Figure 52. Through Phase IV, the project management performs the major coordination activities and governs the progress. The evaluation team reports into the Evolution Catalogue continuously. Evaluation at varying levels is critical to ensure checks throughout the implementation.



Legend: BPMN 2.0 process diagram

Figure 52. Activities in Phase IV. Participation

The activities of Phase IV, which are strongly interrelated, are:

IV-1. Manage and execute participation services. Activity IV-1 starts and manages the participation services. Facilitators actively engage stakeholders. To ensure plausibility and acceptance of participation, this activity accounts for how participation contributed to decision making. The exact composition of tasks depends on the concrete planning of participation processes in Phase II.

IV-2. Administrate e-participation tools. Activity IV-2 keeps the e-participation alive and aims to run it effectively. Running the platform refers to single activities necessary to keep the platform functioning and operative from a technical point of view (maintenance). Pigoski (1997) outlines such activities.

IV-3. Editorial work and moderation. Activity IV-3 is about editorial management of the content and moderating of participation inputs on the e-participation tools. This includes tasks for wrapping up participation inputs and delegating the results to respective authorities and giving feedback to stakeholders. The effort for doing so should not be underestimated and is an ongoing task through the whole e-participation life cycle. In order to support these tasks, Phase II. Design has to reflect the maintenance needs and has to plan the respective processes.

IV-4. Marketing. Activity IV-4 is an ongoing and important task during the life cycle of e-participation. It strongly relates to permanently updating the content and publishing news (see Activity IV-3). As indicated in Phase III. Implementation and Preparation, the marketing activities should already be initiated in advance and at least be active at the launch of the e-participation tools.

7.5.4 Outputs

The outputs of Phase IV are

- Participation outputs
- Evaluation data collected

7.6 Phase V. Evaluation

7.6.1 Objectives

Millard (2009) recommends that each e-participation should do an ongoing evaluation. Panopoulou et al. (2014, p. 210) identifies a monitoring and evaluation plan as a success factor for e-participation. In this respect, the evaluation phase validates the e-participation against its objectives, assesses the impacts that were achieved and derives lessons learned based on the evaluation strategy as result from Phase II. Design.

7.6.2 Inputs

The inputs of Phase V are

- Evaluation Strategy
- Assessment of requirements achievement
- Evaluation data collected during Phase IV.

7.6.3 Approach and Activities

The evaluation of the e-participation tools, the participation processes, the engagement of the target groups as well as participation results shall give insights into whether the EE meets its objectives. The phase identifies critical points for improvement in a next iteration.

The evaluation managers plan activities during Phase IV based on the Evaluation Strategy (see Implementation & Governance Viewpoint). The Evaluation Strategy is developed and agreed in *Phase II. Design*. The activities in Phase V break down this Evolution Strategy into simple evaluation questions to evaluate against objectives, assessment of policy impact, and evaluate the e-participation tool.

Overall, this phase addresses the following evaluation question: To what extent does the EE fulfil its planned operational outputs and outcomes? Against this background, Aichholzer et al. (2008, p. 18) mention important evaluation questions:

- Why are objectives achieved, and why not?
- Were the e-participation services conducted in line with the plans?

Furthermore, the aim is to estimate to what extent the services affect policy and help to boost democracy: To what extent do the e-participation services fulfil their envisaged impacts? With this background, Aichholzer et al. (2008, p. 18) mention important evaluation questions:

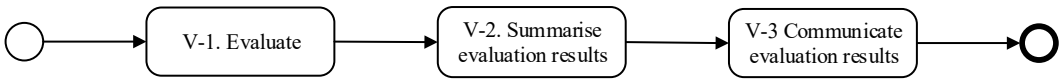
- Why are targets and outcomes achieved, and why not?
- How significantly does the e-participation contribute to meeting stakeholder expectations?
- What are unexpected outcomes of the e-participation process?
- Were the objectives, and what was expected of the citizens, made clear?
- Did the e-participation services reach the target audience?
- Was the information provided appropriate and relevant?
- Were the contributions informed and appropriate?
- Was feedback provided both during and after the eParticipation?
- Was there an impact on policy content?

Another is to estimate to what extent the ICTs affect the outcomes, i.e. help to meet the objectives of the EE and help to boost democracy. It addresses the following evaluation

question: To what extent does the design of the e-participation tools affect the outcomes? With this background, Aichholzer et al. (2008, p. 18) mention important evaluation questions:

- What is the benefit of e-participation in comparison with traditional instruments and methods of participation?
- How well are online and offline services integrated?
- To what extent, and in what ways, can ICTs make policy information more accessible and understandable to citizens?
- Do ICTs contribute to more openness and accountability in policy making?
- Will ICTs encourage and assist the public to participate and facilitate consultation?
- How can ICTs enhance participation of the socially excluded?

The activities of Phase V are visualised in Figure 53.



Legend: BPMN 2.0 process diagram

Figure 53. Activities in Phase V. Evaluation

V-1. Evaluate the achievement of objectives. Activity V-1 estimates to what extent the e-participation meets its defined objectives. It evaluates the EE and the services it provides based on the evaluation strategy. The result is the Evaluation Catalogue.

V-2. Summarise evaluation results. Activity V-2 recaps the results of the Activity V-2 and produces a comprehensive evaluation report, which collects and explicitly states improved practices for future plans.

V-3. Communicate evaluation results. Activity V-3 aims to communicate the evaluation results internally and externally. This activity is based on the recommendations by CEAA (2008) to inform the decision makers on evaluation results and communicate the evaluation outcomes. For example, the participatory budgeting project published its evaluation report (see Taubert, Krohn, & Knobloch, 2010).

7.6.4 Outputs

The outputs of Phase V are:

- Evaluation report
- Lessons and recommendations to improve the approach in the next iteration

7.7 Phase Requirements Management

This section looks into the *Requirements Management* phase.

7.7.1 Objectives

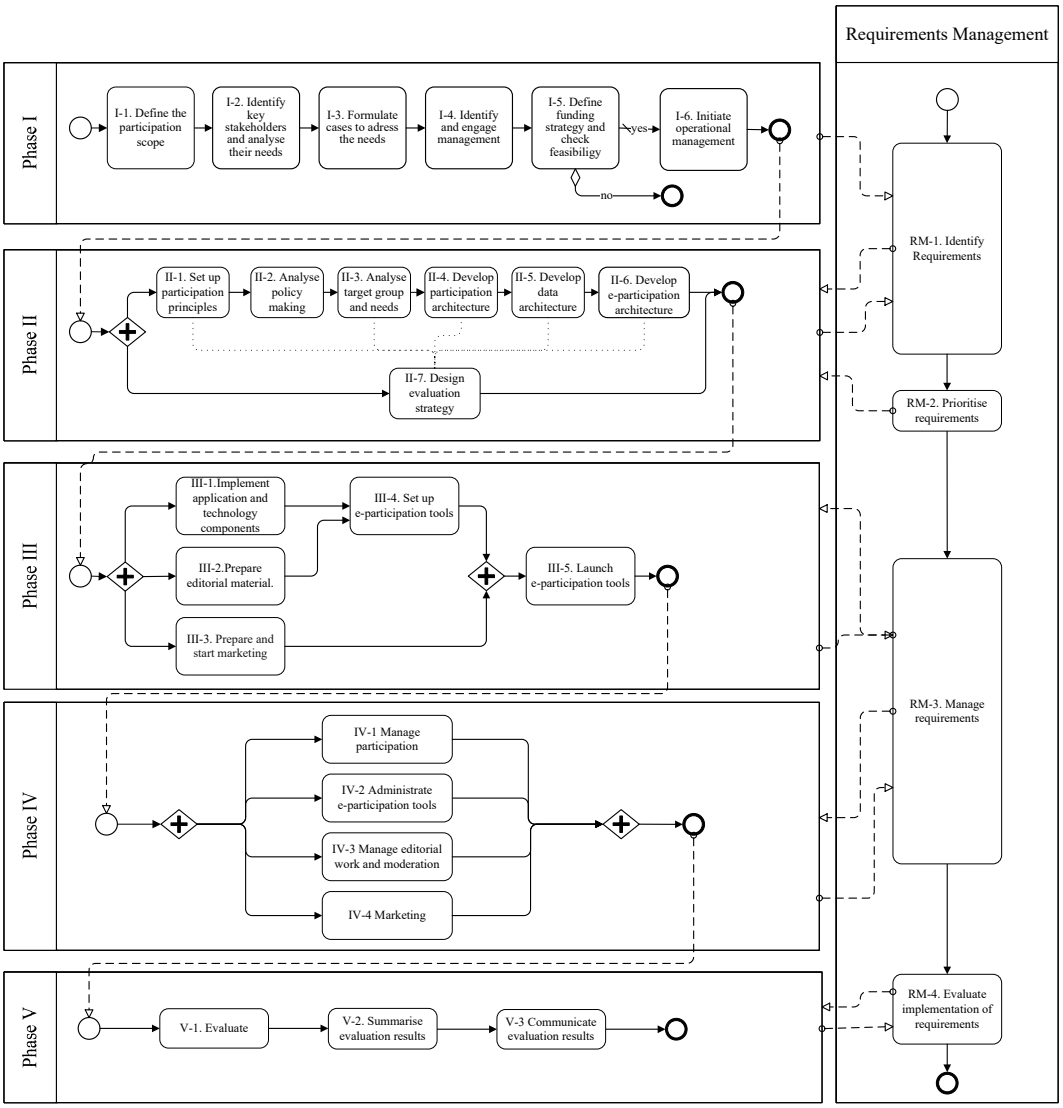
The objectives of the Requirements Management phase are to identify and define requirements, manage requirements, and monitor requirements fulfilment.

7.7.2 Inputs

Inputs of the Requirements Management Phase are all artefacts, in particular the Principle Catalogue and the Objective/Participation Technique Catalogue.

7.7.3 Approach and Activities

The EPART-Method is continuously driven by a dynamic requirements management process as suggested in TOGAF (TOG, 2009, p. 204). Requirements identification happens once at the beginning of the project (in accordance with Eeles & Cripps, 2010). The EPART-Method uses the results of requirements management of one activity in the following activities. Accordingly, the requirements "are refined throughout the life cycle of the project" as suggested by Eeles and Cripps (2010). It also possible to change requirements during the next phases. During Phase I and Phase II, the requirements managers identify and define requirements; the outputs of Phase III and Phase IV are based on these requirements. Finally, the evaluation compares results with requirements in Phase V.



Legend: BPMN 2.0 process diagram

Figure 54. Activities in Phase Requirements Management and interplay with Phase I – Phase V

The E-Participation Viewpoint provides a view on the requirements and their links to principles and objectives. For more information on requirements engineering, the reader is referred to, for example, Eeles and Cripps (2010), Hay (2003), Rupp (2004), Schwinn (2011).

The requirements managers are responsible for each of the following activities. The inputs comprise all documentation available. Outputs are the Requirements Catalogue and the assessment of requirements fulfilment. Therefore, the presentation of the activities is different to the other phases. The activities of the Requirements Management phase are:

RM-1. Identify requirements. Activity RM-1 identifies and defines the requirements based on the objectives, principles and stakeholder needs. Stakeholders collect their requests and needs. Each procedural activity in the initiation phase and the design phase brings forth a number of requirements with respect to general considerations, processes, information, users and technical features.

RM-2. Prioritise requirements. Managing requirements requires determining priorities from the view of the current phase and their documentation (TOG, 2009, p. 206). Activity RM-2 prioritises requirements in must-have, should-have, and nice-to-have based on the objectives and stakeholder opinions.

RM-3. Manage requirements. Activity RM-3 identifies and prioritises changed requirements. It estimates consequences to former and current phases (TOG, 2009, p. 206). This activity asks stakeholders to agree on the final set of requirements.

RM-4. Evaluate implementation of requirements. Activity RM-4 considers if and how the architecture implements the requirements. Lessons learned should result in updated requirements in the next iteration.

7.7.4 Outputs

The output of Requirements Management is the Requirements Catalogue.

After presenting the artefact developed with design science, i.e. the EPART-Framework in Chapter 6 and the EPART-Method in this chapter, the following part addresses its evaluation in order to identify recommendations and limitations and provides conclusions.

Part IV. Evaluation and Conclusions

8. Evaluation

This chapter evaluates the EPART-Framework according to the design science approach applied in this dissertation (see Chapter 3). The evaluation of the artefact (understood as a model) looks if it fulfils its intended purpose of use (Schütte, 1998). The intended purpose of the EPART-Framework is outlined in the introduction of this dissertation. It aims to "provide a coherent whole of principles, templates, and methods, and models to guide participation service providers the comprehensive design of and implementation of e-participation services" (see p. 6). The next section presents the approach for evaluating the architecture framework. Section 8.2 evaluates the EPART-Framework (Chapter 5) and the EPART-Method (Chapter 7) against the requirements.

8.1 Approach

Evaluation of the designed artefact is crucial in design science research to demonstrate its "utility, quality, and efficacy" (Hevner et al., 2004, p. 85), i.e. if the artefact "satisfies the requirements and constraints of the problem it was meant to solve" (Hevner et al., 2004, p. 85). Different evaluation methods are used in design science research (Hevner et al., 2004; Peffers et al., 2007; Riege, Saat, & Bucher, 2009). Table 61 shows an overview of evaluation methods according to the literature studies of Hevner et al. (2004) and Peffers, Rothenberger, Tuunanen, and Vaezi (2012). The evaluation methods used in this dissertation are highlighted bold.

This dissertation applies a combination of evaluation methods as follows: The EPART-Framework is the result of an iterative research approach consisting of two design stages (see also Section 3.3). The result of a first round of literature review and action research, the initial version of the EPART-Framework, is tested in two experiments. Accordingly, *observational evaluation* is applied once in the design science research process. The observational evaluation in a case study and during action research allow the evaluation of the developed artefact against the research gap identified as well as against the real world according to Riege et al. (2009, p. 81). Subsection 3.3.2 (p. 34) and Subsection b) document the evolution of the EPART-Framework. This chapter describes the activities and the results of the observational evaluation. Finally, this chapter *evaluates* the EPART-Framework against the requirements posed in this dissertation *analytically* (i.e. examines the structure of artefact) and *descriptive* (i.e. uses information from the knowledge base to build a convincing argument for the artefact's utility). The aim of the analytical evaluation is to assess the EPART-Framework in respect to the requirements posed (cf. Appendix A). The evaluation result, presented in the following section, describes the strengths and the weaknesses of the EPART-Framework based on logical conclusions.

Table 61. Overview of design evaluation methods and focus of this evaluation

Legend: The focus of this evaluation is marked with bold font.

Type (Hevner et al., 2004, p. 86)	Evaluation methods by Hevner et al. (2004, p. 86)	Evaluation methods by Peffers et al. (2012, p. 402)
Observational	**Case study: Study artefact in depth in business environment**.	**Case study: Application of the artefact to a real-world situation, evaluating its effect on the real-world situation.**
	Field study: Monitor use of artefact in multiple projects.	**Action research: Use of an artefact in a real-world situation as part of a research innovation, evaluating its effect on the real-world situation.**
Analytical	**Static analysis: Examine structure of artefact of static qualities (e.g. complexity).**	
	Architecture analysis: Study fit of artefact into technical IS architecture.	
	Optimisation: Demonstrate inherent optimal properties of artefact or provide optimality bounds on artefact behaviour.	
	Dynamic analysis: Study artefact in use for dynamic qualities (e.g. performance)	
		Expert evaluation: assessment of an artefact by one or more experts
Experimental	Simulation: Execute artefact with artificial data.	
		Subject-based experiment: A test involving subjects to evaluate whether an assertion is true.
		Prototype: Implementation of an artefact aimed at demonstrating the utility or suitability of the artefact.
	Controlled experiment: Study artefact in controlled environment for qualities (e.g. usability).	Technical experiment: A performance evaluation of an algorithm implementation using real-world data, synthetic data, or no data, designed to evaluate the technical performance, rather than its performance in relation to the real world.
Testing	Functional (black box) testing: Execute artefact interfaces to discover failures and identify defects.	
	Structural (white box) testing: Perform coverage testing of some metric in the artefact implementation.	
Descriptive	**Informed argument: Use information from the knowledge base to build a convincing argument for the artefact's utility.**	**Logical argument: An argument with face validity**
	Scenarios: Construct detailed scenarios around the artefact to demonstrate its utility.	Illustrative Scenario: Application of an artefact to a synthetic or real-world situation aimed at illustrating suitability or utility of the artefact

8.2 Results

This section documents the evaluation results after Design Stage 1 and Design Stage 2.

8.2.1 Design Stage 1

The initial version of the EPART-Framework emerged from the first round of the literature review and experience with the LEX-IS, VoicE, and (partially) VoiceS projects. The framework was applied in a) the OCOPOMO project (Bicking et al., 2010) and b) an e-participation experiment at the University of Koblenz-Landau (Huynh (2012)). In the following, the findings from these tests are summarised.

a) OCOPOMO

The design of the OCOPOMO services and the ICT toolbox was based upon the design phases of the guideline for e-participation presented in Scherer and Wimmer (2012a); Scherer, Wimmer, and Ventzke (2010) and the usability engineering process for e-participation (Scherer, Karamagioli et al., 2009), which are integrated into the EPART-Framework. From the experience made in the earlier projects, we put emphasis on designing the participation processes before planning specific electronic features. The participation processes were modelled with BPMN as outlined in Scherer et al. (2009b). From the Reference Procedural Model, a strategy for designing and implementing an *Open Collaboration in Policy Modelling Project* was developed which turned into the *OCOPOMO Policy Development Process*[90] as follows (Scherer et al., 2013):

- *Phase I. Initiation:* Before e-participation can be started, it is necessary to analyse how well the results of the OCOPOMO process i.e. the *consistent policy models* are recognised by decision makers and can influence decision making. For any stakeholder engagement initiative in collaborative policy development, it is necessary to ensure that participation of stakeholders will have an influence in the decision-making process. Otherwise, stakeholders may be demotivated and frustrated for having spent their valuable time without having created any impact. The result of these reflections regarding expectation management particularly influences the structure of the initial scenario and the type of policy model. Further basic conditions, such as available resources or the available period, are also decided roughly in this phase. The final decision about the realisation of the project triggers the next phase.
- *Phase II. Design Participation:* In this phase, it is determined how the OCOPOMO process fits into the existing decision-making process. The planners should define a rough number and duration of iteration cycles in order to allow the team to discuss and contribute to refinements of the results. Decisions regarding if, how often and when face-to-face meetings are taking place etc. are also made. Results of phases I and II may result in an adaptation of the OCOPOMO policy development process and/or tools to the particular and general conditions of the initiative.
- *Phase III. Design E-Participation:* The OCOPOMO ICT toolbox is set up, an initial scenario is developed and background documents are collected or prepared and uploaded to the space. Stakeholders and domain experts are invited to the workspace.
- *Phase IV. Participation:* Participation activities take place during as defined in Phase II and prepared in Phase III.
- *Phase V. Evaluation:* Evaluation of stakeholder engagement in regards to the expectations and objectives of the OCOPOMO e-participation defined in Phase I. The OCOPOMO project based its evaluation on an evaluation framework, which emerged from the consideration of key evaluation questions: the process and the toolbox from the view of the different actors. For each reasonable combination of dimensions, we considered the key evaluation criteria are. We defined a hypothesis and selected the evaluation method for each combination of dimensions.

[90] For a description and an overview of the OCOPOMO Policy Development Process, the reader is referred to Wimmer (2011); Wimmer, Scherer, Moss, and Bicking (2012); Scherer, Wimmer, and Markisic (2013).

Based on this evaluation framework, the OCOPOMO project partners developed questions for each of the groups in the process: stakeholders, policy modellers, policy analysts and facilitators. Each group got a different (online) questionnaire according to the individual experiences in the different phases of the process. By doing two iterations through time in the development process, on the one hand, a comparison of the different roles regarding the platform could be made and, on the other hand, new questions could be asked regarding new functionalities in an evolved platform through time. Detailed figures are available in the project report. This way, the evaluation aimed to ensure to maintain the links between the initial requirements over the process and ICT specifications towards implementations.

The EPART-Framework turned out as useful in OCOPOMO to design and plan the participation services in the pilots and as base for developing the *OCOPOMO Policy Development* Process, i.e. it is a specialisation of the Procedure Model. However, the application showed, that the EPART-Framework needs to be extended to guide the stakeholders to a greater extent.

b) E-participation experiment in the University of Koblenz-Landau

Huynh (2012) designed and implemented e-participation to engage students in the reaccreditation of study programs at the Faculty of Computer Science at the University of Koblenz-Landau. He applied the EPART-Framework to design and implementation this e-participation experiment and documented his insights in this bachelor thesis. In summary, the EPART-Framework turned out as a helpful instrument to design and implement e-participation (Huynh, 2012, p. 61). He documents the use of process models as helpful to have an overview of decision-making and participation processes. In addition, Huynh proposes two particular architecture models to be integrated into the framework: a stakeholder map and a requirements catalogue.

Both experiments show the general applicability and usefulness of the EPART-Framework components. However, they also demonstrate the limitations caused by the poor support of design methods and architecture models. Another issue is the extension of the library with reference models to support design and implementation of e-participation services. Consequently, the research in Design Stage 2 focussed on detailing and explicating the EPART-Framework components in order to support their applicability and usefulness, which resulted in the EPArt-Framework as presented in this dissertation. The following section presents its evaluation against the requirements of structure and content.h

8.2.2 Design Stage 2

First, the quality of the EPART-Framework is assessed according to the requirements for the structure of architecture frameworks identified in Section 5.1.3. Table 62 demonstrates how far the GoM principles (Schütte, 1998, p. 136) are achieved.

Table 62. Analytical evaluation of requirements for the content

Requirement (Schütte, 1998, p. 136)	Is achieved by
Construction adequacy	– The literature study and practical insights confirm the problem consensus as argued in Chapter 4 and Chapter 5. – Construction adequacy is achieved by the construction method that is based on a synthesis of knowledge from e-participation and the architecture framework and practical insights. – The architecture framework covers all relevant aspects of e-participation project design and implementation. The experience from the iterative development of the framework confirms this.
Language adequacy	– The language selection is oriented at the purposed use and the target group. – The syntactic correctness is given by complying modelling rules of standardised modelling languages (i.e. UML and BPMN). – The semantic correctness is proven through the reference models describing an EE. – A final test of the language adequacy by practitioners is topic of future research.
Economic efficiency	– The use of a widely used modelling tool (Visio) ensures the maintenance of a developed architecture description. – By providing the Reference Models, the efforts for creating an architecture description is minimised.
Clarity	– The clarity is supported by the conceptual design of the architecture framework and the viewpoints catalogue that provides different views on an architecture description.
Systematic design	– The conceptual design is based on the review of six architecture frameworks. – The design of the features included in the EPART-Framework is systematically developed as shown in Chapter 3.
Comparability	– Formal comparability is provided through orientation on standards of architecture frameworks and the use of proven and standardised modelling methods. – Content comparability is given on the level of components.

Following, it is assessed how far the EPART-Framework achieves the requirements for the content identified in Chapter 4 and Chapter 5:

Requirement 1. Policy-making cycle: The EPART-FRAMEWORK should regard the policy-making cycle and guide the integration of the participation services into the policy stages.

→ The EPART-Method guides the integration of the participation processes into the policy-making cycle. This is achieved by the consecutive activities starting with the definition of the participation objectives. Then the policy-making processes are identified and studied before participation services and processes are designed. Furthermore, the metamodel explicitly adds an entity for `Policy-making Process` and models the relationships to the `Participation Process`.

Requirement 2. Participation levels: The EPART-FRAMEWORK should consider the participation levels and support their alignment with the objectives of participation.

→ The EPART-Method guides the consideration of participation levels to be linked with the Participation Vision and the selection of appropriate participation services in analogy to Requirement 1. The participation level is an attribute to be defined for a participation service.

Requirement 3. Participation areas: The EPART-FRAMEWORK should support different participation areas and their alignment with participation objectives.

→ The EPART-Method guides the consideration of participation areas to be linked with the Participation Vision and the selection of appropriate participation services. The participation area is an attribute to be defined for a participation service.

Requirement 4. Participation techniques: The EPART-FRAMEWORK should support the integration of different participation techniques and the alignment with the objectives.

→ The EPART-Framework supports the identification of participation techniques based on the participation objectives. These participation techniques are employed by participation services integrating different techniques.

Requirement 5. Participation process design: The EPART-FRAMEWORK should support the design of participation processes based on defined participation objectives and their integration into policy-making processes.

→ The EPART-Framework and the EPART-Method guide the careful design of participation processes and suggest to model them with BPMN. See also Requirement 1 and Requirement 6.

Requirement 6. Reference participation process models: The EPART-FRAMEWORK should integrate reusable participation process models.

→ The EPART-Reference models integrate BPMN process flow diagrams that present reference participation processes. However, the library of reference process models can still be extended for different participation services.

Requirement 7. E-participation tools: The EPART-FRAMEWORK should support the design of e-participation tools to meet participation objectives.

→ The EPART-Framework links the applications with participation services aiming at particular participation objectives.

Requirement 8. Participation guidelines: THE EPArt-Framework should support an EE to develop its own participation guidelines.

→ The EPART-Method integrates an activity for the development of participation guidelines. The Reference Principle Catalogue provides some examples of principes usable in this matter.

Requirement 9. Entities of an EE: The EPART-FRAMEWORK should consider the following entities: stakeholder/actor, role, policy-making stage, level of participation, participation area, participation activity, participation technique, participation process, ICT (application/ICT, tool, tool category, and technology), channel, outcome, objective, driver, and barrier.

→ The EPART-Metamodel integrates all these entities.

Requirement 10. Stakeholder and actor types: The EPART-FRAMEWORK should consider the following actor/stakeholder types: academia; advisory board, industry/business (in particular consultancies); elected representative; government executive; policy maker; political party/politician; citizen/citizen group; NGO/CSO; the media.

→ The EPART-Metamodel integrates the actor type. The EPART-Method and EPART-Viewpoints consider these actor types in their guidance.

Requirement 11. Actor roles: The EPART-FRAMEWORK should consider the following actor roles: input provider and lurker as participant; decision maker; administrator, consultant, evaluator, expert of the particular policy, facilitator, initiator, ICT developer, ICT maintainer; ICT supplier, moderator, marketing/promotion, owner, project manager, support staff.

→ The Reference Role Catalogue employs these roles.

Requirement 12. Architecture development phases: The EPART-FRAMEWORK should guide the following fives phases of operating an EE (Table 22): Phase I. Initiation, Phase II. Design, Phase III. Implementation, Phase IV. Participation, and Phase V. Evaluation.

→ The EPART-Method details these phases.

Requirement 13. Main activities of an EE: The EPART-FRAMEWORK should guide the activities of project management, motivation management, requirements analysis, participation management, e-participation management, stakeholder management and

communication, marketing, editorial management, evaluation management, and decision management.

→ The EPART-Method considers the variety of tasks in the different main task categories identified. The guideline describes these tasks as activities. Nevertheless, the EPART-Method is open for adjustments to put in an existing organisational setting.

Requirement 14. Components of the EPART-FRAMEWORK: The EPART-FRAMEWORK must constitute of a set of recommended viewpoints, a metamodel, an architecture development Method, and a set of reference models. → The EPART-Framework comprises these components.

Requirement 15. Dimensions: THE EPArt-Framework should place emphasis on a multidimensional approach (how, where, who, when, why and what). → The dimensions are considered by the EPART-Viewpoints and entities of the EPART-Metamodel as follows: The Participation and E-Participation Viewpoint puts emphasis on how, Participant Viewpoint on who, Participation Scope Viewpoint on why, and the Data & Information Viewpoint on what. The entities `Location` and `Event` and considered by different viewpoint put emphasis on the dimensions where and when.

Requirement 16. Viewpoints: The EPART-FRAMEWORK should integrate viewpoints on the participation scope, implementation & governance participant, data & information participation, and e-participation.

→ These viewpoints are integrated as follows: The Participation Scope Viewpoint focusses on the motivation of participation. The Participation Viewpoint focuses on participation management and operational editorial management. The E-Participation Viewpoint on e-participation tool engineering. The Data & Information Viewpoint employs view on the relevant data for editorial management. The Implementation & Governance Viewpoint employs project management and evaluation management.

Requirement 17. E-participation orientation: The EPART-FRAMEWORK must be tailored to e-participation, i.e. use the terminology of the discipline and address the specific goals, stakeholders, concerns, and processes.

→ The iterative design approach, which extensively communicated the research results as well as the integration into e-participation design and implementation ensure that this requirement is considered. However, a final evaluation by applying the EPArt-Framework as it is presented in this dissertation is yet to be performed.

Requirement 18. Detailed method descriptions: The EPART-FRAMEWORK must provide detailed descriptions of activities specific to e-participation.

→ The EPART-Method describes activities and provides references to further literature.

Requirement 19. Reference models: Reference models for e-participation must be developed and integrated into the EPArt-Framework.

→ Reference models are integrated in the framework. However, a full reference EPART needs the deployment of the EPART-Framework in a real life situation.

In the following, the evaluation is concluded: Overall, the proposed EPART-Framework is assessed as important and useful in e-participation design and implementation under similar conditions as it was provided in LEX-IS, VoicE, VoiceS, OCOPOMO, and the case study by Huynh (2012) in the University of Koblenz-Landau. The observational evaluation demonstrated the applicability and usefulness of the guidance that the initial version of the EPART-Framework provides in designing and implementing e-participation. However, it also points the limitations consisting of poor support with methods and architecture models. In stage 2, a detailed requirements analysis aims to refine the objectives of the framework based on these insights. These requirements are taken into account during the design of the EPART-Framework. Its test in further case studies remains an issue for further research as it will be argued in the following concluding chapter.

9. Conclusions and Outlook

This chapter concludes this dissertation with an overview of the main outcomes and contributions of the research, arguing the rigour of the overall methodical approach, a critical analysis stating the limitations, and an outlook on future work.

The remainder of this chapter is structured as follows: Section 9.1 summarises the main outcomes regarding the research questions (cf. Section 1.2) and argues the rigour of the research process. Section 9.2 reflects the outcomes of this dissertation and provides an outlook on future research.

9.1 Summary of Results

Part I. Introduction and Foundations introduced the reader to the topic, defined relevant terminology and set the methodical foundations. Chapter 1 discussed the two gaps, i.e. (1) the existing gap in e-participation research to support practitioners with a comprehensive approach for e-participation design and implementation, and (2) the existing gap in research of deploying architecture frameworks in e-participation, and defined the research objective of this dissertation as follows:

Research Objective: Develop an E-Participation Architecture Framework (EPART-Framework) as an instrument that provides a coherent whole of principles, templates, and methods, and models to guide participation service providers the comprehensive design of and implementation of e-participation services.

The research objective was subdivided into three research questions (cf. Section 1.2). The three research questions guided the design and the structure of this dissertation. This chapter summarises the contributions of the single chapters of this dissertation and discusses the achieved results in relation to the research questions.

The foundations for answering these research questions were laid in Chapter 2, which described the theoretical underpinnings of the research presented in this dissertation. It systematically defined the term *citizen participation* by revisiting the forms of political participation and the typology of public engagement methods. Furthermore, it examined the definitions of *e-participation* and of *e-democracy*. Chapter 2 also introduced a common terminology to describe the architecture framework domain. Thereby it revisited different attempts using the ISO/IEC/IEEE 42010:2011 standard. The theoretical foundations concluded with a definition of the terms *E-Participation Enterprise* and *E-Participation Architecture Framework*. Chapter 3 developed an appropriate research approach for answering the research questions using a combination of several research methods to gain rich insights into the research phenomena and to corroborate the results. This chapter described the literature review process relevant to answering Research Question 1, Research Question 2, and Research Question 3. Furthermore, it argued the meaningfulness of action research for answering Research Question 2 and Research Question 3, because the this gained insights into e-participation design and implementation, which existing theories did not yet

grasp. Finally, it outlined the design science research applied to develop the EPART-Framework for answering Research Question 3.

Part II. Literature Review and Action Research scientifically grounded the design of the EPART-Framework shaped by the research questions.

Research Question 1. What are the challenges in designing and implementing e-participation?

Chapter 4 analysed the state of the art in e-participation design and implementation. The chapter started with analysing the characteristics of e-participation by discussing

- the policy-making cycle and participation possibilities,
- the participation paradox with the Stuttgart21 example,
- the benefits and risks of participation,
- the e-participation levels,
- the participation areas presented, concluding with a selection of areas relevant to this dissertation,
- the participation techniques,
- the participation processes employing a case study of participatory budgeting, and
- the participation guidelines from nine different documents published by city councils, and private consulting companies.

Afterwards, the chapter moved on to study conceptual models structuring e-participation by revisiting eight frameworks. The conceptual models were analysed and compared in order to identify entities constituting an EE. It was stated that none of these models provides a complete picture of an EE and a set of relevant entities was derived. Next, the chapter investigated 17 procedure models identified in scientific and practitioner literature guiding e-participation design and implementation. A comparative analysis identified five phases and corresponding activities. A number of main activities framing stakeholder concerns in e-participation were also derived. The investigation of procedure models revealed that there is no single approach, which can serve as a reference procedure for designing and implementing different types of e-participation. Chapter 4 concluded with a number of challenges of e-participation design and implementation resulting from the literature review answering *Research Question 1* and arguing the need for an architecture framework.

Research Question 2. What are the commonalities and variations around architecture frameworks and e-participation design and implementation?

Chapter 5 investigated to what extent EA frameworks can support successful e-participation design and implementation and what adaptations or revisions are necessary to streamline architecture frameworks towards e-participation. The chapter started with an analysis of the related work in architecture frameworks. The purposes and challenges of enterprise architectures were argued according to the challenges of the public sector. Purposes and challenges of enterprise architecture were identified. Thereafter, Chapter 5 reviewed six architecture frameworks to study their concepts and structure. The study of functional architecture framework requirements together with considerations from Chapter 2 revealed the relevant components of the EPART-Framework: a set of viewpoints, a metamodel, an architecture development method, and reference models. Requirements in Buckl (2011), which are based on GERAM were studied together with the GoM (Schütte & Rotthowe,

1998) to derive requirements for the structure of the framework. These investigations built the basis for answering *Research Question 2* by determining the characteristics of architecture frameworks. The chapter moved on with introducing the setting of the action research and derived challenges of e-participation design and implementation from practice. Afterwards, it synthesised results from the literature reviews with insights from practice for each of the architecture framework components identified. Chapter 5 concluded with discussing the findings and answering *Research Question 2:* The investigation showed that architecture frameworks can support e-participation procedures and objectives and identified relevant aspects. Nevertheless, it also outlined some drawbacks hindering the simple adaption of existing EA frameworks, which should be considered for answering Research Question 3 in *PartIII. Designing the E-Participation Architecture Framework.*

Research Question 3. What should the EPART-Framework look like and what components should it include?

Answering this research question required an iterative approach of design science research. This was scientifically grounded to achieve its goal and objectives. Accordingly, a combination of several research methods was used to gain rich insights into the research phenomena and to corroborate the results, i.e. the literature review, the action research, and the desk research. The design considerations driving this research were discussed in Subsection 3.3.2. The literature review and action research documented in Chapter 4 and Chapter 5 informed the requirements analysis, and requirements were accordingly captured. These requirements were taken into account when the EPART-Framework was developed. Finally, UML was selected for designing the conceptual architecture models and BPMN for process models.

After documenting the design of the EPART-Framework, Part III moved on with the description of the designed artefact. Chapter 1 answered Research Question 3 by proposing the EPART-Framework to guide the design, implementation and sustainment of an e-participation architecture. The chapter presented an outline of the EPART-Framework, and detailed the EPART-Viewpoints. The content of the EPART-Framework was based on the architecture framework components identified in Chapter 5. The EPART-Viewpoints, designed from the synthesis of architecture framework viewpoints with the concerns of e-participation stakeholders were selected to structure an Architecture Description and a Solution Repository. The EPART-Metamodel was introduced as the basis for these viewpoints. The EPART-Reference Models brought together best practice architecture models for e-participation. Chapter 7 presented the EPART-Method to guide the application of the framework to design the EE and implement e-participation. An overview of the five-phased procedure model was provided and each phase was outlined in one subsection.

Part IV started with an assessment if this artefact fulfils the Research Objective. Chapter 8 outlined the evaluation approach based on the iterative design approach and the analytical and descriptive evaluation of the final EPART-Framework against its requirements and outlined some resulting recommendations for future research. The rigour of the overall methodical approach was argued based on the design science research guidelines (Table 63). Accordingly, Research Question 3 was answered by the requirements posed, the EPART-Framework and the EPART-Method.

Table 63: Design science research guidelines and relevance in the dissertation

Design science guideline (Hevner et al., 2004, p. 83)	How this dissertation aims to fulfil the guideline
Guideline 1: Design as an Artefact	This research produced different artefacts in the form of the EPArt-Framework, the EPArt-Metamodel, the EPArt-Viewpoints, the EPArt-Method, and the EPArt-Reference Models (Chapter 1 and Chapter 7).
Guideline 2: Problem Relevance	The relevant problems were identified and research aims were argued from literature review in Chapter 4 and Chapter 5 of this dissertation. The placement of the research in the environment ensures the relevance of the problem.
Guideline 3: Design Evaluation	The research method integrated an iterative evaluation of a first version of the EPArt-Framework and the EPArt-Method. The test of this initial version grounded the research for designing the EPArt-Framework in its current form. This approach was demonstrated accordingly in this dissertation.
Guideline 4: Research Contributions	The architecture framework provided a contribution to the e-participation body of knowledge as outlined in Chapter 1. I am not aware of any architecture framework for this particular domain.
Guideline 5: Research Rigour	The rigour of the research design was argued in Chapter 3 for construction methods and Chapter 8 for the evaluation methods. Synthesising literature studies and practical insights in an iterative approach played a crucial role. Evaluation of the final EPArt-Framework based on the requirements developed in the course of this research.
Guideline 6: Design as a Search Process	The research method combining literature review and action research supported the iterative nature of Design Science Research through iteration activities.
Guideline 7: Communication of Research	The resulting EPArt-Framework is expected to be understood by technology-oriented and management-oriented audiences and to serve as basis for communication between managers and ICT consultants. The modelling language used has a degree of formality that allows the use of models for the implementation of e-participation. Audiences are provided with the research methodology and design considerations to support them in understanding the construction of the model. The research was extensively communicated as outlined in Appendix E.

9.2 Critical Reflection and Future Research

The EPArt-Framework was introduced as an innovative framework to support the design and implementation of e-participation based on “practice”-proven solutions. The EPArt-Method provided methods and techniques to ensure organisational implementation of the EPArt-Framework. Its usability was demonstrated by applying iterative design science research and testing the EPArt-Method in practice. In summary, the dissertation provided five main outcomes that represent the result of this research:

- The EPArt-Framework framing architecture work in an EE,
- The EPArt-Viewpoints governing the development of architecture models to design e-participation,
- The EPArt-Metamodel defining a glossary for e-participation and conceptualising an EE,
- The EPArt-Method supporting the design and implementation of e-participation, and
- The EPArt-Reference Models providing practice proven architecture models

During the research, it turned out as necessary to introduce and define new terms, such as E-Participation Enterprise, E-Participation Enterprise Architecture, and new roles in e-participation design and implementation, such as e-participation architects, (e-)participation analyst, to the e-participation domain.

Throughout the observational research, the significance of understanding the participation goals and how to break them down towards the EEA was observed as important. It seemed that the use of business process engineering for designing participation processes

is not straightforward. One of the significant insights obtained from the analysis was that the participation processes have to be aligned to the policy-making processes. Therefore, the analysis of the policy-making processes is such important after determining the scope of participation. Only if the participation analysts can identify a *point of time* in the policy-making process, which allows meaningful participation, the further design can proceed. Only then, the analysts can plan the participation processes around this point and conceptualise the data. Only afterwards, the ICT architects can design the electronic tools. The EPART-Framework guided this procedure. These contributions provided innovations in the field of e-participation (as demonstrated by the communications of this research, cf. in Appendix E) and lay the groundwork for further research. The potential future research topics based on the EPART-Framework are now discussed.

In this dissertation, a prototypic tool constellation based on MS Visio and MS Excel was selected to develop the reference models, which leaves open space for future research. E-participation architects as intended users of the EPART-Framework could benefit from an EA tool supporting the EPART-Framework (including the EPART-Metamodel and the EPART-Viewpoints). This could enhance the benefit of the EPART-Framework, especially from a practitioner's perspective. Section c) proposed some examples.

The evaluation outlined limitations of this research. First, the study should have involved more experts in order to generalise the requirements for the EPART-Framework. Second, the action research was based on typical EU projects. Involvement in another kind of e-participation could have given additional experiences. Finally, the evaluation approach lacked a real world application of the final result. An evaluation by experts needs the application of the EPART-Framework in a real-world situation. These issues could not be addressed in this research due to limitations in time and resources.

Considering these limitations, future work is planned, including the following: First, the framework should be applied in a real-world situation. The application of the architecture framework in e-participation will result in more specific architecture frameworks adapted to the specific needs of the organisations implementing e-participation. Second, it will result in more reference models for different cases extending the EPART-Reference Models. Third, the architecture framework in terms of the users' view has to be evaluated by the stakeholders after further improvements. Fourth, the ICT support for applying the architecture framework should be advanced as described above.

Another open research question, which we experience in our recent research is the role of trust for e-participation (see e.g. Scherer & Wimmer, 2014a, 2014b; Wimmer, Scherer, & Appel, 2015). A question in this regard will be how far the EPART-Framework can support the design and implementation of trustworthy e-participation. Alexander Heimers investigates in his master thesis (Heimers, 2016) the influence of trust on e-participation focussing on technology and processes. The resulting recommendations could update the EPART-Framework and result, e.g. in extensions of the EPART-Reference Models or adaptions of the EPART-Method.

In conclusion, the analytical and descriptive evaluation indicates that the EPART-Framework is a valuable addition in academia and in practice to improve e-participation design and implementation. As well, various opportunities for future research to extend and advance the framework are possible.

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Part V. APPENDICES

A List of Functional EPART-Framework Requirements

B EPART-Metamodel Entities

The following table lists all entities defined in the EPART-Metamodel with their definition and an example for an instance. Cursive font indicates that the entity is abstract.

Entity	Definition	Example instance
Activity	A task, which transforms input resources into output resources or changes the states of resources (DoD, 2011, p. 25).	Submit a proposal
Actor	A organisational entity that is capable of performing behaviour (TOG, 2013, p. 14).	<abstract>
Application Component	A group of interacting or interdependent ICT elements, which can be functional, physical or behaviour related (DoD, 2011, p. 25). A group of integrated Applications may form an e-participation platform as an application component.	Forum Application
Budget	The definition of available resources for operating the EE.	50,000 €
Constraint	An external factor or restriction influencing the way in which participation can be realised (TOG, 2011a, p. 24, 2013, p. 122).	Application should be realised in Java
Data Component	An "encapsulation of data abstract data entities into units that can be governed and deployed into applications" (TOG, 2011a, p. 350).	User data
Data Entity	A specific encapsulation (TOG, 2011a, p. 356) or information that is materialised in any medium or form and communicated or received (DoD, 2011, p. 25). It is represented in a formalised manner suitable for communication, interpretation, or processing by humans or by automatic means (DoD, 2011, p. 25).	Proposal
Event	An "organisational state change that triggers processing events; may originate from inside or outside the organization and may be resolved inside or outside the organisation" (TOG, 2011a, p. 357).	Submission of draft budget
Impact	A general objective, i.e. a societal objective or public value that describes an overall e-participation goal (Smith et al., 2011, p. 308).	Citizens' trust in the communal budgeting processes increased
Information Process	A procedure, which intends to inform stakeholders on the participation topic.	Inform on the e-participation
Input Provisioning Process	A procedure, which intends to inform stakeholders on the participation topic.	Deliberation process
Location	A place where an activity is performed or a resource is placed (DoD, 2011, p. 26). A Location can be hierarchically decomposed (TOG, 2011a, p. 357). It can be physical or logical.	– The city – Location, where the public hearing takes place – IT Server Centrecated
Measure	An "indicator or factor that can be tracked, usually on an ongoing basis, to deter mine success or alignment with objectives and goals" (TOG, 2011a, p. 626).	Number of participants is 30% of habitants.
Mitigation Strategy	An action for reducing the probability of a risk.	Extensive marketing, ensure to address a large group of people and that the target group is not excluded
Objective	A goal of the EE. Objectives can be defined on different levels: general objectives (impacts), specific objectives (outcomes) and operational objectives (outputs) (Millard, 2008).	To enable the citizens to contribute to the communal budgeting process
Organisation		Administration
Outcome	A specific objective that describes a benefit of e-participation for stakeholders (Smith et al., 2011, p. 308).	5 out of 10 proposals were considered in the communal budget
Output	An operational objective that e-participation generates through	Leaderboard of 10

	its construction (Smith et al., 2011, p. 308).	best ranked citizens proposals
Participation Process	A procedure, which presents the actively engagement of participants.	Input provisioning process
Participation Result	The product or value of a Participation Service.	<abstract>
Participation Service	A specific service to involve or engage target groups based on participation techniques employed.	Online Participation Service Leader board Creation Service
Performer	Any entity or complex of entities responsible to perform an activity and provide a capability (DoD, 2011, p. 33).	<abstract>
Person	A human actor involved in the e-participation.	The Major of the citizen
Policy-making Process	A set of coordinated activities with certain start and end points that are performed by a government with the aim to set a policy on the political agenda, formulate a policy, decide a policy, implement a policy and/or evaluate a policy.	Communal budgeting process
Principle	A "qualitative statement of intent that should be met by the enterprise" (TOG, 2011a, p. 22). Principles are "general rules and guidelines […] that inform and support the way in which an organisation sets about fulfilling its mission" (TOG, 2011a, p. 235).	"There is some scope for decision making and there is something to decide or influence."
Process	A behaviour element that groups behaviour based on an ordering of activities (TOG, 2013).	<abstract>
Reporting Process	A procedure, which intends to report stakeholders on the results of participation, the decisions made, and the impact reached and get their feedback.	Report on decided budget
Requirement	A "statement of need that must be realised" (TOG, 2013, p. 120) by the EE.	The e-participation platform must provide a 'remove my account' button in the user profile.
Resource	Something that is consumed or produced by an activity (DoD, 2011, p. 25). Resources include the underlying infrastructure necessary to construct the e-participation (Smith et al., 2011, p. 308).	<abstract>
Result-Processing Process	A part of the participation process when the participation inputs are processed to be considered in the policy-making/decision-making processes.	Create leader board process
Risk	A danger, which might influence if objectives are achievable.	Few users and/or target group too small
Role	The part and the contribution, which an actor plays in the EE (TOG, 2011a, p. 30).	Input provider
Target Group	The group of people or organisation units, who the e-participation aims to engage	Habitants of the city
Technology Component	An "encapsulation of technology infrastructure" (TOG, 2011a, p. 631).	– Application Server – DB2[91] Database
Vision	A mental image of the intended future (cp. inputs in DoD, 2011, p. 26) with regards to what the EE aims to achieve.	To enable a sustainable participatory budgeting, which supports trust in communal budgeting and enables better decision-making

[91] DB2 is a commercial database provided by IBM (http://www.ibm.com/analytics/us/en/technology/db2/, access: 2016-15-05)

C EPART-Metamodel Attributes

The following table lists the entity specific attributes.

Entity	Attribute	Description
<each entity>	name	Name of the entity
	description	A short description of the entity
Actor	num	Estimated number of persons or organisation units that operate as this **Actor**.
	objectives	Description of the general objectives of this **Actor**.
	activities	Description of the general activities, which this **Actor** performs.
Data Entity	type	Data Type: A particular kind of Data Entity (Table 46). A data entity may have multiple types.
Location	type	Location Type: The following categories apply: Country, Region, City, Building, Specific Location
Organisational Entity	type	Organisation Type: A particular kind of Organisation (Table 42).
Participation Service	participation technique	Description of the participation technique employed by this service. A participation technique is a method or instrument applied to engage individuals or groups in the policy-making process (Kalampokis et al., 2008).
	area	Participation Area: A democratic field in which participation takes place. The participation areas that apply are presented in Table 8 (p. 53).
	level	Participation Level: The power that is put in the hands of the participants. The participation levels that apply are presented in Subsection 4.1.4 (p. 51).
	stage	Policy Cycle Stage: A stage in the policy-making process. The policy cycle stages that apply are presented in Subsection 4.1.1 (p. 47).
	channel	The interface through which the service is provided
Person	***type***	Person Type**:** A particular kind of Person (Table 41). A person can have multiple types.
Process	***type***	Process Type: Whether this process is supported by IT or is a manual process
Requirement	priority	Definition of whether the requirement is a nice to have, should have, or must have.
	indicator	Statement of the indicators, which define that the requirement will by met.
Role	num	Estimated number of actors that operate in this role.
Vision	area	Participation Area: A democratic field in which participation takes place. The participation areas that apply are presented in Table 8 (p. 53).
	level	Participation Level: The power that is put in the hands of the participants. The participation levels that apply are presented in Subsection 4.1.4 (p. 51).
	stage	Policy Cycle Stage: A stage in the policy-making process. The policy cycle stages that apply are presented in Subsection 4.1.1 (p. 47).
	target group	Description of the target group(s) to be involved and engaged.

D EPART-Metamodel Relationships

The following table lists the relationships between the entities of the EPART-Metamodel. The origin of these relationships are detailed in the overview of the EPART-Metamodel (cf. Figure 27, p. 138). The relationships can be inverted, what is not explicitly modelled and described, e.g. `Event` triggers `Process` is also `Process` is triggered by `Event`.

Relationship	Source	Target	Description/Example
accesses	`Performer`	`Data Entity`	A performer accesses a data entity, e.g. to read it.
aims to achieve	`Participation Service`	`Objective`	*Information Provisioning Service* aims to achieve *better informed stakeholders*
associated with	`Vision`	`<all>`	Instances of participation scope entities can be associated with any other instance. It means that the instance, e.g. a particular objective, is linked to this particular instance, e.g. a requirement with an application component.
	`Objective`	`<all>`	
	`Principle`	`<all>`	
	`Requirement`	`<all>`	
	`Constraint`	`<all>`	
creates	`Performer`	`Data Entity`	A performer produces a data entity.
communicates with	`Application Component`	`Application Component`	Communication between components.
	`Technology Component`	`Technology Component`	
decomposes	`Application Component`	`Application Component`	Some entity is contained in another entity.
	`Technology Component`	`Technology Component`	
	`Stakeholder/Actor`	`Stakeholder/Actor`	
generates	`Process`	`Event`	A process creates an event
governs	`Stakeholder/Actor`	`Performer`	A stakeholder controls, regulates or is responsible for a performer.
in	`Resource`	`Location`	Where a resource is virtually/physically located.
is assigned to	`Event`	`Location`	Where an event takes place.
is realised through	`Participation Service`	`Application Component`	Which application component realises which service.
is related to	`Risk`	`Objective`	Links a risk with the corresponding objective, which fulfilment could be hindered.
	`Mitigation Strategy`	`Risk`	A strategy to mitigate a risk.
	`Data Entity`	`Data Entity`	Links between data entities.
limits	`Budget`	`Cost`	A budget limits the costs for resources.
is part of	`Activity`	`Process`	A process consists of activities.
is performed by	`Activity`	`Performer`	An activity is executed by a performer.
produces	`Resource`	`Cost`	A resource has costs.
	`Participation Service`	`Participation Result`	A participation service generates a result.
provides platform for	`Technology Component`	`Application Component`	Technology components provide the technical platforms for application components.
realises	`Principle`	`Objective`	What instance is the cause to happen another instance.
	`Requirement`	`Principle`	
	`Objective`	`Vision`	
	`Process`	`Participation Service`	
	`Participation Result`	`Objective`	
resides within	`Data Component`	`Application Component`	A compartment relationship between two instances.
	`Data Entity`	`Data Component`	

sets performance criteria for	Performance Indicator	Objective	When is the objective fulfilled?
triggers	Event	Process	The triggering relationship describes the temporal or causal relationships between events and processes.
	Event	Activity	The triggering relationship describes the temporal or causal relationships between events and activities.
updates	Performer	Data Entity	The updating relationship describes that

E Glossary

Architecture: A conceptualisation of a system (that is embodied in an environment) in its fundamental concepts or properties, their relationships to each other and the environment and in design and evolution principles (ISO/IEC/IEEE 42010:2011, no. 3). [Definition 10, p. 20]

Architecture description: A coherent whole of artefacts or work products to document an architecture (ISO/IEC/IEEE 42010:2011, 3). [Definition 12, p. 22]

Architecture framework: An instrument consisting of conventions, principles, and practices that guides the architect the development, implementation, and sustainment of a range of different architectures (derived from Perroud & Inversini, 2013; ISO/IEC/IEEE 42010:2011; TOG, 2011a, p. 7). [Definition 16, p. 26]

Citizen participation: The "process by which members of a society (those not holding office or administrative positions in government) share power with public officials in making substantive decisions and in taking actions related to the community" (Roberts, 2004, p. 320). [Definition 2, p. 15]

Concern: A consideration that appears during the design, implementation, and operation of a system from its needs and requirements or the choices selected during the life cycle of the system (ISO/IEC/IEEE 42010:2011, p. 6). [Definition 13, p. 23]

Electronic participation (e-participation): The use of ICT to facilitate citizen participation (Macintosh, 2004b; Sæbø et al., 2008**).** [Definition 3, p. 16]

Enterprise: Any collection of organisations that commonly holds goals, processes and resources (Bernard, 2012, 481; TOG, 2011a, p. 5). [Definition 11, p. 22]

E-participation architecture framework: An instrument that guides the development, implementation, and sustainment of a wide range of different EEAs. [Definition 22, p. 28]

E-participation enterprise (EE): Any collection of organisations that commonly holds a participation vision encompassing the resources, information and technology services, processes, and infrastructure to realise the vision (based on TOG, 2011a, p. 5).

E-participation enterprise architecture (EEA): A conceptualisation of an EE in its fundamental concepts or properties, their relationships to each other and the environment and in design and evolution principles (based on ISO/IEC/IEEE 42010:2011, no. 3). [Definition 21, p. 27]

E-participation tool: A set up consisting of software, hardware, and data to facilitate participation. [Definition 4, p. 16]

Mental model: An "internal conceptual representation of an external system whose structure maintains the perceived structure of that system" (Doyle & Ford, 1998, pp. 17–21). [Definition 6, p. 18]

Metamodel: A conceptual description of a model, which defines the used modelling concepts as well as their usage (Winter, 2000, p. 116). [Definition 7, p. 19]

Method: A document that guides "the optimal ways to carry out design or implementation activities" (TOG, 2011a, p. 624). [Definition 17, p. 26]

Model: A purposeful image of a system, which allows the interpreter to make similar observations and statements as to the original system but reduces the system to relevant aspects with regards to the investigated problem through abstraction (Winter, 2000, p. 104). [Definition 5, p. 17]

Participation service: A service, which enables citizen participation to the stakeholders. [Definition 18, p. 27]

Participation vision: A high-level view on the overall impact (Moore, 2000, p. 183), which the EE wants to achieve by providing participation services. [Definition 20, p. 27]

Policy making: The general procedure that results in public decisions by political actors and groups to reach certain goals (Howlett, Ramesh, Perl, & Ramesh, 1995, pp**. 4–6**). [Definition 1, p. 14]

Reference model: A designated model, which describes characteristic properties of a class of similar systems and serves as a reference point to develop specific models (Winter, 2000, p. 106). [Definition 8, p. 20]

System: A set of entities, which are interrelated, and can be differentiated from its environment (Krallmann, Frank, & Gronau, 2002, p. **24)**. [Definition 9, p. 20]

View: A work product that describes a part of an architecture description and addresses concerns from the perspective of particular stakeholder groups (ISO/IEC/IEEE 42010:2011). [Definition 14, p. 24]

Viewpoint: A description of conventions/principles how to create, interpret or use of a view, i.e. an abstract model of a view (ISO/IEC/IEEE 42010:2011). [Definition 15, p. 24]

F Communications of this Dissertation

Research communication is a fundamental part of design science research (Hevner et al., 2004; Hevner & Chatterjee, 2010). The research presented in this dissertation is communicated through conference proceedings, journal papers, conference presentations and a bachelor thesis. In the following, the publications are listed according to the main contributions of this dissertation.

The *EPART-Metamodel* presented in Section 6.3 is published in the following conference paper:

> Scherer, S., & Wimmer, M. A. (2016). A metamodel for the e-participation reference framework. In E. Tambouris, P. Panagiotopoulos, Ø. Sæbø, M. A. Wimmer, T. A. Pardo, Y. Charalabidis,. . . T. Janowski (Eds.), *Electronic participation* (Vol. 9821, pp. 3–16). Cham: Springer International Publishing. doi: 10.1007/978-3-319-45074-2_1

The *initial version of the EPART-Framework* (see Section 3.3.2) is communicated in the following three publications. Furthermore, these publications present the results of the first round of literature review, which flowed into *Section 4.3*, and *Chapter 5* of this dissertation.

- Scherer, S., & Wimmer, M. A. (2012a). E-participation and enterprise architecture frameworks: an analysis. *Information Polity*, *17*(2), 147–161. doi: 10.3233/IP-2012-0270
- Scherer, S., & Wimmer, M. A. (2011a). Analysis of enterprise architecture frameworks in the context of e-participation. In S. A. Chun, Luis Luna-Reyes, & V. Atluri (Eds.), *Digital Government Innovation in Challenging Times. 12th Annual International Digital Government Research Conference. Proceedings* (pp. 94–103). New York, NY, United States: ACM Press. doi: 10.1145/2037556.2037571
- Scherer, S., & Wimmer, M. A. (2011b). Reference framework for e-participation projects. In E. Tambouris, A. Macintosh, & H. de Bruijn (Eds.): *Vol. 6847. LNCS, Electronic participation. Third IFIP WG 8.5 international conference. Proceedings* (pp. 145–156). Berlin, Germany, et al.: Springer. doi: 10.1007/978-3-642-23333-3_13

The *EPART-Method* presented in Chapter 7 of this dissertation is based on two initial versions – called the *Hands-on Guideline for E-participation Initiatives* and the *Regional Participation Model for E-participation* (cf. Section 3.3.2) – communicated in the following three publications. Furthermore, these publications present the results of a first round of literature review and action research, which flowed into *Section 4.3* and *Chapter 5* of this dissertation:

- Scherer, S., Wimmer, M. A., & Schepers, J. (2012). Regional participation model to engage citizens in distant decision making. In Y. Charalabidis & S. Koussouris (Eds.), *Empowering Open and Collaborative Governance. Technologies and Methods for Online Citizen Engagement in Public Policy Making* (pp. 139–156). Berlin, Germany, et al.: Springer-Verlag. doi: 10.1007/978-3-642-27218-9-6_8

– Scherer, S., Wimmer, M. A., & Ventzke, S. (2010). Hands-on guideline for e-participation initiatives. In M. Janssen, W. Lamersdorf, J. Pries-Heje, & M. Rosemann (Eds.): *Vol. 334. IFIP AICT, E-government, e-services and global processes. Joint IFIP TC 8 and TC 6 international conferences. Proceedings* (pp. 49–61). Berlin, Germany, et al.: Springer. doi: 10.1007/978-3-642-15346-4_5
– Scherer, S., Karamagioli, E., Titorencu, M., Schepers, J., Wimmer, M. A., & Koulolias, V. (2009). Usability engineering in eParticipation. *European Journal of ePractice*, *7*, 1–12

The initial version of the EPART-Framework serves as the basis for implementing e-participation in the frame of the 2012 reaccreditation at the Faculty of Computer Science at the University of Koblenz-Landau by Huynh (2012):

> Huynh, V. (2012). *E-Partizipation im Rahmen der Reakkreditierung 2012 im Fachbereich Informatik der Universität Koblenz-Landau* (Bachelor thesis). Universität Koblenz-Landau, Koblenz, Germany. Retrieved from kola.opus.hbz-nrw.de/volltexte/2012/835/, last access: 2016-04-14[92]

Furthermore, the OCOPOMO project applied these initial framework versions in the design and implementation of its pilots as documented in its initial project deliverable (see Bicking et al., 2010). The results of both studies (Huynh, 2012 and OCOPOMO) and their influences to designing the *EPART-Framework* are documented in Chapter 8 of this dissertation.

The *EPART-Reference Models* in *Section 6.4* of this dissertation present practice proven and research grounded best practices of e-participation. The following publication communicated an earlier version of the Reference Participation Process Models (cf. *Subsection 6.4.4*). The results of a research internship[93] at the University of Koblenz-Landau under the supervision of Prof. Dr. Maria A. Wimmer and me built the basis for the models presented in this publication. The internship aimed at developing participation process models for consultation, petitioning, electioneering, spatial planning, and participatory budgeting. For each of these participation areas, the students selected a number of projects based on the following criteria: up-to-dateness and activeness, impact, geographical level, quality, and diversity. First, the students modelled the traditional processes and, second, the participatory processes. Their results on participatory budgeting were grounded with an additional literature study. The literature review in this publication also flowed into *Section 4.1.7* of this dissertation.

> Scherer, S., & Wimmer, M. A. (2012b). Reference process model for participatory budgeting in Germany. In A. Macintosh, E. Tambouris, & Ø. Sæbø (Eds.): *Vol. 7444. LNCS, Electronic Participation. Fourth IFIP WG 8.5 International Conference. Proceedings* (pp. 97–111). Berlin, Germany, et al.: Springer. doi: 10.1007/978-3-642-33250-0_9

The following publication proves the use of the Business Process Modelling Notation for communication and design of e-participation processes as formulated in *Subsection 6.4.4*.

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[92] Translation of the title: "E-participation in the frame of the 2012 reaccreditation at the Faculty of Computer Science at the University of Koblenz-Landau". The bachelor thesis was supervised by Prof. Dr. Maria A. Wimmer and Sebastian Alsbach.

[93] Stephan Adams, Carsten Einig, Olaf Gärtner, Marc Vogel and Navid Zarabian participated in this research internship in the Winter Term 2011/2012 (see https://www.uni-koblenz-landau.de/de/koblenz/fb4/iwvi/agvinf/lehre/archiv/wise1112/master/forschungspraktikum, access 2016-03-21).

Scherer, S., Wimmer, M. A., & Ventzke, S. (2009b). Modellierung von Prozessen für E-Partizipation in BPMN. In S. Fischer, E. Maehle, & R. Reischuk (Eds.): *LNI, Im Focus das Leben* (pp. 1804–1813). Bonn: Köllen Druck+Verlag GmbH.

The following publication documents evaluation results from the LEX-IS project. Results of this evaluation flowed into the documentation of action research in Chapter 5:

Scherer, S., Neuroth, C., Schefbeck, G., & Wimmer, M. A. (2009). Enabling eParticipation of the youth in the public debate on legislation in Austria: a critical reflection. In A. Macintosh & E. Tambouris (Eds.): *Vol. 5694. LNCS, Electronic Participation. First International Conference. Proceedings* (pp. 151–162). Berlin, Germany, et al.: Springer. doi: 10.1007/978-3-642-03781-8_14

Furthermore, the e-participation requirements elaborated in the following six publications flowed into the development of the *Reference Requirements Catalogue* (Subsection 6.4.5):

- Scherer, S., & Wimmer, M. A. (2015). Vertrauensförderung in E-Partizipation: Analyse von Gefahrenpotentialen und Sicherheitsanforderungen. *DuD (Datenschutz und Datensicherheit)*, *39*(5), 295–302. doi: 10.1007/s11623-015-0416-6
- Scherer, S., Liotas, N., Wimmer, M. A., Tambouris, E., & Tarabanis, K. (2011). Interoperability requirements, recommendations and standards in e-participation. In Y. Charalabidis (Ed.), *Interoperability in Digital Public Services and Administration: Bridging E-Government and E-Business* (pp. 95–117). IGI Global. doi: 10.4018/978-1-61520-887-6.ch006
- Scherer, S., Ventzke, S., & Wimmer, M. A. (2011). Evaluation of Open Source Content Management Systems for E-Participation. In *Electronic Government and Electronic Participation. 10t IFIP WG 8.5 International on e-government and 3rd IFIP WG 8.5 International Conference on e-participation. Joint Proceedings of Ongoing Research and Projects* (Vol. 37, pp. 413–421). Linz, Austria: Universitätsverlag Rudolf Trauner.
- Scherer, S., Wimmer, M. A., & Ventzke, S. (2009c). Requirements and recommendations for eParticipation applications. In A. Prosser & P. Parycek (Eds.), *EDEM 2009 - Conference on Electronic Democracy 2009, Proceedings of EDEM 2009, September 7.-8, 2009, Vienna* (Vol. 251, pp. 187–197). Wien: Druckerei Riegelnik.
- Scherer, S., Wimmer, M. A., & Diedrich, L. (2008). User requirements for legislative eParticipation applications. In : *books@ocg.at, Proceedings of 6th International Eastern European e|Gov Days 2008. Results and Trends.* Vienna, Austria: Austrian Computer Society.
- Scherer, S., Wimmer, M. A., & Schneider, C. (2008). Investigating Effective Use of Information and Knowledge Management in eDeliberation. In P. Cunningham & M. Cunningham (Eds.), *Collaboration and the Knowledge Economy: Issues, Applications, Case Studies* (pp. 270–277). Amsterdam: IOS Press.

G Curriculum Vitae

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Education

2010-2016	Doctoral Studies in Information Systems Research Faculty of Computer Science University of Koblenz-Landau Koblenz, Germany Candidate for the Degree of Doctor in Natural Sciences (Dr. rer. nat.)
1999-2004	Diploma Programme in Computer Science with Business Studies as subsidiary subject Saarland University Saarbrücken, Germany Diploma in Computer Science (Dipl.-Inform.)

Professional Experience

2016-today	Software Architect iRT Systems GmbH Koblenz, Germany
2007-2016	Research Associate University of Koblenz-Landau Faculty of Computer Science Department of IS Research Koblenz, Germany
2004-2007	Software Engineer Dacos Software GmbH Saarbrücken, Germany

Award

2014 Best Paper Award at the 6th IFIP WG 8.5 International Conference on Electronic Participation (ePart 2014) for Scherer, S., & Wimmer, M. A. (2014). Conceptualising Trust in E-Participation Contexts.

Publications

Journal articles

Scherer, S., Wimmer, M. A., Lotzmann, U., Moss, S., & Pinotti, D. (2015). An evidence-based and conceptual model-driven approach for agent-based policy modelling. *Journal of Artificial Societies and Social Simulation (JASSS)*, *18*(3). doi: 10.18564/jasss.2834

Scherer, S., & Wimmer, M. A. (2015). Vertrauensförderung in E-Partizipation: Analyse von Gefahrenpotentialen und Sicherheitsanforderungen. *DuD (Datenschutz und Datensicherheit)*, *39*(5), 295–302. doi: 10.1007/s11623-015-0416-6

Scherer, S., & Wimmer, M. A. (2012). E-participation and enterprise architecture frameworks: an analysis. *Information Polity*, *17*(2), 147–161. doi: 10.3233/IP-2012-0270

Wimmer, M. A., Scherer, S., Moss, S., & Bicking, M. (2012). Method and tools to support stakeholder engagement in policy development: the OCOPOMO project. *International Journal of Electronic Government Research*, *8*(3), 98–119. doi: 10.4018/jegr.2012070106

Chapters in peer-reviewed books

Scherer, S., Wimmer, M. A., & Schepers, J. (2012). Regional participation model to engage citizens in distant decision making. In Y. Charalabidis & S. Koussouris (Eds.), *Empowering Open and Collaborative Governance. Technologies and Methods for Online Citizen Engagement in Public Policy Making* (pp. 139–156). Berlin, Germany, et al.: Springer-Verlag. doi: 10.1007/978-3-642-27218-9-6_8

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H Erklärung

Hiermit erkläre ich gemäß §8 der Promotionsordnung des Fachbereichs 4: Informatik der Universität Koblenz-Landau,

- dass ich die vorliegende Dissertation mit dem Titel “Towards an E-Participation Architecture Framework (EPART-Framework)” selbst angefertigt und alle benutzten Hilfsmittel in der Arbeit angegeben habe,

- dass ich die Dissertation oder Teile der Dissertation noch nicht als Prüfungsarbeit für eine staatliche oder andere wissenschaftliche Prüfung eingereicht habe, und

- dass ich weder diese noch eine andere Abhandlung bei einer anderen Hochschule als Dissertation eingereicht habe.

Koblenz, im Mai 2016

Sabrina Scherer