

The practitioners guide to a digital index: Unearthing design-principles of an abstract artefact

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Abstract. Based on the perspective of e-government practitioners at a government agency in Sweden, this article analyses the design-process with the aim of unearthing the design-principles of a Digital Index (DI). The DI is developed to address challenges of how to: understand; appraise; learn from and develop e-government – by combining digital technologies with the context of public administration. This study applies a design-science research method and analyses the initial steps of the design-process: awareness of the problem, suggestion, and development. The results show how the abstract artefact – the DI – is constructed and how it is based on three main design-principles. Firstly e-government should be contextualised with the nature of public administration – which means relating digital technologies vis-a-vis core-businesses of a public authority. Secondly: digital technologies support administrative processes and must be premised on the classification of information and law. Thirdly, apply a process view of e-government that highlights the relationship between internal administrative procedures, the interaction with citizens/companies and the sharing of government data. The discussion highlights how the DI is relevant for research on e-government by offering some concrete as well as general perspectives on how to combine e-government and public administration.

Keywords: e-Government, public administration, digital technology, digital index, design science, design-principles, abstract artefact, government information, information classification, strategic information systems, civil service

Key points for practitioners:

- e-Government should be contextualised with the nature of public administration – which means relating digital technologies vis-a-vis core-businesses of a public authority.
- Digital technologies support administrative processes and must be premised on the classification of information and law.
- A process view of e-government should highlight the relationship between internal administrative procedures, the interaction with citizens/companies and the sharing of government data.
- A digital index can help research to integrate and understand technology in the context of public administration.
- A digital index can also address how to balance hype and critical awareness of e-government.

1. Introduction

This paper analyses the design-process of a group of practitioners at a government agency in Sweden called the Swedish Transport Agency (STA) regarding the obstacles of how to understand, appraise,

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learn from and develop e-government. e-Government is here used as an overarching concept denoting a broad array of *digital technologies* ranging from the application of e.g. AI, e-services and data-driven development in the public sector. The domain of public administration studied in this paper involves case-handling of various types of permits for drivers and companies as well as infrastructure and the supervision of these permits in the areas of transportation pertaining to sea, air, land and railway in Sweden. The area of public policy dealt with in this case is called *förvaltning* in Swedish i.e. what Lenk (2012) calls the “nuts and bolts of administrative action”: the way in which public administration carries out administrative procedures in order to uphold laws and regulations via the implementation and use of digital technologies. This paper therefore has a public management perspective on the implementation of digital technologies in the public sector, similarly to e.g. Lips (2020). To understand and implement digital technologies, practitioners in the public sector are reliant on different models and frameworks for interpreting and evaluating e-government, such as maturity-models and benchmarks (see e.g. Bannister, 2007; Jansen, 2005; Layne & Lee, 2001; Lee, 2010). Yet benchmarks for e-government are of limited use since they have a tendency to disregard the context of public administration, and focus on technology and e-services (see Skargren, 2020). The problem of how to understand the purpose of technology in the public sector is also an issue for e-government research, as Bannister and Connolly (2012) show by identifying how dominant research has been on “front end services” at the expense of other key areas such as internal-processes and informatisation (see also Bannister & Connolly, 2015; Gil-Garcia et al., 2018; Lips, 2020; Lips & Schuppan, 2009; Yıldız, 2012).

It is argued here that key suggestions on how to deal with combining digital technologies with the context of public administration can be found in the single case studied in this paper. These suggestions are studied as design-knowledge and defined as an abstract artefact, and as a set of propositional design-principles for how such an artefact ought to be designed in order to deal with obstacles of how to understand, appraise, learn from and develop e-government. The case is selected due to how its relevance for both practice and research can provide a starting point for learning from practical problems and transposing them to a scientific context for further revision and validation (see e.g. Flyvbjerg, 2006). In order to make this leap and enable practice to become engageable and relevant for research, a contribution of this study is the applied method. The method departs from a standard design-science research process model, and the perspective of design-knowledge, and is modified in order to analyse how a design-process takes place in practice based on key materials and the context of public administration in Sweden. The study thus departs from central tenants of a design-science research process and analyses key initial steps of the design-process conducted by the practitioners: awareness of the problem, suggestion, and development, and adds aspects such as *material* and *context* to understand the design-process. By extracting design-knowledge in this way, the method allows for revealing key aspects of design-knowledge as to how and why the DI was designed and which also allows us to unearth the design-principles for building an abstract artefact. Based on the artefact and the proposed principles, the aim of this study is to examine and discuss their relevance for research on e-government against a current problem on how to combine digital technologies with the context of public administration.

1.1. Background: The DI and the design-principles

The DI studied in this paper is referred to as an abstract artefact because it exists as a conceptual model consisting of ideas, words, and images of how technology and public administration relate to each other. The DI was an outcome of the design-process and evolved based on interactions around certain issues and topics, such as how to understand e-government, how to assess it and how to develop a normative

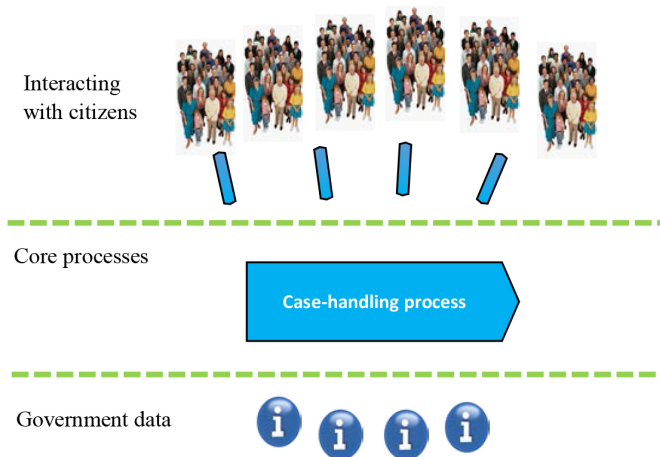


Fig. 1. Three key perspectives of the artefact.

understanding of digital technologies with relevance to public administration, as discussed between key-stakeholders in the design-process (see Section 5). The expected outcome and demand from the design-process came from senior management and was, quite simply, to find a way on how to measure and assess the progress of digitalisation at the STA over time. However, the design-process of the DI became much more and was designed to cope with four broad types of obstacles, namely:

- **Define:** present a definition and understanding of e-government,
- **Appraise:** provide a way to give a normative account on how e-government progresses over time,
- **Learn:** based on the model, and the results, offer a possibility to learn and discuss the pros and cons of e-government,
- **Develop:** offer a factual account of how digital technologies support the agency's core-processes in order to make strategic decisions on how to develop the agency further with the help of digital technology.

In a nutshell, the artefact consists of three key perspectives where technology has a crucial role to play: interacting with citizens, core processes and government data (see Section 6.2).

The knowledge-output here is called design knowledge as derived from Cross (1999), and in order to analyse how the design-knowledge evolved, a standard theoretical model of a design-process and its outputs is applied based on the work from Vaishnavi et al. (2004) and Takeda et al. (1990) (see Section 3). A focus on design-knowledge and design-science provides the research output which is the abstract artefact and the three propositional design-principles (see Sections 6.1 and 6.2). It is argued here that the design-principles can be used to construct similar and/or enhanced abstract artefacts as presented in this paper, or for points of critical departure on how to further nuance, develop and discuss the question of digital technologies in the context of public administration.

2. Previous research – public administration: The missing piece in e-government

This paper analyses the process of designing a DI, which is created for understanding, appraising, learning from and developing e-government. These factors can be key obstacles in managing e-government and are crucial for practitioners to implement and cope with, in order to work towards sound and efficient use

of public funds when implementing digital technologies. Practitioners are thus dependent on theoretical models for e.g., appraising, measuring, and understanding e-government (see e.g. Bannister, 2007; Heeks, 2008). Attempts at measuring and evaluating the potential and progress of digital technologies in the public sector has been done in many forms and shapes since at least the late 1990's; not least via the method of benchmarking e-government (Skargren, 2020). One prominent example of describing the process of developing e-government towards being "fully functional" is the four stage maturity model offered by Layne and Lee (2001) and indeed these maturity models have come in many different shapes and sizes (see Fath-Allah et al., 2014).

The question of how to contextualise digital technologies in public administration is complex but can be described in three perspectives. The first of these is the concern that technology has taken precedence over public administration. According to Lips and Schuppan (2009, p. 741) e-government research by scholars in Information Systems (IS) has led to a focus on technical aspects, rather than "[...] for instance political, governmental, democratic or societal issues [...]". Other scholars argue how e-government needs to be better grounded in public administration in order to tackle the "Big" research questions of the day (Yıldız, 2012), and there have been calls for more studies on the relationship between technology and administration – highlighting a need for "greater attention" to the practical aspects of how digital technologies impacts the public sector (Gil-Garcia et al., 2018, p. 641). There seems to be a lack of suggestions in the field of e-government concerning a theory on how to combine digital technologies and public administration (see e.g. Bannister & Connolly, 2015), except for the proposals from Lenk and his colleagues (see Lenk, 2002, 2007, 2012; Lenk & Traunmüller, 2002; Lenk et al., 2002).

The second key perspective is partly an answer to the first one. Scholars have studied the process of informatisation in public administration and which does not primarily involve digital technologies, but the information itself and how it is communicated and shared (Bellamy & Taylor, 1992). Advocates of this perspective can be sceptical of too much attention being directed on ICT-artefacts instead of how and where "ICTs are acting upon information flows" (Lips, 2007, p. 249). One consequence of this angle is that technology itself is not of primary interest, and it allows for the study at a micro-level of public administration such as e.g. interaction between clients/citizens and street-level bureaucrats, judicially bound processes in terms of "administrative action", and automatization of public decision-making (see Lenk, 2007; Snellen, 2007).

Bringing the two previous perspectives together means being able to balance an understanding of digital technologies in the context of public administration which is paramount for developing e-government. One reason for this is that a practitioner's ability to manoeuvre and understand how public administration and digital technologies function together can have large social and economic consequences. Practitioners are often faced with issues imbued with complex, political and strong normative assumptions about what e-government or "new technology" can do in terms of "transformation" or efficiency, and this prevalent hype and enthusiasm for e-government has been identified as dangerous enthusiasm and being a potential source to failed e-government projects (see Gauld et al., 2006). Practitioners are caught between two opposing fluxes in what Margetts (2014, p. 382) has eloquently summarised as two facets of a modernist perspective on technology: the enthusiastic or the critical view regarding the question of "ICT as a modernizing tool" for public administration.

A general advice for practitioners when it comes to the development of e-government is to avoid the Scylla of hype and the Charybdis of technological determinism, and instead think in pragmatic and holistic perspectives. A way forward, as is suggested in the case studied in this paper, is to balance the relationship between technology and the nature and purpose of public authorities in terms of their administrative processes, judicial frame-work and organisational structure (see also Bannister & Connolly,

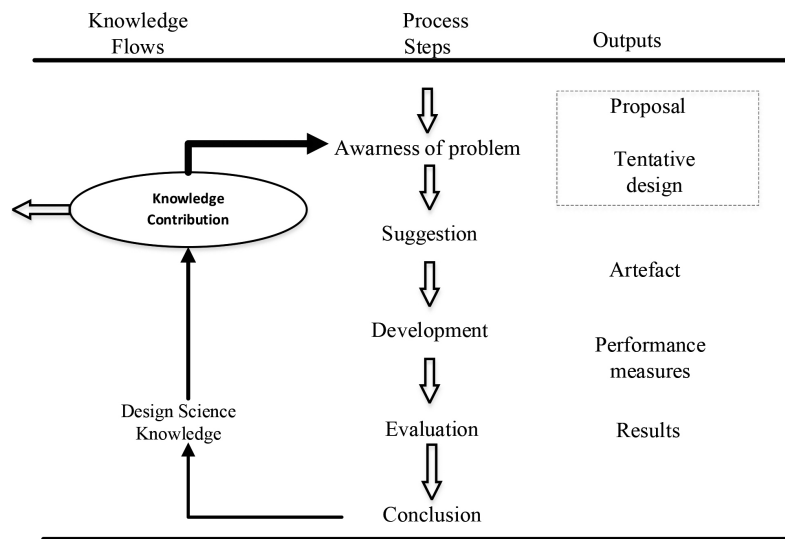


Fig. 2. Adapted and slightly modified from the original (Vaishnavi et al. 2004, p. 11).

2012, pp. 221–222). To reach this end, we argue that research must be geared towards the purpose of technology in public administration and present alternative perspectives to technology-oriented and project-management methodologies as presented by e.g. Borrás (2004) and Sánchez and Macías (2019). Furthermore, the outcome of this study, the DI and its design-principles, has many resemblances to theoretical contributions that allow for a holistic perspective such as has been provided by Steven Alter’s application of the concept of work system and his Work Systems Theory (WST) (Alter, 2003a, 2003b, 2013), and Klaus Lenk’s systemic view on how to analyse and understand digital technologies in a judicial institutions such as public administration (see Lenk, 2012; Lenk et al., 2002).

3. Theory – design science and science of design

This study analyses a design-process in order to extract the design-principles that came out of this process, as well as the resulting artefact. This type of knowledge is what Nigel Cross calls design knowledge and can be found in design research (Cross, 1999). Analysing the DI in terms of *the process of designing*, can be connected to one out of potentially three sources of design knowledge as has been put forward by Cross (1999). Cross defines process as the study of the design process itself, while adding that this includes the study of the “[...] development and application of the techniques which aid the designer.” (ibid, p. 6).

In order to understand and analyse how a design-process takes place, this study applies some tenants of a standard design science research process model as presented by Vaishnavi et al. (2004). This is useful because the model is based on experimental research showing how designers design solutions to a problem (see Takeda et al., 1990) i.e. design knowledge.

The process steps: awareness of problem, suggestion, and development in Fig. 2 are applicable in the present case on how practitioners proceed when working towards a solution to a problem. By studying practice in this way, and not designing the project as a design-science endeavour, the left side of the model on knowledge flows is not applicable, and this side is modified to instead entail the circumstance aiding and/or impacting the design-process. Another important change is on the right side of the model relating to the output of the process which is the design-principles and the abstract artefact.

3.1. Awareness of the problem

Awareness of the problem are the circumstances that initiate the design process i.e. a description of how one becomes aware of a problem. The circumstance can consist of several sources, it can be managers asking for a solution to a certain type of issue, it can come from a particular mission or request from the government, or it can be a strategic problem in need of a solution identified by civil servants. Awareness of the problem does not imply a clear problem-formulation, and this part of the process is often slow and develops via a series of proposals and tentative designs. A driver for the awareness phase is to find a solution to a particular problem, rather than asking questions answered via explanation (Vaishnavi et al., 2004).

3.2. Suggestion

The suggestion phase is about providing answers and solutions relative to the level of awareness gained in the previous phase and the identified problem/s. This can entail looking at current models and solutions, and trying to adapt them or implement them to the particular problem at hand. Takeda et al. (1990) defines this stage as providing concepts for how to solve the problem, while the authors also seem to suggest how this is part of a cycle where the suggestions may be evaluated to see if they achieve a solution, and if not, the cycle starts over again with new suggestions.

3.3. Development

The starting point of the development phase is the point where the focus of the process is turned towards developing the suggested solution or tentative design (see also Vaishnavi et al., 2004). This means focusing on how the suggestions are tried out and tested vis-à-vis the problem and the inclusion of other participants that has an interest in solving the problem. This stage requires a saturation of the previous two phases, implying that a relatively stable suggest solution has been constructed, which is now developed further.

3.4. The abstract artefact and design-principles

The DI is an example of a type of artefact that Gregor and Jones (2007, p. 321) calls *abstract* – as opposed to a material artefact which has a “[...] a physical existence in the real world, as a piece of hardware or software, [...]”. In other words, the DI is understood as an abstract artefact which means that it does “[...] not have a physical existence, except in that they must be communicated in words, pictures, diagrams or some other means of representations” (ibid.). Consequently, the DI consists of a group of concepts moulded together in a design process based on a search for certain types of problems. Besides the abstract artefact, another output of a design-process are design-principles.

A design-principle is defined as a declaration “[...] that prescribes what and how to build an artefact in order to achieve a predefined design goal” (Chandra Kruse et al., 2015, p. 4040). Chandra Kruse et al. (2015, p. 4043) proceed to qualify “the what and how” in terms of action and materiality-oriented design principles. Design principles can contain both these elements, meaning that the principles stipulate both what the artefacts enables users to do (action), and how to build the artefact in order to achieve these actions (materiality) (ibid.). In the present case, the design-principles provide a basis for the types of actions to be achieved in order to cope with certain obstacles, namely the promoting of understanding, appraisal, learning and development of e-government.

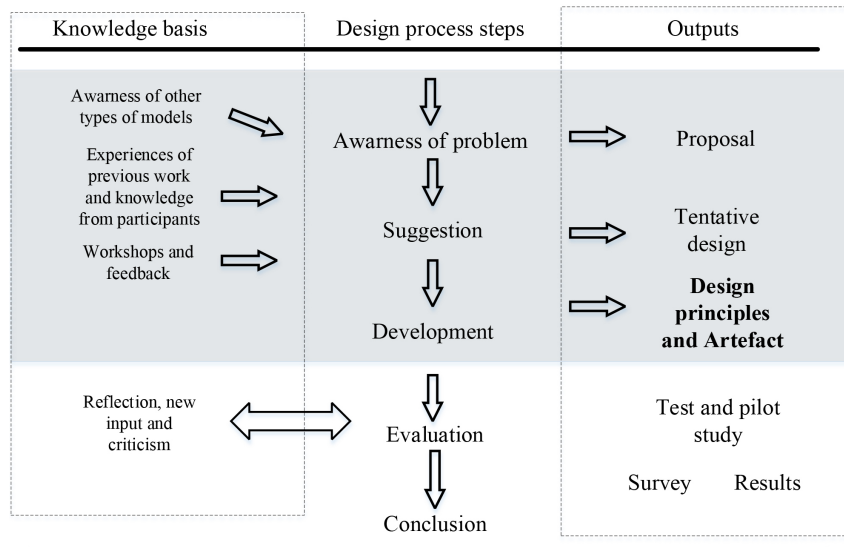


Fig. 3. Design process and design science research process. Changed and adapted from Takeda et al. (1990) and Vaishnavi et al. (2004).

4. Method

As explained in the theory section, this study focuses on the three first steps of the design-process (see greyed area in Fig. 3). The purpose of this delimitation is twofold. Firstly, the focus on the design-process itself and its outputs is significant because it conveys design knowledge contributions in the shaping of *design principles* and the *abstract artefact* relevant for practitioners and research on e-government. Secondly, the DI has been applied in practice, and the test and pilot study along with the survey and the results will be the focus of another study dealing with the application of the artefact and the results yielded.

As can be seen in Fig. 3, the method at its core is to first methodically structure the knowledge basis underlying the design-process steps, and then work through this material and classify it in relationship to the design-steps. This, in turn, was done with the aim of presenting the basis for the output in the far right of Fig. 3 – namely the abstract artefact which became the DI, and the design-principles underpinning it.

4.1. Context

The case studied in this article – a government agency in Sweden – was selected for three reasons. Firstly, because the authors have first-hand experience and knowledge of the details presented. Secondly, the STA studied in this paper is argued to be an instance of what Flyvbjerg (2006) calls a “critical case”, which means that the study delivers deliberate knowledge that is useful in relationship to the general problem of how to understand digital technology in the context of public administration. Thirdly, by presenting the design-process, the design-principles and the abstract artefact, the case is relevant because it provides an instance that can be used for learning among practitioners and researchers (see Flyvbjerg, 2006).

As of January 2020 there are approximately 341 state authorities under the Swedish Government, and 21 of these – such as e.g. the STA – have 2000 employees or more (Statskontoret, 2020). Swedish

authorities can be considered highly staffed relative the departmental offices of the government, and they have a high degree of autonomy vis-à-vis the government when it comes to carrying out core-business. The STA's main responsibilities are to manage new regulation, issue permits and supervise the compliance to these regulations in four major areas of traffic: road, railway, air and sea. The STA is also responsible for the collection of congestion taxes and infrastructure charges. Consequently, as the agency carries out numerous processes with a concrete and very tangible impact on the daily routines of people and companies, it is heavily dependent on the functionality of digital technologies and the management of enormous amounts of information.

The authors of this paper were involved in the design-process of the DI by working in various degrees at all three steps of the design-process. The principal author had duties as a business developer and was responsible for strategic issues and perspectives on how to develop e-government at the STA during the period studied here. The co-author joined the work in November 2015 as a consultant, based on previous work in the national government delegation on e-government development for Sweden.

The material analysed in this article dates back to the period of August 2015 until February of 2016, some of it produced by the authors in their roles as responsible for developing what was to become the DI. The process of designing the artefact also included the participation of other civil servants, via e.g. workshops and meetings discussing suggestions and aspects surrounding the development of the abstract artefact.

From a general perspective, the DI is constructed based on normative assumptions and conclusions drawn from several official documents. First and foremost on work by the "e-delegation", a committee appointed by the Swedish government in 2009, governed by senior managers and supported by civil servants, experts and academics on questions on how to coordinate and address aspects related to developing e-government in Sweden (see E-delegationen, 2011; SOU, 2015). The work by the e-delegation had also set the tone for the national goals for digitalisation of the public sector, which influenced the design-process by setting the standards and goals for which aspect that should be evaluated by the DI, *Putting the Citizen in the Centre – Swedish Government Strategy for Digital Cooperation among State Agencies* (Swedish Government Offices, 2012). In addition, the design-principles underpinning the DI are based on aspects relating to the management of records and information provided by The Swedish National Archives, and on a process-model by the Swedish Agency for Public Management (SAPM) of how administrative procedures – i.e. administrative action, case-handling process – in Swedish public administration are carried out (Riksarkivet, 2008, 2012; Statskontoret, 2004).

4.2. *Material*

The material for this study is based on written sources produced during a period of six months at the STA, and official documents from other government agencies in Sweden. All of the material can be classified into six categories depending on the purpose of the document (see Table 1).

The main part of the analysis is based on the authors reading of the information produced at the STA in Table 1. The design-process can be characterised as a deliberative procedure performed by consensus seeking Swedish public servants guided by public sector values. Some examples of these values are objectivity, legality, efficiency and respect (see the Swedish Agency for Public Management (Statskontoret), 2019).

The written material is based on a series of meetings (twelve in total, see document type A in Table 1) and in between these meetings there are field-notes (document type B), as well as structured PM's (document type C) and reports (document type D and F) that document suggestions and outcomes of readings

Table 1
Classification of material according to their purpose and steps in the design-process

Minutes from meetings (A)	Field-notes (B)	Structured PM's (C)	Reports and drafts of reports from the agency (D)	Presentations (E)	Official reports (F)
A1 – 2015-08-17	B1 – 2015-09-08	C1 – 2015-09-22	D1 – 2015-11-06	E1 – 2015-12-17	F1 – 2011
A2 – 2015-10-09	B2, B3 and B4 – 2015-09-09	C2 – 2015-12-22	D2 – 2015-11-26	E2 – 2015-12-29	F2 – 2015-05-28
A3 – 2015-11-02	B5 – 2015-09-10	B5 – 2015-09-10	D3 – 2015-12-17	E3 – 2016-02-01	F3 – 2004
A4 – 2015-11-16	B6 – 2015-09-11				F4 – 2012
A5 – 2015-11-19	A5 – 2015-11-19	A5 – 2015-11-19			
A6 – 2015-11-20	B8 – 2015-09-21				
A7 – 2015-12-03	B9 – 2015-09-22				
A8 – 2015-12-09	B10 – 2015-09-22				
A9 – 2015-12-17	B11 – 2015-09-27				
A10 – 2016-01-12	B12-13 – 2015-10-08				
A11 – 2016-01-13	B14 – 2015-10-12				
A12 – 2016-02-17	B15 – 2015-12-03				
	B16 – 2015-12-21				

Green: awareness of problem phase, pink: suggestion-phase, and blue: development phase.

of official material and deliberations among public servants within the agency. These deliberations and searching for information were then presented for e.g. senior management (document type E) to discuss the progress of the work and to report on the suggested ways of solving the problems at hand. All stakeholders in this design-process are included based on a) their previous experiences of addressing the same type of issues or having been involved in various activities related to e-government development, or b) being managers hierarchically responsible for approving and/or using the model.

4.3. The analysis

The material constitutes the design-process and the analysis of these documents was carried out in four steps. Firstly, all types of document from the period August 2015 to February 2016 were gathered (see Fig. 4 and Table 1). The material was first read and classified as six different types based on their purpose: minutes from meetings, field-notes, structured PM's, reports and drafts of reports from the STA, presentations, and official reports. In the second step, the written materials were coded according to when they were produced in time, their purpose and how they fitted the definitions of awareness of problem, suggestion and development. For example, in the case of document A1 which is coded as part of the awareness of problem phase, this is based on that A1 was: produced very early in the period, labelled as a meeting with a certain manager and includes, among other things, a note on how the manager expresses a need for “[. . .] presenting an overview of how digitalisation (e-government) is progressing in the agency”.¹ Another example is document B8 which is headlined “notes for project” and appears about a month later in the design-process relative to the initial document (A1), and contains various suggestions on how to measure digitalisation such as “number of e-services” and “digital documents”

¹This and all the other quotes from the material is the author's translation from Swedish to English. Individual names have been made anonymous.

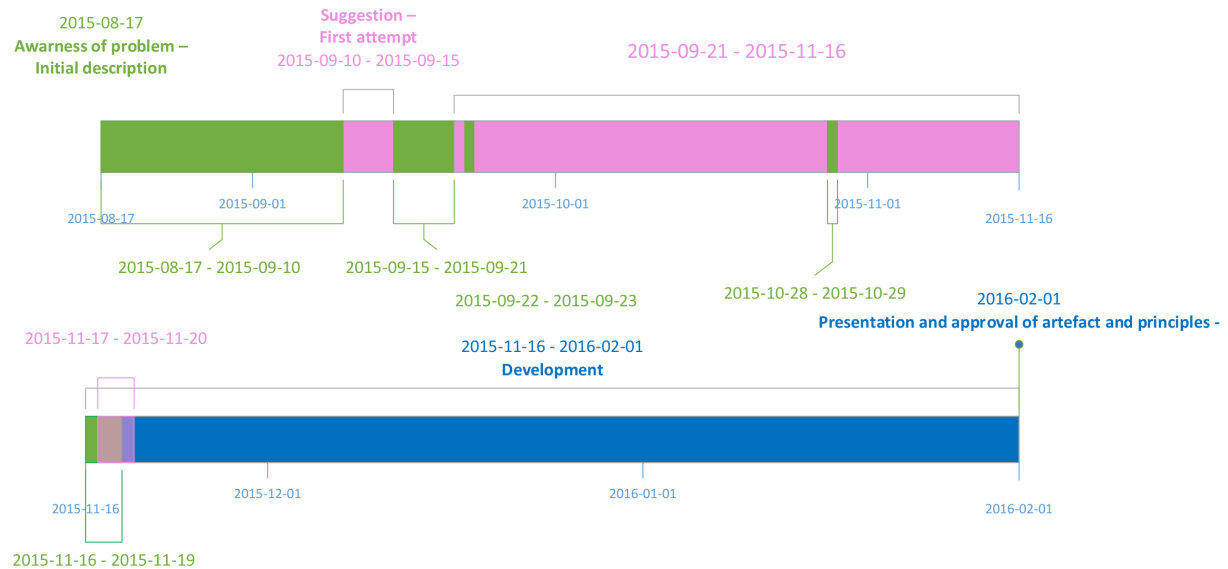


Fig. 4. Timeline of the various phases of awareness of the problem, suggestion and development.

(see Fig. A4 in appendix for further examples of analysis of the material). An overview (Fig. 4) of how the design-process phases developed over time was also created. The third step included writing up small summaries, as a way of re-constructing the process, from the different types of material and how they were coded to find the key features relating to the three design-phases. In the fourth and final step, the summaries were cross-referenced with the material to make sure that they were correct and to provide material for the analysis of the three design-process-phases presented in Section 5.

5. The design-process of the digital index

This section provides an analysis of the design-process that led to the abstract artefact and the design-principles. References to the material listed in Table 1 are given in parentheses, e.g. A1 and B14. Starting with the phase awareness of the problem, the initial design-process period stretches from the 17th of August 2015 until the 1st of February 2016 when the development phase of the abstract artefact was presented and accepted by senior management. The various stages of awareness of the problem, suggestion and development sometimes work in tandem and they overlap – and in the example of the DI the process went back and forth between becoming aware of the problem and making suggestions (see Table 1 and Fig. 4). Eventually a point was reached when the DI was initiated, and the process of development took firmer ground.

5.1. *Becoming aware of the problem*

Awareness of the problem started with a meeting with a manager in august of 2015 (A1). The STA lacked a broader perspective of the progress and evaluation of digitalisation across time. Management needed to report quarterly, or every six months, on the progress of digitalisation. Digitalisation was not clearly defined, although the need to evaluate e-government was mentioned. Becoming more aware meant probing the spectrum of possible problems relating to what was being asked for. Two immediate problems

were: what is going to be measured and more importantly how to define that which is to be measured? (B1). The early stages involved looking at previous attempts at “measuring digitalisation” at a local level (at the agency), at the national level as well as international examples. The local level had produced quantitative measures of numbers and usage of e-services, the national level engaged in digital maturity evaluations focusing on organisational capabilities prone to enhance digitalisation and at the international level mainly benchmarking-studies were performed by international organisations and companies.

These examples of how to measure digitalisation in the public sector extended our queries on why and what to measure and the importance of purpose, usefulness and added value by measuring digitalisation (B2), not least to separate description from normative judgement. There was a sense of urgency to get to practical solutions, and thus methodological aspects were probed further with respect to how to define and operationalise indicators for digitalisation in the suggestion phase. The initial awareness-phase also entailed additional problem-formulations relating to aspects such as: is the data reasonably acquirable? (C1).

5.2. Suggestion

The suggestion-phase lasted roughly two months and overall, the suggestions can be categorised into three types. The suggestion phase was also characterised by becoming more aware of the problem, in terms of figuring out the fundamentals of the purpose of measuring. The need to provide a solution to the problem, eventually led to the first suggestion (B5). This first suggestion grapples with a) trying to understand e-government, b) how to evaluate it in order to c) identify what was in need of development. The concept of digitalisation was grouped into three areas: social digitalisation (the increased exchange of communication in society), informational-digitalisation having to do more with the conversion and exchange of data and metadata in digital form, and e-government which was defined as e-services combined with the potential to “transform” the public sector by means of new technology. The initial suggestion was to select one or more types of data relating to each area and measure them in some quantified way.

The second suggestion focused on e-government and informational-digitalisation. This attempt included “five dimensions” (B10) of e-government: “internal e-government” (case-handling, transfer of data, number of it-systems), “e-services” (number of digital channels, e-services), open data, common administrative services (e-id), and development projects within the agency (business-process developments relating to the digital strategy). Based on a series of methodological suggestion on how to score and operationalise some of these five dimensions (B12-14), and a workshop in early November (A3) resulting in a written document outlining which of the five dimensions to measure, this turned into a third proposal. The “why” in this suggestion was that the measurements should be connected to the goals and strategy of the STA’s Digital agenda, and thus being able to provide a relevant overview for management on the progress of e-government.

5.3. Development

The development phase began with the construction of a fourth suggestion, which grew out of the realisation that there was a lack of connection between the concept of e-government and what the agency *actually does*. This redirected the focus to the purpose of the STA itself and its responsibilities in society. It also led to an emphasis on the potential for automatisation of case-types in relationship to three levels: the engagement with citizens, internal processes and the exchange of data (A5 and D2). This idea came from a standard on how to cooperate among agencies at the national level in e-government projects

(E-delegationen, 2011, 2015) and the national goals for digitalisation of the public sector (Swedish Government Offices, 2012) and turned the focus towards on the core-business processes of the STA, and the ability to evaluate progress of e-government vis-à-vis the national strategy. The attention on case-types and the administrative process posed new problems: how to measure the three levels? The response to this problem was to apply a general process-view of how cases are carried out (see Fig. A1 in appendix), which was used by SAPM (Statskontoret, 2004).

In the development phase, the authors started to perceive digitalisation as a gradual state depending on which aspect of the case-handling process that was evaluated (D3, E1-3). Looking at the core-business in this way implicated having a holistic and learning perspective: evaluating all case-types in this way provided the big picture and the ability to discuss the administrative processes in relative detail. In order to identify these processes, which are made up of enormous amounts of data spread across many different systems and registries, the development phase turned to an established system for classifying all this information into processes and case-types (see Riksarkivet, 2008), a classification that could be used in order to measure e-government at the administrative level (see Figs A2 and A3 in appendix).

6. Design-principles and the abstract artefact

Looking at the development stage of what was to become the DI, it clustered around – starting from the awareness of the problem phase and matured in the suggestion phase – four overarching obstacles: to understand e-government, appraise progress over time, learn from the results and to use this combined knowledge in order to develop the agency with the support of digitalisation. In order to understand e-government, the design-process taught that it must be conceptualised vis-à-vis the core purpose of public administration – starting from the administrative core and how digital technologies support this process. To evaluate progress, there must be a clear operationalisation of the administrative processes in terms of the case-types involved, which calls for a clear classification of information and an ideal-type of how an administrative process is carried out. In terms of learning, the results and the artefact must be visualised in a clear and simple way closely tied to core-business process of public administration and show the extent to which digital technologies are involved. To promote a development perspective, the goal was to design an artefact where the level of detail of the processes fleshes out to what extent the handling of case-types is supported by digital technologies, and subsequently relate these to the three operative levels based on how they are regulated by law.

6.1. *The design-principles*

The design-principles of the DI are three in total.

- **Design principle I:** *e-government must be contextualised with the nature of public administration – which means to relate digital technologies vis-a-vis core-businesses of a public authority.* Design principle 1 was born out of a general insight gained during the design-process linked to the need to operationalise e-government vis-à-vis the main tasks and particular responsibilities of a public authority. The principle demands a focus on the relevance and purpose of digital technologies in a public organisation, which was perceived by the practitioners involved in the design-process as a shortfall in technology prone measurements and other models looking only at maturity aspects. Public authorities must also have a very high degree of availability and transparency as well as having services that can mandate and enable citizens/companies rights as well as obligations. The specific dimension of public authorities regarding the importance of lessening the burden of administration

and amount of data and information demanded from citizens and companies, therefore adhering to the once only principle (The European Commission, 2020), must also be taken into account.

- **Design principle II:** *digital technologies support administrative processes and must be premised on the classification of information and law.* The realisation of the following aspects became clear during the development phase of the design-process when looking for answers on how to identify the purpose (judicial standards) and the classification of information. This principle is important for three reasons. Firstly, it demands a starting point in the content of public administration as opposed to starting from a technological perspective. In this way technology is levelled with information and law. Secondly, this principle details the content of the first principle: public administration as information processes governed by, and carried out, in order to uphold and serve judicial demands. The third reason for this principle is to take into account citizens' and companies' perspectives and needs in the interaction with public authorities, which can be catered to by focusing on e.g. key life-events. This latter aspect of the principle often requires complex processes and feedback-loops between policy, politics and bureaucracy, and requires the capacity, maturity and will to work more closely with citizens and companies in designing and creating new ways to deliver services and uphold judicial demands.
- **Design principle III:** *apply a process view of e-government that highlights the relationship between internal administrative procedures, the interaction with citizens/companies and the sharing of government data.* The main input for this principle was unearthed during the development phase when studying the work from the e-delegation. This principle is significant because it instructs a holistic view of the public administration per se, required to understand the different layers of how digital technologies support administrative action. By applying this triad of perspectives, it is possible to start analysing the relationship between these layers and core administrative processes in order to comprehend the complexity and different dimensions of administrative action within e-government. The holistic perspective provides the ability to actively argue for and *choose* where to focus, when developing new and/or changing processes and implementing new digital technologies. This course of reasoning back and forth between the possibilities that digital technologies offer can provide many important lessons and ideas as well a solid foundation for making informed decisions.

6.2. *The abstract artefact*

Figure 5 represents the abstract artefact that was the outcome of the design-process and adheres to the design-principles. The artefact consists of three perspectives: interacting with citizens, core processes and government data.

6.2.1. *Interacting with citizens and companies*

The interaction between a government agency and a citizen/company takes place through various channels of communication, both digital and non-digital, and at various points. The interaction interfaces can vary and adhere to either a clearly expressed strategy or be developed ad hoc, at the discretion of each development project.

6.2.2. *Core processes*

Core processes have to do with the necessary steps performed in the “back-office” – the administrative action. This is how mandatory information is collected, revised, judged, decided upon and finally filed during a full case cycle. The core process can either be performed by one or more case-handlers in the traditional way, or fully and/or partly automated in some way. With respect to automation, it is important to remember that prevalent administrative procedures also can be subject to transformative change by applying the possibilities of new digital technologies.

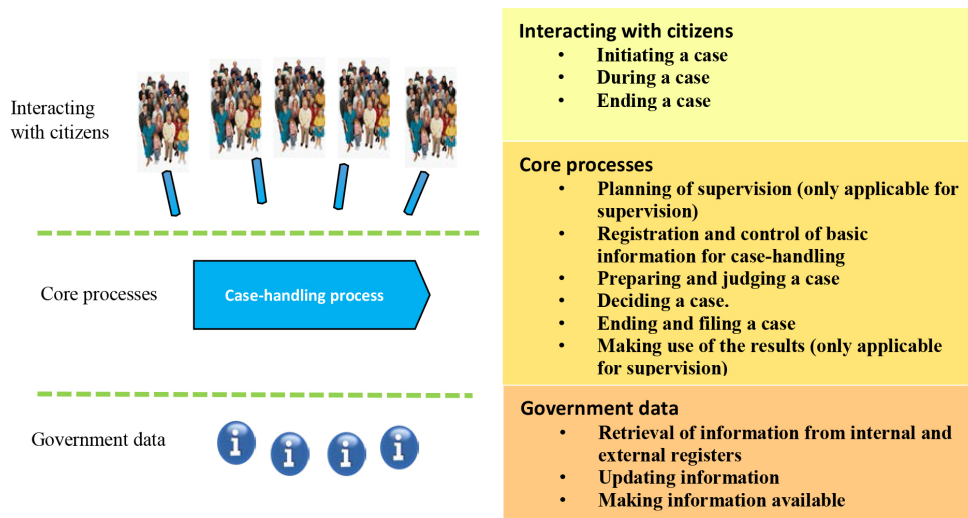


Fig. 5. Overview of the DI.

6.2.3. Government data

The information exchanged in the first layer (see Section 6.1. above) refers to direct involvement with the citizen/company, while the present perspective regards information exchange between government agencies or other actors with respect to the information needed in a specific case type. The information could be both base data managed centrally at a government level (e.g. personal identity data such as addresses), or case specific information (e.g. health and crime records provided by medical entities or the police and courts). The government data concept also includes if and how data is published and shared with other actors as e.g. open data. As noted in the second design-principle above, this dimension becomes all the more important when applying the-once-only-principle, and thus lessening the burden on citizens in the interaction-phase (Section 6.1).

7. Discussion

There were three key perspective that can be summarised from past research discussing the relationship between e-government and public administration. The following discussion picks up on these perspectives and argues for the relevance of the DI and the design-principles in each case.

Firstly, there was the tendency to overemphasise technology at the expense of context with respect to public administration (see e.g. Bannister & Connolly, 2012; Lenk, 2012; Lips & Schuppan, 2009). The design-principles and the DI together provide an integrated perspective on technology and public administration as to how technology supports mandatory process-flows that are the core-business of a public authority. This offers a levelling of technology to be on par with administrative action and includes the interaction with citizens and companies. The design-principles highlight *what goes on* in core administrative processes and from the perspective of a practitioner this helps to get an overview and concrete realisation of how the processes are carried out and a starting point for discussions regarding possible areas of development. In this sense, technology does not become a means to itself but is imbued with a relationship to its purpose in a public authority. Since the DI provides avenues for how to operationalise public administration together with digital technologies, this way of viewing e-government can in turn be of great heuristic support to researchers wanting to study these processes.

Secondly, past research has argued for a perspective on how digital technologies support what organisations as well as public administration *does* – information, administrative action and work processes (see e.g. Alter, 2013; Lenk, 2007, 2012). The design-principles presented here connect with the theoretical arguments from the WST that if we are to understand digitalisation in an organisation, we must start by viewing how digital technologies function in relationship to, among other, key dimensions such as information-flows, business-processes, and customers. Similarly, the design-principles are supported by past theoretical models on how to understand digital technologies in public administration as information-processes taking place in an environment imbued and structured by judicial standards (such as Lenk). Applying the principles provides impetus for the theoretical importance of how technology, information and law are intertwined towards the output of providing information and/or services to citizens, companies, and other public authorities. The application of these principles can thus offer a socio-technical perspective customised to the context of public administration. This provides a starting point for critical discussions and a common framework for engaging with the possibilities of new technology. More concretely it allows for a very specific discussion on exactly how certain types of digital technologies support the various parts of an administrative process – where and why they are used and how they support the process – which in turn can lay the foundation for decisions on possible transformative changes in public administration.

Thirdly, by combining the perspective of the lack of contextualisation of digital technologies in public administration, and the suggestion to view how digital technologies support information-process, we argue that these aspects are important for practitioners of e-government to understand to balance the hype of new technology with a sober perspective of the actual challenges of e-government. We also argue that the design-principles can offer the ability of balancing hype with a critical perspective by focusing on information processes and judicial aspects. This would bring “technology down to earth” by allowing for a clear focus on the administrative processes and thereby its challenges. A deeper understanding of how technology relates to the core administrative processes allows for a multitude of questions to arise, which are critical for the development of e-government. Such questions could be e.g.: which part of the three aspects of the DI should we focus on and why? Are we making the most out of new technology if we only offer an e-service when applying for a particular case-type? How can we produce innovative and more efficient ways of dealing with certain processes given the nature of their judicial demands? In what way can we lessen the burden of exchanging information between public authorities and citizens/companies by shifting the focus from front-end services to the exchange of government data? Are there several processes and case-types which rely on the same type of key procedures and can these be served by one instead of many different systems/applications? The multilevel perspective of e-government provided by the DI is a holistic perspective which can limit the tendency to search for narrow technical solutions to complex problems.

Although a key theme in this paper is to highlight the importance of maintaining a critical and practical perspective on e-government, it is equally important to remember that the DI and the design-principles also can promote digital transformation in the public sector by making the most of the application of new technology. Even though the DI is very close to how businesses is carried out in public administration, this should not hinder novel ways of changing these processes with the help of digital technologies. The model subsequently requires a high degree of ability to think beyond today’s processes and procedures, to discover what can be changed to reach “transformative” effects. The analysis and the results presented in this paper concur with Lenks’ (Lenk, 2012, p. 224) statement that in order “[...] to fathom the enabling and transformative potential of IT [...]” there must be “[a] focus on the operative level of administrative work [...]”.

There are at least two main avenues for future research. One of these is to improve the principles, with the purpose of studying if, and how, other variants of abstract artefacts can be constructed based on the principles. The DI is not the only abstract artefact to come out of the application of the principles and looking at them in the context of different traditions of public administration might produce other results. The abstract artefact in this case is developed based on ideas that are applicable to public authorities in general in Sweden, and they have so far only been applied in the case of the STA. The design-principles are thus currently a set of propositions with the potential to be tested in other contexts and traditions of public administration. Another task could be to look at how to combine the theoretical premises of the WST from Alter and the work from Lenk with the DI and the design-principles to see how these combined can be advanced as e.g. descriptive or analytical theories of e-government. Both Lenk and the work in the DI are heavily contextualised vis-à-vis public administration, while the work by Alter is more attuned to private organisations in general. Perhaps there is an interesting model to be constructed based on these theoretical premises?

From a practitioner perspective the DI and the underpinning design-principles are relevant in the following four ways:

- Defining how to understand e-government vis-à-vis the execution of core-business processes in public administration;
- Possibility to assess the level of digitalisation across all or a limited set of key information-processes;
- A starting point for discussion and engagement regarding how digital technologies supports the agency and thereby raising the level of awareness of e-government and enhancing learning;
- A holistic and process-based model for strategic discussions and decisions on how to develop e-government.

For researchers the results of this paper can be relevant in the following ways:

- Design-principles that can be used to create other abstract artefacts dealing with how to understand and assess e-government;
- A theoretical model that operationalises digital technologies within a public administration context, which can be developed and applied for research purposes;
- The DI has clear connections with previous theoretical work on how to study information systems in organisations and in the public sector, and these aspects can together strengthen and/or create new descriptive/analytical theories of e-government;
- A framework for analysis that allows for comparative and empirical case-studies of e-government.

8. Conclusion

The aim of this article is to present and analyse the design-process of creating a DI, flesh-out its design-principles, and show how these principles are relevant for research on e-government. The analysis has showed how the design phases: awareness of the problem, and the ensuing suggestion phase as well as development phase, spurred an awareness for the need for four basic aspects. Namely: to better understand e-government, to measure and appraise e-government, to learn from engaging with the DI and to use it as a tool for development and strategic decision-making. In this study we have unearthed three design-principles; relating to the importance of contextualising e-government in public administration, how digital technologies support core-business processes and must be premised on the classification of information and law, and a three-tiered perspective on how digital technologies interact with, and support, the information and interaction processes both within public administration as well as vis-à-vis customers

and companies “front-end”, and in terms of the transfer, sharing and communication of data with other actors (“back-end”).

The discussion in this study argues for how the design-principles and the DI are relevant for research on e-government in three major ways: as a model for integrating and understanding technology in the context of public administration, addressing how to balance hype and critical awareness of e-government, and how it is relevant and relatable to past theories of how to study digital technologies in organisations in general and public administration in particular. Venues for future research include how to construct theories of e-government based on work from the WST, administrative action and the DI and to test the relevance and generalizability of the DI in other cases in Sweden as well as in other national contexts and traditions of public administration across the world.

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Declaration of interest

While conducting his PhD-studies Skargren is employed as an analyst at the Swedish Agency for Digital Government. The present research has been financed via his former employer, the Swedish Transport Agency (STA), and the research conducted by him is done independently and within the academic framework of Örebro University. Dr. Garcia Ambrosiani was hired as a consultant by the STA during the period studied in this article. However, no firm or consultancy has provided any support, financial or otherwise, for the current study. The design of the study and the collection, analysis, and interpretation of the data is done independently by the authors and at their sole discretion.

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Author’s biography

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Appendix

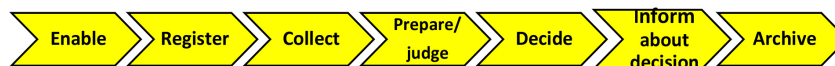


Fig. A1. Overview of case-handling process.

Code	Area	Area-group	Process	Case-type
01.	Management and control	Command and plan activities	Plan budget	Annual budget
02.	Provide operational support	Administer personnel	Recruitment	Recruiting temporary staff
03.	Deciding on permits for individuals	Aviation permits for individuals	Issuing permits for aviation operatives	Pilot-license

Fig. A2. Example of the structure of the classification system.

-
1. Management and Control
 2. Provide operational support
 3. Work with regulation
 4. Decide on permits for individuals
 5. Decide on permits for companies and organizations
 6. Decide on permits for vehicles, trains, aircrafts and vessels
 7. Decide on permits for facilities and infrastructure
 8. Supervise personal permits
 9. Supervise companies and organizations
 10. Supervise vehicles, trains, aircrafts and vessels
 11. Supervise facilities and infrastructure
 12. Keep records
 13. Sell information
 14. Work internationally and cooperate nationally
 15. Market surveillance
 16. Process information and investigate accidents and incidents
 17. Be enrollment authority
 18. Construct and follow up tests
 19. Produce certificates and licences
 20. Administrate taxes and fees
 21. Pay grants
 22. Review the decisions of other organizations
 23. Prosecution notify
 24. Report specific assignments
-

Fig. A3. Overview of the classification system.

Time	Document purpose	Document type	Example of quote	Code
8th of September 2015	Fieldnote	B1	“There are at least two previous drafts on how to measure digitalisation. XX and X have created these. In the document produced by X she has chosen to measure six aspects: channels (defined as digital channels where the citizen can come into contact with the agency such as via the webb, mobile-phone, sms, phone, system to system) [...]”	Awareness of problem
22nd of September 2015	Structured PM	C1	“The most important perspectives concern delimitations and the availability of data. We cannot measure the full spectrum of the phenomenon of digitalisation [...] According to X her report was too ambitious because it set out to measure too many aspects of digitalisation.”	Awareness of problem
2nd of November 2015	Minutes from meeting	A3	“Notes from workshop on the e-index [...] the indicator for digital channels will be changed, and we will not ask question about functionality [...]” “X suggests as an additional question to include if the particular e-service is coupled to a certain case-type (which can allow us to measure the level of digitalisation of a certain case-type).”	Suggestion
22nd of September 2015	Fieldnote	B10	“Five dimensions of e-government – e-index for the Swedish Transport Agency” “internal e-government A) digital casehandling, B) Digital cooperation with other agencies C) Number of information systems [...]”	Suggestion
26th of November 2015	Draft of a report from the agency	D2	“It is suggested here that the level of digitalisation at the Swedish Transport Agency will be measured in two ways, first by looking at the level of automatisisation [...] From a principal perspective the handling of case-types can be said to consist of three parts, information management, internal processes and the interaction with citizens [...]”	Development
1st of February 2016	Presentation	E3	“The purpose of the e-index and key performance indicators. To create a holistic view of digitalisation at the Swedish Transport Agency (STA). Show STA’s progress over time. Create common views regarding the possibilities and challenges of digitalisation. Provide input to the identification of areas with the potential for development.”	Development

Fig. A4. Example of data analysis of the material produced from the design-process.