

# Requirements engineering for e-Government services: A citizen-centric approach and case study

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## Abstract

Throughout the last decade, user involvement in e-Government service design has been virtually non-existent. Over time, e-Government experts began to realize that these services would benefit from a citizen-centric requirements engineering approach which has led to a demand for such an approach for this particular field. This article presents a citizen-centric approach towards user requirements engineering for e-Government services. It utilizes interviews and citizen walkthroughs of low-fidelity prototypes. A case study of a social support portal illustrates the approach and shows the need for repeated citizen inquiry, as the implementation of user requirements in low-fidelity prototype design is not always accepted by prospective end-users.

**Keywords:** Requirements engineering e-Government e-Services User-centered design

## Introduction

Many governments strive for citizen-centric e-Government services. However, the actual e-Services that government agencies have provided in the last few years have fallen short of being citizen-centric (Soufi & Maguire, 2007) due to a lack of representative user involvement in the design process (Følstad, Jørgensen, & Krogstie, 2004). A survey among the most innovative European e-Government service designers showed that they mainly consult users when evaluating prototypes (Benchmark, 2008). Such a design tactic is out of step with the principles of user-centered design in which repeated consultancy of the prospective users from an early stage in the system design process onwards is advocated (Gould & Lewis, 1985). In order to design high quality e-Government services that comply with the needs and wishes of citizens, a user-centered design approach needs to be developed within this context. The approach should not only include activities that deal with the evaluation of prototypes, but also, and perhaps even more importantly, activities deployed during the requirements engineering stage.

The requirements engineering stage is the foundation on which system development rests. User requirements engineering has been defined as “all the activities devoted to the identification of user requirements, analysis of the requirements to drive additional requirements, documentation of the requirements as a specification, and validation of the documented requirements against the actual user needs” (Saiedian & Dale, 2000, p. 420). Several studies have shown the added value of including a user-centered requirements engineering stage in the system development process: by involving prospective users, requirements gain in accuracy (Damodaran, 1996; Kujala, 2003). But a user-centered requirements engineering approach also brings positive effects over time. According to Kujala (2003), it prevents the inclusion of superfluous features and increases system acceptance. Ultimately, user involvement leads to increased usability (Karat, 1994) and usefulness (Mao, Vredenburg, Smith, & Carey, 2005) of the final system. From a cost-benefit perspective, user involvement in the requirements engineering stage is also interesting: it can save money because potential problems can be fixed early on (Karat, 1994).

A survey among e-Government project managers (Følstad et al., 2004) found that the key players in e-Government design need a clear and formalized approach for generating user requirements. Such an approach should include measurements that determine the success of the system design (Irani & Love, 2001). In this article, we present a citizen-centric approach for user requirements engineering for e-Government services and illustrate it with a case study. The article has been organized as follows: in Section 2, we discuss considerations for the requirements engineering activities in an e-Government setting. Then, in Section 3, we present our citizen-centric approach and the methods involved. In Section 4 this approach is applied in a case study. Sections 5 and 6, respectively, round off the article with a reflection on the case study and our conclusions and recommendations.

Considerations for user requirements engineering in e-Government projects

Governmental e-Services differ from their commercial counterparts. It is crucial to take these differences into account when setting up requirements engineering activities or analyzing their results. The main differences include the following:

*A heterogeneous user group.* The target group of e-Government services is highly heterogeneous as it comprises the entire population of a region or country, while e-Commerce can focus on one single target group. Government agencies must take all the members of a population into account, which should result in a system design that caters to different cultures (Sandberg & Pan, 2007), skills (Wang, Bretschneider, & Gant, 2005), political opinions (Oostveen & Van de Besselaar, 2004), and disabilities (Becker, 2004).

*Incidental use.* Most e-Government services are used only once or rarely. As a result, clients do not have a mental model of the service they are about to apply for and must be guided through the service process by the system (Klaassen, Karreman, & Van der Geest, 2006). In the case of commercial e-Services, where the service process is more or less the same, clients have a clearer idea of the kind of service process they can expect.

*Complicated content.* Many governmental services include difficult regulations which citizens often find hard to apply to their own personal situation. In the case of e-Commerce, the service provided is usually more simple and straightforward.

*Interoperability.* e-Government services often span several organizations or departments. Such a service can be offered to the citizen via one single website, supported by an interoperable system. This website should present the service as a coherent and logical whole for the user. Of course, acceptance by the employees of such interoperable systems, and the working methodologies associated with them, is crucial for success, and needs to be addressed in the design process as soon as possible. However, discussing all the challenges related to interoperability lies outside the scope of this article.

*No competition.* e-Government services are usually provided by one single body and the client (citizen) is obliged to make use of each particular service (e.g., to acquire a driver's license). Therefore, e-Government services do not need to make any effort to seduce the visitor into using them as much as commercial e-Services do (Wang et al., 2005). As a result, there is no incentive for designers to focus on user-friendliness or attractiveness and this may result in less usable design.

*Return on investment.* Governments use public money. This money has to be well-spent as any investments in e-Government services need to be justified afterwards (Wang et al., 2005). This return on investment is difficult to assess for government organizations as it often manifests itself as a reduced burden for the citizen (e.g., less effort needed to complete a service application). Therefore, Irani, Love, Elliman, Jones, & Themistocleous (2005) argue that returns on investments in e-Government projects should be assessed using subjective user-satisfaction criteria, rather than by means of a strict economic analysis. The manner in which user requirements are formulated and the possible evaluation criteria that are attributed to these requirements can serve as the basis for such a return on investment evaluation (Jokela, 2001).

Citizen-centric requirements engineering for e-Government services

In the past, some requirements engineering activities of e-Government projects have been reported. Haraldsen, Stray, Päivärinta, & Sein (2004) discussed an approach to requirements engineering for e-Government portals that facilitates the citizen via life-events. Other citizen-centric requirements studies have applied methods such as a literature review (Wimmer & Holler, 2003), a combination of interviews with experts, a literature review, surveys and focus groups (Krenner, 2002) and a combination of interviews with users and thinking-aloud sessions (Lines, Ikechi, & Hone, 2007). Although these studies report useful requirements, they do not describe a general approach for generating user requirements for e-Government services. From the array of user-centered methods that can be used in the requirements engineering stage (as discussed in Maguire (2001) and Lauesen (2002)), we selected those that suit the context of e-Government services very well. Fig. 1 depicts our citizen-centric approach to requirements engineering for e-Government services. We do not claim that this approach is the best, but will demonstrate its usefulness through the case study of the requirements engineering stage of a social support portal. This approach provides an opportunity to integrate users in the system design in a feasible and cost-effective manner. In this section we will discuss the different methods and techniques chronologically, as they are applied in the approach.

Interviews

During the interview, the interviewer asks the interviewee a series of questions about the current form of service provision and problems that arise, their goals, and the way in which digitalization can play a role (Lauesen, 2002). The interview is also a fine method with which to identify incidents that are critical for (dis)satisfaction with the service (Gremler, 2004). Often, interviews are semi-structured: the interviewer has prepared a list of questions but is allowed to deviate from this format in order to pursue interesting issues that come up during the conversation. For a practical guide to conducting interviews, we refer to Patton (2002).

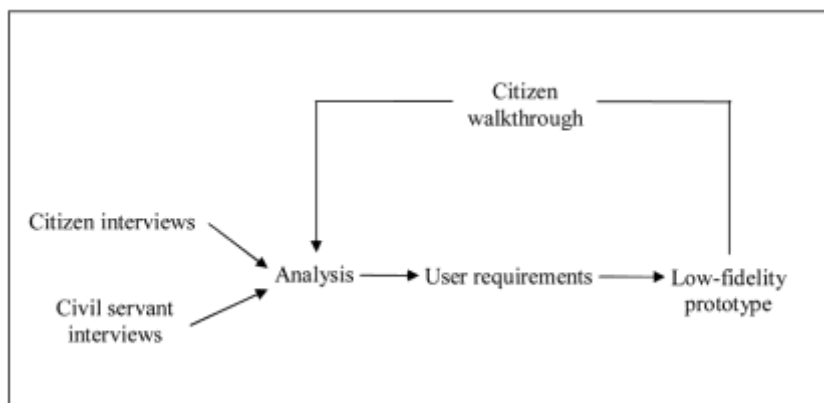


Fig. 1. Citizen-centric requirements engineering for e-Government projects.

For the elicitation of user requirements for e-Government services it is wise to consult stakeholders with previous and direct experience of the service

in question. Two stakeholders comply most with this profile: citizens who recently applied for the service, and civil servants who are directly confronted with the service's applicants. As opposed to secondary stakeholders who are involved from a distance, these primary stakeholders know the strong and weak points of the current, non-digital, service delivery as implemented in real life, which the digital version can enhance.

In requirements engineering, it is common practice to base interviews on the experienced interaction with the system to be replaced. Currently, most government services are not facilitated (completely) via the internet. In that case, the interview can provide an exploration of the context of the process which the system has to facilitate. One practical approach is to focus the discussion on the service delivery that takes place via face-to-face or telephone contact. Ambrosini and Bowman (2001) suggest encouraging citizens tell stories about their own experiences as this makes it easier for them to speak freely and they are then more likely to share more information about the decisions made and the rationale involved.

When primary stakeholders are interviewed the focus should be on their specific knowledge. In both cases we advise using semi-structured interviews as these will enable the interviewer to pursue other potentially relevant topics that were not previously included in the interview scheme. In the case of the citizen interviews, we suggest that each conversation should address the following topics:

- Client demographics (age, housing situation, disabilities, etc.);
- Critical incidents that determine (dis)satisfaction with either the application process or how the application is managed, as experienced by the client;
- The chronological service application process, as experienced by the client;
- Expectations of digitalization of the service application and management processes.

By posing these questions, the interviewer covers the issues of incidental use and complicated content.

When interviewing civil servants, each conversation should include the following topics, thereby addressing the issues of incidental use, complicated content and interoperability:

- Typical client questions or situations and their translation into actual service;
- The information required of the client;
- Different organizations in the service supply chain: their role, information-exchange processes and trust in the quality of information, supplied by others;
- Expectations of digitalization of the service application and management processes.

#### *Interview analysis*

In order to generate input for the requirements formulation stage, the transcribed interviews need to be analyzed. In an overview by Davis (1982) we identified three systematic analysis techniques that are relevant for our approach. Combined, they provide the requirements engineer with an overview of the critical issues that an e-Service needs to take into account, the decisions citizens and civil servants feel they have to make and that need to be facilitated, and finally, the relevant human factors. Although each technique has its own goal, we do not think that only one of the three techniques should be selected. On the contrary, we encourage requirements engineers to apply all three techniques. As the focus for each technique differs, they will complement each other.

1. *Critical factors analysis.* This analysis technique focuses on uncovering the factors that are critical for citizens to successfully complete a process or make decisions. If addressed in the interview, the analysis can also focus on experiences which citizens deemed critical for their satisfaction with a service. This way, the requirements engineer can identify the kind of information, or the manner in which it is communicated, that is vital for an effective and efficient system.
2. *Decision analysis.* By analyzing the service process, as experienced by citizens, and focusing on the decisions they made, an overview of the information that needs to be provided to citizens, and at what moment, can be constructed. In order to do so, one first has to identify the (important) decisions in each process, identify the steps involved and, finally, the information that the citizen needed here. A systematic approach for this activity has been set out by McGraw and Harbison (1997). By breaking the service delivery process down into the steps as perceived by the citizen and summarizing their context, the parties involved, the information sources, and finally, the consequences of the manner in which each step is concluded, one gets a useful overview of factors and conditions that shape citizen decision making. When taking decisions made by the citizens and how they reach them into account, the system design can simplify the interaction between the citizen and the e-Service.
3. *Human factors analysis.* This last analysis method concerns the search for issues that may hinder successful interaction between user and system. By taking the resulting human factors into account as user requirements in the system design, a greater fit between the system, the needs and wishes of the user, and the context can be achieved.

#### *User requirements notation*

Every critical factor, step in the decision process, or human factor that should be taken into account in the e-Service design, should be formulated as a user requirement. Several formats for the documentation of requirements are available. In order to keep this discussion clear and focused, we will discuss only one here: the Volere method<sup>1</sup> (Robertson & Robertson, 2006). Several features make this format superior to others in a user-centered design process.

First, the rationale behind each and every requirement needs to be written down. This will function as anecdotal evidence for the designers and, in this respect, increase the likelihood that the requirement will be implemented in the system design.

Second, and most importantly, the template forces the requirements engineer to think about the means to evaluate whether the requirement has been successfully implemented in e-Service design or not. A fit criterion specifies how the successful implementation of a requirement in (a prototypical version of) the e-Service design will be assessed, preferably by means of user evaluation. This fit criterion not only establishes the quality of the (prototypical) e-Service design, but can also determine the return on investment. When a contractor delivers a system that complies with the fit criteria, the money can be considered well-spent and vice versa. One can even draw up a contract stating that

the contractor will only be paid when the system complies with the fit criteria, as in Coble, Karat, & Kahn, 1997. Finally, the template forces one to estimate the increase, or decrease, in customer satisfaction as a result of taking the requirement into account or not. This estimation serves as input to determine the requirements in order of priority and shows which user requirements should at least be taken into account in the final e-Service design.

Writing a document that outlines the requirements marks the end of the first stage in our approach.

#### *Low-fidelity prototyping*

Now that we have an initial set of user requirements, their relevance for stakeholders and the form in which they are to be implemented in the e-Service interface and interaction design must be evaluated. It is hard to create an instrument that makes requirements (which are often of a technical nature) understandable to prospective users (Sutcliffe, 1996). A prototypical version of the system in combination with a real-life scenario can be used to facilitate a discussion between the requirements engineer and future users (Saiedian & Dale, 2000; Sutcliffe, 1997). Furthermore, the production of a low-fidelity prototype is a design activity that makes the design team commit itself to the formulated requirements. This way, the prospective user is ensured of a prominent role in the design process.

We propose a strategy that uses citizen walkthroughs, facilitated by a low-fidelity prototype and a fictive scenario. This strategy is inexpensive and easy to set up and conduct. In a system design phase where general user feedback is needed, this approach delivers the best return on investment.

A low-fidelity prototype can take the form of a set of pictures, displaying the main screens and functionality of a system. It does not have to be representative of the final system and can be made in programs like Photoshop. Low-fidelity prototypes enable designers to quickly and inexpensively visualize the functionality and 'look and feel' of a future system, but limits the possibilities of showing the navigation within a system (Rudd, Stern, & Isensee, 1996). The use of such a prototype has been found to be a fine trigger of user feedback (Benyon-Davies, Tudhope, & Mackay, 1999) and because screenshots do not resemble a finished system in which a lot of time and effort has been invested, evaluation participants are less reluctant to provide negative feedback (Grady, 2000). Ultimately, the evaluation of a low-fidelity prototype will inform the requirements engineer whether he or she has missed some important user requirements and whether the visualized requirements are valid or not (Snyder, 2003). Examples of such prototypes can be found in Kinzie, Cohn, Julian, & Knaus (2002).

When designing the low-fidelity prototype, one should take into account the fact that it must facilitate the evaluation of the requirements for which a fit criterion has been formulated. When there are too many requirements to be assessed in a user evaluation, one will have to decide which ones will be evaluated. Such a decision must be based on the priority of the requirements (Coble et al., 1997). The more important a requirement, the more important it is that its relevance is evaluated with prospective users.

#### *Citizen walkthroughs*

During a citizen walkthrough, a participant is shown the low-fidelity prototype version of the e-Service and is asked to provide comments on the functionality, the interface and the interaction design. When confronted with important functions or steps in the service process, participants can be explicitly questioned about their opinion. These questions are to be drafted before conducting the sessions and should be posed to each participant at the same time during the walkthrough. Traditionally, these sessions are conducted with experts, but they can be held with regular users (citizens) as well.

'Walking through' the prototype is supported by a scenario: a story about a (fictive) character who uses the e-Service. This way, the prototype functionality and its usefulness become tangible to the participant. Such characters and their stories are commonly referred to as 'personas'. Cooper (1999) describes how to choose a persona and to create a story around this character and his or her system use. When a very heterogeneous user group is to be served with the e-Service, it might be rewarding to create several personas and conduct a citizen walkthrough with representatives of the subgroups in the end-user population, each time using the appropriate persona.

When evaluating a low-fidelity prototype of an e-Service making use of personalization, an upcoming trend in the design of e-Government services, some specific issues need to be taken into account. Alpert and Vergo (2007), Jameson (2007) and Pieterse, Ebbens, & Van Dijk (2007) have listed these issues which include the predictability of personalized output, and feelings of control and trust. In order to get an indication of the extent to which the final version of the system will be accepted by citizens, and which barriers might play a role, these issues need to be addressed.

We advocate a citizen walkthrough set-up in which a low-fidelity prototype, with a limited set of screenshots (approximately 15), is presented by means of a persona. At the end of each screenshot the participant is to be asked about his or her impression of the screenshot, the completeness of the information provided, and the functionality displayed. At the end of the walkthrough, the citizen can be questioned about abstract issues such as trust, control and barriers to using the e-Service. Through this set-up, the issues of catering for a heterogeneous user group, incidental use, complicated content and interoperability are all accounted for. For a practical guide to conducting walkthroughs, we refer to Wharton, Rieman, Lewis, & Polson (1994).

#### *Citizen walkthrough analysis*

The citizen walkthroughs will result in a large amount of transcribed text. In order to generate meaningful results from these transcriptions, a systematic analysis approach is required. Based on Patton (2002), we present four analysis approaches.

1. *Process analysis.* This approach focuses on the user's overall perception of the e-Service process as well as the different steps contained within it.
2. *Functional analysis.* This approach focuses on the typical features of the e-Service, derived from the user requirements.
3. *Question analysis.* This approach focuses on citizens' responses to questions, related to specific screenshots or functionality, posed during the walkthrough.
4. *Sensitizing concept analysis.* This approach focuses on concepts that are not interface-specific, such as trust in the system or the intention to

use it.

Each approach must result in the compilation of a summary of the participants' feedback about the different topics. As the citizen walkthroughs are likely to entail more than one kind of response (e.g., comments on the functionality displayed and answers to questions), more than one approach should be applied during analysis. Of course, analysis should be designed and conducted in such a way that it provides results on the fit criteria drawn up along with the user requirements.

After the citizen walkthrough, one will have to review, and possibly revise, the initial user requirements, as some will prove not to be as important as expected or will not be accepted by citizens. For all requirements, the history section of the Volere template needs to be updated. New requirements need to be added to the requirements document and, when crucial for the appearance or functioning of the e-Service, these requirements have to be tested by means of, again, a citizen walkthrough, facilitated by an updated low-fidelity prototype and scenario. When the requirements document is complete, one can start designing and programming the e-Service which, according to user-centered design principles, should also be tested with prospective users.

#### A case study in citizen-centric requirements engineering: a social support e-Service

We will now illustrate our citizen-centric requirements engineering approach with a case study: a Dutch social support portal. First, we will discuss the application process which the e-Service is to facilitate, followed by our requirements engineering activities.

##### *Social support in the Netherlands*

Dutch citizens who, because of physical or mental ailments, cannot take care of themselves or their housekeeping, can rely on the Social Support Act (in Dutch: Wet Maatschappelijke Ondersteuning, or WMO). If they are found to be eligible for this kind of aid, they are awarded a housekeeper or nurse for a designated amount of time and for a fixed number of hours a week. For example, John, who just underwent hip replacement surgery applies for social support as he will not be able to clean his house and has no family to help him. After being found eligible, John is given a home help for six hours a week for two months. The party that offers and arranges social support is the municipality. Municipalities often have contracts with care agencies that supply home helps and nurses, and take care of the administrative tasks involved in hiring personnel.

When applying for social support, the citizen can choose one of two options: receiving help in kind or receiving a personal budget to hire someone. When opting for help in kind, the citizen is appointed help by the municipality or care agency which then also takes on the administrative burden involved. When opting for a personal budget, the citizen can hire a home help of his or her own choice (e.g., a family member) but he or she will also have to act as the home help's employer. This means that the citizen must comply with the labour laws (e.g., maintain a system of administration to deal with salaries, etc.).

Applying for social support is difficult and involves a lot of paperwork, especially when choosing for a personal budget. In addition, each municipality has a certain degree of freedom to extend regulations regarding the Social Support Act. As the application and regulations involved differ from municipality to municipality, it is impossible to provide instructions on this process on a national level. Digitalizing the process involved in applying for a personal budget might be one way of simplifying the procedure and reducing the paperwork involved.

The requirements engineering team in our case consisted of two human-computer interaction specialists, a public administration specialist, an interface and interaction designer, and an ICT service innovator. None of us was involved in developing the final system; our task was only to deliver a set of user requirements and to advise the system developers.

##### *Citizen and civil servant requirements interviews*

Two sets of interviews served as input for the user requirements. In the first set, we interviewed six citizens who recently completed an application for social support and consequently, could easily reflect on their experiences. This number may seem small, but at the time of interviewing the Social Support Act had just been introduced and, therefore, the pool of applicants from which participants could be recruited was very limited. In the second set, we talked with six employees who were professionally involved in the application or administration of social support services. Here, we also spoke to six people in order to generate as much input as the applicants. The six participants represented the different professions that support social support applicants (council office clerks, application assistants and salary administration assistants).

The citizens were recruited by the municipalities that were taking part and received a gift voucher. The interviews took place in their homes, as some were physically unable to travel, and were audio-recorded. All clients had recently applied for a personal budget as a form of social support. In the end, only five of them actually received a personal budget. One citizen decided to abandon the option of the personal budget during the application process and chose to receive help in kind instead. One client was represented by a family member who also took care of the personal budget, as the client herself suffered from dementia, and one couple was interviewed together as they both received help. The employees who were interviewed were recruited through the various organizations involved in the project. These interviews were held at the offices of the employees and were also audio-recorded.

##### *Requirements interview analysis*

All audio-recorded interviews were transcribed. Next, the three analysis techniques we listed in paragraph 3.2 were applied to uncover requirements that were subsequently written down in the Volere template.

*Critical incidents* were only elicited from the clients. Therefore, the analysis focused on the parts of the discussion in which citizens told us about such experiences. The following example of a negative critical incident highlights the difficulty one woman had in obtaining a parking permit for a disabled person:

"I wanted to apply for it [the permit] and it caused me a whole lot of grief. In this instance, you don't get just one letter, but one for every word that's being said. I might have understood it if I had only been living in this county for two years or so... but I have been living here for 20 years. You would think that they would know me by now! I applied for it in October and received it just before Christmas. The same thing happened at the hospital: they should just put my data into one single computer and get everything out of that."

This story, along with other statements by the interviewees, led us to formulate requirement #28 (see Fig. 2): The system must provide clients with the option of collecting data from another organization involved in the service supply chain, where that data is already known.

Decision analysis was performed by means of the systematic approach by McGraw and Harbison (1997). Sometimes interviewees entrusted an agency to apply on their behalf, so in these cases a decision analysis was not performed. In the resulting tables we used the interviewees' experience of steps in the application process and choice of words as closely as possible to describe the steps they went through during the application process. An excerpt from one such table can be found in Table 1.

Social analysis resulted in the following statement made by a client, addressing the wish to choose a home help herself:

"I used to get help from the home help agency. But each time I got a different person. I didn't like that [...] They told me I would be better off applying for a personal budget, so I could choose my own home help. Now I get the same help two times a week. A home help I chose myself."

This statement, and others like it, prompted us to formulate requirement #2 (see Fig. 3): The system must support the applicant's prerogative to select his or her own home help if a personal budget is chosen.

#### Paper prototyping the social support e-Service

The citizen interviews resulted in 63 requirements while the interviews with the employees added another 39. Based upon these requirements, a low-fidelity prototype was developed which had to function as input for the citizen walkthrough. The team brainstormed

Requirement #: 28	Requirement Type: Functional
Description: The system must provide the clients with the option of collecting data from another organization involved in the service supply chain, where the data is already known.	
Rationale: Having to provide the same data more than once to a government agency involved in the service chain should be avoided.	
Source: Client interview 1, 2, 3 and 5; Employee interview 1 and 3	
Fit Criterion: Not applicable	
Customer Satisfaction: 4	Customer Dissatisfaction: 4
Priority: High	Conflicts: none
History: Created May 1, 2007	

Fig. 2. Requirement #28 in the Volere template.

about possible translations of the requirements into a visual design, which was then worked out by the interface and interaction designer. This resulted in 16 screenshots, implemented in a PowerPoint presentation.

Requirement #28 was visualized by means of collecting a citizen's net income from the Tax Administration in an e-form, and is displayed in Fig. 4.

When citizens reach a field in the e-form requesting their net income in 2006, they can click on a button 'Retrieve from Tax Service' and the displayed pop-up appears, showing the net income for 2006, as it is known by the Tax Administration. Applicants can then choose to use this number in their form or to ignore it and fill it in themselves. Requirement #2, which specifies that a client should be able to choose his or her own home help via the portal when opting for a personal budget, resulted in a separate step in the application process. This step made it possible for a client to choose a home help from a list of possible candidates. This list of candidates could be narrowed down based on their geographical proximity to the applicant, the appreciation they received from other social support clients (in the form of 1 to 5 stars), or their name. An applicant could also choose a home help on a map of his or her neighbourhood. This was visualized by means of a map of the Netherlands, containing several buckets (each representing

a help). Fig. 5 shows the screen that displays this functionality.

#### Citizen walkthrough of the social support e-Service

We conducted a walkthrough that was focused on the acceptance and comprehensibility of the functionality, derived from the requirements, as implemented in the low-fidelity prototype. We guided the participants through the prototype via the persona of Mrs De Vries, who recently underwent hip replacement surgery and, via the e-Service, applied for social support, choosing for a personal budget.

The organizations involved recruited 15 participants who recently completed an application for social support, or were in the process of applying at that moment. In line with the total population that applies for social support, the percentage of senior citizens in our sample was high and included a 79-year old and an 81-year old. All in all, the participants were a representative sample of the e-Service's prospective end-users. As in the case of the citizen requirements interviews, we visited them at home and rewarded them with a gift voucher.

We would start a session by introducing the fictitious character of Mrs De Vries. Then we would show the prototype, tell Mrs De Vries' story, and, after showing each screenshot, question the participant about the visualized functionality. In the case of requirement #28 and the screen displayed in Fig. 4, we asked each participant two specific questions, in addition to the standard questions as listed in Section 3.5:

For you personally, what are the benefits and disadvantages of retrieving data from other organizations and incorporating this directly into your own form?

Do you like this way of filling in a form?

After showing Fig. 5, depicting requirement #2, we asked the participant the standard and the following specific questions:

Do you think it is useful that you can select a home help from a map?

Do you think it is useful that the appreciation of the different home helps is rated by others?

Do you think this is a pleasant way to select a home help?

Table 1  
Excerpt of decision analysis table.

Step	Context	Involved parties (besides client)	Used information sources	Decision (D) or action (A)	Problems	Simplicity	(dis)Satisfiers
Contact with Social Security Bank	Telephone contact about commissioning salary administration.	Social Security Bank	n.a.	(D) requesting form: commissioning salary administration (A) filling in form: commissioning salary administration	Client did not understand calculation of fixed monthly salary by Social Security Bank	Average	— High number of forms — Filling in the same questions more than once + Clear information
Renewed contact with 'support desk' at municipality	Taking care of financial affairs	'Support counter' at municipality	n.a.	(A) submitting annual income form		Average	

Requirement #: 2	Requirement Type: Functional
Description: The system must support the selection of a home help if the applicant opts for a personal budget.	
Rationale: Social support clients use a personal budget to be able to determine themselves who is going to help them. The system has to support them in this.	
Source: Client interview 1	
Fit Criterion: Not applicable	
Customer Satisfaction: 5	Customer Dissatisfaction: 5
Priority: High	Conflicts: none
History: Created May 1, 2007	

Fig. 3. Requirement #2 in the Volere template.

When all the screenshots were dealt with, we posed some general questions, addressing the citizens' intention to use the e-Service, their self-efficacy, trust in the website and participating organizations, and the biggest (dis)advantage of using the website. Finally, we asked them to formulate one piece of advice for the designers of the social support portal.

#### Results of the citizen walkthrough

All of the citizen walkthroughs were audio-recorded, transcribed and analyzed using the approaches listed in Section 3.6. The analysis of feedback on the functionality, derived from requirement #28 and depicted in Fig. 4, resulted in the following section in our evaluation report. The suggestion to collect personal data from other organizations received an enthusiastic response. Nine interviewees told us that they thought this mechanism was pleasant and five people thought it was useful. The participants had several reasons for this opinion. The most frequently mentioned (four times) reason was that it saved them from having to search for papers. Two people stated that it prevented mistakes being made and, last but not least, two participants liked this idea because it meant that they would no longer have to do calculations themselves. One participant





**maatschappelijke ondersteuning**

**zoek een hulp**

Hieronder kunt u zelf op zoek gaan naar een hulp. U kunt selecteren op afstand, waardering of naam.

0 compleet 1 aanvraag 2 informatie/advies 3 zoek een hulp 4 contract

Afstand tot uw woning:  OK

Minimale waardering: ★★★★★ OK

Naam:  OK

ZOEKRESULTATEN:

Minimale waardering: ★★★★★

NAAM	AFSTAND (KM)	WAARDERING
Zonneklaar Zorg <a href="#">meer info...</a>	58	★★★★★
Mevr. K. Putz <a href="#">meer info...</a>	32	★★★★★
Mr. J. de Bruin <a href="#">meer info...</a>	134	★★★★★
<b>Mevr. J. Veenstra <a href="#">meer info...</a></b>	<b>3</b>	<b>★★★★★</b>

Uw keuze: **Mevr. J. Veenstra**

terug naar stap 2 Overleg dit met het zorgloket Email dit naar... door naar stap 4

Fig. 5. Selecting a home help on the basis of vicinity and appreciation by peers (text in Dutch).

wondered how this would work in practice if the application was managed by a representative and thought that this alternative approach was not visualized clearly in the prototype. All in all, the results indicate that potential users greatly welcome the idea of collecting data at other organizations in order to speed up and simplify the process of filling in e-forms. Only one participant disliked the idea altogether. One point of attention should be the application process that is completed by a representative. In this case, the interface must make clear that it is the client's data that is being collected and not that of the representative.

The analysis of feedback on the functions that were derived from requirement #2 and depicted in Fig. 5 can be summarized as follows. The functionality that facilitated the search for a home help via the e-Service received mixed feedback. Five participants were positive about the prospect of finding a home help via the website, as displayed in the low-fidelity prototype. The majority of the participants, however, provided negative feedback. This was caused by the space of problems they had encountered with the functionality as displayed in the low-fidelity prototype. First of all, seven participants did not understand the function of the 'vicinity' criterion by which they could select home helps who lived close to their homes. Second, five participants did not understand the function of the stars which were used to indicate how other people rated a home help. Moreover, five of the participants indicated that they could not deduct any useful information from these ratings, as they thought they were too subjective. Third, participants told us that critical information was missing, such as someone's experience (mentioned 7 times), age (5 times) and gender (3 times). Finally, seven participants said that they would not be able to choose a home help solely via a website as they would have to meet him or her face-to-face in order to see whether they could get along well together.

#### Revision of the user requirements

Based on the prototype evaluation, we corrected our user requirements. In all cases, the evaluation results of the requirements that were visualized in the prototype had to be included in the 'history' section of the template.

Requirement #28 ("The system must provide the clients with the option of collecting data from another organization involved in the service supply chain, where the data is already known") was greatly appreciated by the citizens. In the Volere template a functional requirement (like requirement #28) is not awarded a fit criterion, as a function is either implemented or not. However, a positive appreciation by prospective clients can serve as a check for the right of a requirement to exist. Based on the results of the citizen walkthrough, requirement #28 should be included in the final system design in the form as it was displayed in the low-fidelity prototype, but with an added requirement, satisfying the need for clear information for representatives of social support clients, specifying how data collection goes on in their particular situation.

Requirement #2 ("The system must support the selection of a home help if the applicant opts for a personal budget") was not appreciated by participants in the form in which it was implemented in the low-fidelity prototype. This forced us to formulate additional requirements which catered for the problems that had been identified in this step of the application process. For example, a more detailed explanation about what was meant by 'vicinity' in the 'vicinity' entry field was needed, more information about the background of all the home helps was requested and finally, a function that facilitated a meeting between the two parties was to be added (a result

generally received negative feedback and therefore did not contribute to the usefulness of the system.

#### A reflection on the social support e-Service design

During our case study, we were confronted with two issues that we think shape the outcome of the requirements engineering activities and thus, shape the final e-Government service. Therefore, it is crucial to make the right decision when faced with both situations.

The first issue concerns the role of the requirements engineer(s). The person or persons that take on this role have a major influence on the functionality and appearance of the system that is about to be designed. Hertzum and Jacobsen (2001) have shown that experts can differ tremendously in their interpretation of evaluation results. Therefore, it is wise to put together a team of requirements engineers rather than let one single expert do all the work. Furthermore, Cooper (1999) has contended that specialists with a technical background often have dissimilar interests and beliefs on the use of technology than regular users, which may take the upper hand during the process of designing the systems. Generally speaking, this is not in the best interests of the citizens as they might end up being burdened with functionalities they do not use or understand. Therefore, human-computer interaction specialists need to be involved. The composition of our team of requirements engineers appeared to be one way of avoiding one design viewpoint from dominating the discussion. The many debates between team members resulted in a low-fidelity prototype design that gave into user, as well as technical, demands. As a result, the prototype not only served the wishes of the user, it was also feasible to start development. Second, the sample of citizens consulted during the requirements engineering stage of an e-Government service should be representative of the entire population. Especially since their user groups are often heterogeneous and government agencies cannot afford to neglect a sub-group. In order to overcome this issue, we handpicked our participants so as to have representatives from the different user groups which the social support portal is supposed to serve. A clear view of the segmentation of the prospective user group turned out to be a prerequisite for the manual selection of participants. This segmentation can also serve as input for the personas that support methods in the design process, like the citizen walkthrough (Flak, Moe, & Sæbø, 2003).

## Conclusions

In this article, we have presented a citizen-centric approach to requirements engineering for e-Government services and demonstrated its value by means of a case study. The approach utilizes interviews, the formulation of requirements with a focus on concrete and measurable criteria, low-fidelity prototyping, and an evaluation by means of a citizen walkthrough. This approach, like any user-centered design process, should be seen as an iterative process: requirements, as they are translated in the prototype, need to be checked with prospective users and, if necessary, must lead to reformulated or elaborated requirements, which need to be checked again. Our case study underlined the benefits of applying more than one iteration. The need for iterative design originates in the stage in which designers develop the requirements into system design: a creative step. This interpretation may not fully correspond with the citizens' wishes, needs or the context that prompted this requirement and thus, needs to be tested with prospective end-users. In our case study, most of the requirements, as translated in the prototype design, were accepted by the clients receiving social support. However, some requirements needed to be redefined and some additional requirements were formulated. The effort invested in the citizen walkthrough certainly proved to be worthwhile as the evaluation revealed some new issues that were crucial for successful and useful interaction between the e-Government provider and the citizen. The information clients need when searching for a home help, for example, appeared to

be more detailed than we expected on the basis of the interviews that were geared towards determining their requirements.

The use of our requirements engineering approach, we believe, increases the chance of obtaining a good match between the wishes and needs of the citizens and the context in which they find themselves, and governmental e-Services, as illustrated by the mainly positive responses to the low-fidelity prototype. The way in which requirements were elicited proved to be a good basis for the design of the prototype of the system. The subsequent refining and elaboration of the requirements helped to create an even better fit.

e-Government services not only have to match the needs of the citizens for whom they are intended, but should also correspond with the needs and work practices of the civil servants who provide and deliver the service in question. If this is a bad match, it can reduce the quality of the service that is delivered: civil servants may encounter obstacles when working with the system or may use the system ineffectively. In our case, the civil servants contributed to the requirements through the requirements interviews. Their perceptions of delivering the service and their contacts with the users were incorporated in the requirements and hence, in the design. In this way, we created a basis for a good fit with the e-Service providers and their work practice. Many governmental ICT projects appear to fail because of a lack of attention for the interests, attitudes or work practices of the civil servants who have work with them (Algemene & Rekenkamer, 2007). We see the interviews with civil servants as an important part of our approach and one that increases the likelihood of the systems succeeding on the organizational side.

Professionals involved in developing e-Government services who want to apply a similar citizen-centric approach, have to take several factors into account. First, the elicitation of user requirements takes time which has to be reserved in the planning process. Preferably, the technical design process of the system should only start after all the activities geared towards determining the user requirement have been completed. That way, a situation can be avoided in which some user requirements cannot be implemented in the system because the design and development process has already progressed too far. Second, the team of user requirement engineers that has to be put together must be multi-disciplinary. By using the knowledge of different disciplines involved in governmental e-Service design, a system that is feasible and accepted by all parties can be created. Ideally, the team should consist of at least one specialist in human-computer interaction, a specialist in public administration, a system developer or application engineer, an interaction and interface designer and a representative from the organization for which the e-Service is being developed. Third, the team of requirements engineers and the system developers need to meet regularly. During these meetings the requirements can be translated into system characteristics and functions in an ongoing dialogue about what is possible and feasible (from a technological and administrative perspective) and what is required and desirable (from an organizational and end-user perspective).

Finally, the formulation of fit criteria for each requirement (required by the notation method used in our approach) provides a good baseline for assessing the quality of the (prototypical) governmental e-Service. The quality of the work of the designers and developers can be assessed against the requirements' fit criteria, which should be part of the briefing with the designers and developers. For e-Service systems it is often hard to define the return on investment and yields in a user-centric way, and this applies even more in the case of e-Government services. The development of an e-Government service, based on requirements and a prototype that complies with well-specified fit criteria, minimizes the risk of building a system that is disliked by citizens or under-used by service providers. In the case of the exemplary social support portal we created, the requirements, low-fidelity prototype and evaluation results were convincing enough for one of the largest cities in the Netherlands to take it as the basis for the development of a full-fledged, interoperable and personalized social support portal.

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