8-4-2008

Wide Audience Requirements Engineering (WARE): A Practical Method and Case Study

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芽|Sprouts Working Papers on Information Systems ISSN 1535-6078

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Abstract
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Keywords: Requirements Gathering and Analysis, Critical Success Chains, CSC, Laddering, Wide Audience End-users (WARE), Requirements Engineering, Requirements Elicitation, Systems Analysis, Means-ends Analysis

Permanent URL: http://sprouts.aisnet.org/4-27

Reference: Tuunanen, T., Peffers, K., Gengler, C. (2004). "Wide Audience Requirements Engineering (WARE): A Practical Method and Case Study," Helsinki School of Economics, Finland . *Sprouts: Working Papers on Information Systems*, 4(27). http://sprouts.aisnet.org/4-27

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HELSINKI SCHOOL OF ECONOMICS
WORKING PAPERS
W-378

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September
2004

HELSINGIN KAUPPAKORKEAKOULU
HELSINKI SCHOOL OF ECONOMICS
WORKING PAPERS
W-378

HELSINGIN KAUPPAKORKEAKOULU
HELSINKI SCHOOL OF ECONOMICS
PL 1210
FIN-00101 HELSINKI
FINLAND

Sprouts

ISSN 1795-1828
ISBN 951-791-888-7 (Electronic working paper)

Helsinki School of Economics -
HeSE print 2004

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ABSTRACT

This study presents a new method to effectively determine requirements for information systems involving widely dispersed end users, such as customers, suppliers, business partners, and other end-users outside the organization, and demonstrates the efficacy of the method in a case study. Recently more IS have been targeted towards users outside the organization, making effective requirements engineering (RE) difficult. Outside users may have little relationship with the firm, are more costly to reach, may have different world views, and may not be available for iterative RE efforts. We identified seven problems associated with RE for wide audience end users and seven associated desirable characteristics for RE method that would address them. We reviewed IS, RE, and manufacturing literature to identify methods that addressed these characteristics and found three methods that supported four to five of the desired characteristics. We developed a method, wide audience requirements engineering (WARE), intended to support all seven characteristics. Major WARE features include a flexible, structured interviewing process (laddering), cognitive modeling (CSC), interpretive analysis, and a presentation tool that allows managers to view the requirements at several levels of aggregation by "drilling down" all the way to the original interviews. We used WARE to develop the requirements for a major information system, directed at outside users, at *Helsingin Sanomat*, Finland's largest newspaper. The demonstration showed that WARE was effective for its intended purpose. The requirements developed using WARE became the basis for a three year development roadmap for the system. The use of WARE helped managers and developers understand user preferences, reasoning, and priorities.

Key words: requirements gathering and analysis, critical success chains, CSC, laddering, wide audience end-users (WARE), requirements engineering, requirements elicitation, systems analysis, means-ends analysis.

INTRODUCTION

The problem of determining the best features and attributes for information systems has been recognized to be important and increasingly difficult [51] . Many important systems have been designed, implemented, and rolled out only to fail because users found that the systems either didn't meet their functional needs, required time-consuming, frustrating behavior to make them work, or even required awkward work-arounds to complete work [40]. Researchers sought to resolve the problem of mis-understood requirements by advocating elicitation of requirements from end-users, the use of elicitation methods to help users to express their needs, and methods to present the elicited needs in ways that helped developers understand them well [11, 16, 44, 73].

Now the problem of determining requirements is becoming increasingly more difficult because the IS development community is facing a new type of end-user. Increasingly firms develop systems for which the primary users are not within easy reach of the organization and for which functionality and usability for such users determine whether the systems are ultimately successful. Such systems include those that are intended for use by customers and vendors and systems in which substantial value for external users is embedded in system features. We refer to such systems as wide-audience information systems (WAIS). They might go beyond traditional organizational computing to, for example, include Java applications embedded in consumer-oriented mobile telephones or similar devices.

WAIS present several problems that haven't been addressed completely in prior IS development literature and practice. Consequently, traditional methods of

requirements gathering and analysis [17, 66] may no longer adequately support development for these systems and new methods may be necessary to support requirements engineering (RE) for wide audience end-users (WAEU) [69, 70].

We have identified seven distinct problems associated with RE for WAEUs:

1. *Context.* The potential end-users may have little or no historical relationship with the firm, the product line, or the technology and hence may have little context in which to have ideas about desirable functionality [54]. This is particularly true when developers wish to design new applications with features hitherto unavailable [56].

2. *Reach.* WAEUs are more costly to reach for data collection than in-house users and are likely to be unavailable for iterative or interactive consultation about their needs.

3. *Modeling.* The character of their knowledge may differ sufficiently from that of developers so that it isn't easy for decision-makers to understand what they want or need, why they want it, and the importance of their preferences.

4. *Model aggregation.* The character of knowledge among WAEU may differ sufficiently so that it becomes difficult to aggregate their preferences to present a meaningful, aggregated view for decision-makers.

5. *Presentation.* Differences in perspective and culture between WAEUs and managers may make it difficult for managers to understand and evaluate data from WAEUs to make decisions about which features to incorporate and how to do so.

6. *Consensus making.* Managers may lack the concepts and tools necessary to make the most effective decisions about features and attributes, the source of which is external to the organization, from WAEUs.

7. *Requirements-design interface.* It may be hard to model the results of the RE process in forms that permit WAEU views to be used effectively in the design process.

This is an important problem in IS research and practice. First, many of the most important new IS applications for the firm involve external users for whom extensive in-house training and involuntary participation is clearly not an option. Secondly, increasingly short technology development cycle times make it impractical to diffuse knowledge of such applications to the general public before they are developed. Consequently, it is necessary for firms to develop such applications before potential users may have a chance to understand and accept them. Thirdly, inadequate requirements specification is known to be a leading cause of system failure, as voluntary users refuse to use applications with flawed functionality or usability.

A method to effectively address the problem of RE for WAEU might include these desirable characteristics:

1. *Context.* Use a method to gather data from WAEU participants that does not require participants to have prior knowledge of predecessor systems, the firm, or the technology.

2. *Reach.* Support data gathering reach by gathering data that is sufficiently rich so that further interaction, if not available, is not required. In addition, the data gathering method should be economical.

3. *Modeling.* Allow participants' ideas to be flexibly modeled without overly restrictive modeling assumptions.

4. *Model aggregation.* Allow participants' models to be quickly and flexibly aggregated across individuals.

5. *Presentation.* Allow developers to see the data at various levels of aggregation and even to observe a view of the data gathering event to better understand participants' meaning.

6. *Consensus making.* Provide concepts and tools to help managers reach decisions about proposed system features and attributes by allowing them to see the proposed features and attributes in terms of managerial analytic concepts.

7. *Requirements-design interface*. Present models of new system features and attributes in a semi-structured form that supports incorporation into IS design process.

Here we address these needs with a new method for wide-audience requirements engineering (WARE). WARE is a method for requirements analysis and specification that meets the needs for understanding and meeting the needs of WAEUs in IS development. WARE an extension of critical success chains (CSC), an IS planning method that has been used successfully to develop portfolios of innovative applications

involving external and internal stakeholders [55, 56, 58]. WARE extends this method so that it can be used at the feature level and integrated into the IS development process.

We demonstrate the use of WARE to elicit requirements for the Medianetti e-Ad Traffic and Ad Information Systems (META-IS) at *Helsingin Sanomat*, Finland's major newspaper. The demonstration showed that WARE is a usable, effective method for eliciting requirements from WAEU.

This paper makes two contributions to the literature on requirements analysis for IS development. First, it introduces WARE, a method that meets the needs that we have identified for the development of innovative applications for WAEUs. Secondly, it demonstrates the use of this method in a case study, showing that it works well for this purpose.

The remainder of this paper is organized as follows. In the next section, we review literature from IS, RE, and manufacturing to understand prior attempts to address some of these issues. Next we describe the extension to CSC that makes WARE suitable for use in specifying the requirements for a new system. In the fourth section, we present a case study in which we implemented WARE to investigate the requirements for META-IS. Then, in the discussion section, we compare the earlier reviewed methods to WARE, presenting the methods in a comparative framework. Finally, in the conclusions, we discuss advantages of the new method and identify possibilities for further research.

REQUIREMENTS GATHERING AND ANALYSIS FOR WAEUS: A REVIEW OF THE LITERATURE

Traditional data gathering for IS requirement specification assumed that objective requirements existed somewhere in the minds of users, managers, or engineers to be

gathered by analysts [41, 59]. In the case of external users this notion led firms to use managers and engineers as proxies for end-users to develop applications without knowing what the users want or value [57]. Managers thought that they needed only find the right informants and use the right techniques to achieve complete specifications [38]. They assumed that the users were known and the requirements could be elicited from them using some predefined semi-formal methods. However, in the case of WAEU development we do not have suitable tools and techniques for collecting and organizing the requirements, in many cases we do not even have very effective ways to understand the users' opinions.

RE researchers have realized that developing requirements for systems to interact with external end-users is different from such development for organizational users. They point out that prioritization of requirements, continuous improvement of requirements and short period of time-to-market are vital [12, 60].

Attempts to Involve Users in Requirements Elicitation

Ever since the first major software systems were developed, chronic "software crises" have threatened the development community [8]. Researchers have sought solutions mostly through raising programmer productivity, making systems less defective, and with development methods that better take into account end-users and their needs. More recently discussion has focused on the need to do better at including end-users in IS development (ISD), for example through participatory design [3, 23]. A consensus developed, e.g., [50], that user participation improves the IS quality through requirements that are more complete, better fit the organization, are selected for their

importance, and promote user understanding of the system. However, no consensus developed for how users should be involved in the development process [13].

Techniques for tackling the issue

Researchers and consultants have developed a variety of methods for requirements elicitation. Textbooks describe interviews, scenario analysis, use-cases, soft systems methods, observation and social analysis, ethnographic analysis, requirements reuse and prototyping. The number of techniques and methods developed for these purposes is almost unlimited, especially by practicing ISD consulting firms, many of which are similar, although differently branded. Nuseibeh and Easterbrook [53] have classified these methods into six conceptual groups, including 1) traditional techniques, 2) group elicitation, 3) prototyping, 4) contextual techniques, 5) cognitive techniques, and 6) model-driven techniques.

Traditional Techniques. Methods in this group include a broad class of generic data-gathering techniques, not specific to ISD, such as questionnaires and surveys, interviews, and analysis of existing documentation such as organizational charts, process models or standards, transactions documents, correspondence, and user or other manuals of existing systems [53].

Prototyping. As requirements elicitation methods started to evolve towards answering needs of end users, one of the early adaptations was *prototyping*. Prototyping allows the analyst to get feedback from end-users [17, 39, 73] about what they want and need by means of focused, iterative experimentation with new features and system attributes. It involves a close interaction between the analyst/designer and the end-user.

Group elicitation techniques include a range of methods, the purpose of which is to elicit requirements from groups of end-users. Group techniques aim to foster stakeholder agreement and buy-in, while exploiting team dynamics to elicit richer understanding of group member needs. They include, for example, brainstorming, focus groups, rapid application /joint application development (RAD/JAD) workshops [42], and group support systems (GSS) workshops [49]. Many researchers, e.g. Herlea [26] and Davison and Briggs (2000), have applied the GSS method to requirements elicitation. It is said to be very adaptable to this problem environment, but the integration of the GSS and software engineering process has hitherto been seen as a bottle-neck. In an attempt to address this need, Briggs and Gruenbacher [7] have created a solution that integrates the WinWin spiral model of developing software [4, 5].

Contextual Techniques. Contextual methods emerged in the 1990s as an alternative to both traditional and cognitive techniques [21]. These include the use of ethnographic techniques, and ethnomethodology and conversation analysis, both of which apply fine-grained analysis to identify patterns in conversation and interaction [74]. Contextual design (CD) [36], an example of the genre, draws a lot from both the American RAD/JAD and the Scandinavian participatory design literatures. Holtzblatt and Beyer [36] make three observations about the use of their method: the best product designs happen when (1) the product's designers are involved in collecting and interpreting customer data, (2) they really understand what users and customers need and desire and, (3) when they see themselves as customers' apprentices, rather than teachers.

Cognitive Techniques. These are techniques originally developed for knowledge acquisition [67]. They include protocol analysis (in which an expert thinks aloud while

performing a task to provide the observer with insights into the cognitive processes used to perform the task), laddering (using probes to elicit the structure and content of stakeholder knowledge), card sorting (asking stakeholders to sort cards into groups, each of which has name of some domain entity), repertory grids (constructing an attribute matrix for entities, by asking stakeholders for attributes applicable to entities and values for cells in each entity). The cognitive techniques have been traditionally used in marketing, e.g. by Reynolds and Gutman [61] and Gengler, Howard and Zolner [20]. However, IS researchers have taken interest in these techniques. Boland, Tenkasi, and Te'eni [6] have suggested that cognitive techniques can be used to better identify the needs of distributed systems. Browne et al [9, 10] have claimed that by using laddering analysts are enabled to produce a richer set of requirements compared to other techniques.

Model-driven Techniques. Model driven techniques differ qualitatively in their approach to requirements elicitation. The techniques usually provide a specific model of the type of information to be gathered and use this model to drive the elicitation process. Nuseibeh and Easterbrook [53] describe goal-based methods [71, 72] and scenario-based methods [45, 46], as examples. These techniques, like knowledge acquisition in automated specification (KAOS), [71], usually require a thorough knowledge of the domain area of the system or a high level of knowledge of work practices.

Methods for Facing Wide Audience End-Users

Next we review representative RE methods to evaluate them in terms of the requirements for WAEU RE that we identified above. There are many dozens, perhaps hundreds of methods for IS requirements analysis. Here we have selected three that

1. are methods, rather than techniques or technologies,
2. are well represented in RE, IS, or software engineering research literature about requirements analysis,
3. seem representative of the state-of-the-art in requirements gathering and analysis, and
4. come close to fulfilling the seven requirements we have identified.

Table 1 evaluates the three methods in terms of the number of the identified WARE RE requirements for which they provide support.

Contextual Design [36, 37], one of the contextual methods [53], focuses primarily on system end-users. At its heart is the contextual inquiry technique, intended to bring the designer and user together. Using this method the designer comes to understand users by becoming an apprentice to them. Understanding users is clearly the method's *forte*, but it may be also its Achilles' heel when applied to WAEU because it may limit wide participation of diverse users [19]. In addition, its emphasis on the end-user the method also supports ideation through team interpretation sessions. The method includes a strong modelling component, where work processes models are derived through in-depth interviews. They are later aggregated to larger models for managerial use. This information is transferred back to the end-user in user environment design, where each of the features is related back to the work processes. Paper prototyping of the user interface with feedback results in shared understanding among stakeholders and provides analysts an interface to design. Finally, the method incorporates a prioritization

of requirements to support decision-making with QFD. CD has been used by many firms, for example, to collect user needs for business oriented mobile devices [76].

Table 1 Analysis of selected RE methods in terms of eight requirements identified for RE with WAEUs.

	Context	Reach	Modeling	Model Aggregation	Presentation	Consensus-Making	Requirements-Design Interface
Contextual Design [37]			√	√		√	√
EasyWinWin [7]		√	√	√	√	√	
Software Quality Function Deployment (SQFD) [29]		√	√	√		√	

EasyWinWin [7] is based on the group support system [52] and on research done in the spiral method of ISD [4]. It is intended to help stakeholders to gain a more thorough understanding of a problem domain and supports co-operative learning about other's viewpoints. Briggs and Gruenbacher [7] do not address the problem of distributed requirements elicitation, however, Herlea, Eberlein, Shaw and Gaines [27] have proposed a distributed elicitation using World Wide Web applications.

Modeling is a strong component of this method. In the WinWin negotiation model, stakeholders' objectives are captured as win conditions and agreements are developed out of win conditions and options by taking decision process and rationale into account. This way the software enables model aggregation and provides multiple options to represent requirements. EasyWinWin is maybe strongest in its support for decision-making. Briggs and Gruenbacher [7] assert that using the method will produce a shared

project vision, high-levels requirements definition, detailed requirements for features, functions and properties, and requirements for transitioning the developed system to the end-users. EasyWinWin has been used in about 50 projects [7].

Software Quality Function Deployment (SQFD) [29, 31, 32] is a variant of QFD [1, 24] meant for software development. QFD is a way of data gathering for customers needs, i.e. requirements elicitation, in a total quality management (TQM) project. TQM is a way to include the customer in development process, to improve product quality [68]. The emphasis of QFD is interaction with the customers of the product along the all phases of the design process [24, 68]. The emphasis in the QFD literature is in listening to the voice of customers [22], not in the specific techniques. Lately, researchers [29] have extended the reach of the method with a distributed Internet based software. Their main emphasis has been within team communication, but they have proposed of using GSS type discussion forums to elicit end-user requirements. The method takes a multilevel view to communicating stake-holder requirements and presents them as a "house of quality," the result of qualitative analysis of requirements data. It furthermore supports aggregating of these matrixes to larger ones. Herzwum et al. [30] have developed a 'software house of quality' that combines requirements and product functions into a matrix. It includes a prioritization of requirements for the whole project. SQFD is used in several firms, including German software developer SAP [28].

As table 1 suggests, each of these three methods provides support for four to five, but not the same ones, of the seven requirements that we have identified for RE for WAEUs. A method that could provide support for all seven requirements might be more effective for the development of systems that are intended to deliver innovative features

to external users. In the next section we propose a method to support all seven requirements.

The problem of techniques

As suggested by our review, many techniques have been developed for requirements elicitation. How can we determine the best characteristics for a method to support WAIS development?

IS Researchers have attempted to determine how best to select from among requirements elicitation techniques. Davis's [17] contingency model, revised by Fazlollahi and Tanniru [18], is one of the most well-known solutions. Davis [17] proposed a simple contingency model, based in part on prior research [2, 48], that included reducing uncertainty by using more complex methods if projects risks were higher. Mathianssen and Stage [47] extended this idea by proposing a way to explain the tradeoffs between different requirement elicitation techniques

In software engineering, the method selection problem has been addressed somewhat differently. Pohl [59] proposed three dimensions of RE: 1) *Specification,* dealing with the methods used to gather and organize requirements from stakeholders. 2) *Representation,* presenting the gathered requirements, using some form of either diagrammatical notation or natural language prose. 3) *Agreement,* dealing with the issue of reaching a common vision, or agreement on key system requirements and goals. Hickey and Davis [35] have extended the techniques selection discussion and used three dimensions of reach to divide techniques to different groups.

Peffers and Tuunanen [58] used media richness and synchronicity theories to identify important needs for information systems planning (ISP), i.e., to determine what systems to build and where to allocate resources in the organization. They operationalized six information processing needs for ISP:

1. **Multiple source data gathering:** gathering data from many sources within and around the organization about ideas for potential systems and features that might be important to convey a wide variety of different ideas to the planning process.
2. **Modeling reasoning:** simplifying information so that planners can understand why individual participants think that preferred systems or features might be important.
3. **Aggregated modeling:** meaningfully combining the ideas of many, so that planners and developers can make sense of it.
4. **Ideation:** translating aggregated preferences and reasoning about systems and features into feasible project ideas.
5. **Presentation:** putting the ideas into presentation forms that can be used effectively by decision makers and developers.
6. **Decision-making:** deciding which systems and features to build, using rich media and feedback to support deliberation and consensus-making behavior.

Comparing these six elements to Pohl's [59] three dimensions and Hickey and Davis [34, 35] reach ideas, we can see that there are some similarities, even though the domain differs and planning is generally thought to sequentially precede RE. Of course, there is good reason to think that this should be so, for ISP and RE are processes with very similar objectives, albeit at different levels of aggregation. The ISP activity involves

gathering data about a portfolio of application ideas to supply a decision making process about what systems to build. RE involves gathering ideas for system features so that managers and developers can reach decisions about what features and attributes a system should have.

This suggests that we can we extend these six elements of ISP to address the needs of RE for WAEUs. In table 2, we connect the information processing needs for ISP with requirements that we identified in the opening pages of this paper for a method that would be well suited for RE for WAEU.

Table 2 Information processing needs for ISP [58] compared with requirements for a method for RE for features and attributes of value to WAEUs that we identified here.

INFORMATION PROCESSING NEEDS FOR ISP	WAEU RE REQUIREMENTS
Multiple source data gathering.	*Context.* Data gathering method that does not require users to understand firm or technology.
	Reach. Data sufficiently rich so that interaction is not required. Data gathering economical
Modeling reasoning.	*Modeling.* Modeling user preferences and values flexibly.
Model aggregation.	*Model aggregation.* Aggregating user ideas quickly and flexibly
Presentation.	*Presentation.* Ability for developers to easily examine data at different levels of aggregation.
Ideation.	
Decision-making.	*Consensus making.* Supporting consensus reaching behavior.
	Requirements-design interface. Present models of new features and attributes in a semi-structured form useful for systems design.

The close match that we see in table 2 and the near conceptual identity between ISP and RE suggest, first, that that we might reasonably use the WAEU RE requirements that we have identified here as a basis to evaluate existing RE methods for use with

WAEUs and, second, that we might draw on ideas developed in [58] as the basis for a new method.

THE WARE METHOD

We developed the wide area requirements engineering (WARE) method to address the seven problems that we identified in the introduction for WAEU RE. WARE is an extension of critical success chains, a method that we developed to facilitate widespread participation in ISP, while keeping the focus on what is important in the firm. CSC allows for the economical incorporation of views from a variety of perspectives, such as suppliers, customers and others from in and around the firm. It provides a structured way to collect data from planning participants that helps the participants focus on what is important for the firm, a modeling language that doesn't impose restrictive assumptions on participant ideas, a flexible way to aggregate participant models, and a process to transform participant preferences and values into feasible ideas [55, 56, 58].

WARE applies CSC to RE and extends it so that it provides support for all seven WAEU RE requirements. It uses data gathering methods that don't require users to understand the firm, product line, or technology. It collects data that is sufficiently rich so that that a lack of user/designer interaction doesn't affect the quality of requirements elicitation. In addition the data collection process is economical. It provides for flexible modeling of user preferences and reasoning. It allows individual user models to be aggregated without restrictive assumptions. It provides for the presentation of aggregated user models in a semi-structured form, useful for systems design. It facilitates business/designer ideation to transform user preferences and values into feasible system

features. It supports consensus reaching behavior through post-ideation feedback and reporting.

To describe the details of the method and to demonstrate its efficacy, we tell the story of our use of it to develop the requirements for the Medianetti e-Ad Traffic and Ad Information System, Version 2.0 (META-IS) at *Helsingin Sanomat*.

APPLYING WARE TO UNDERSTAND USER REQUIREMENTS FOR THE E-AD TRAFFIC SYSTEM

Helsingin Sanomat (Helsinki) is the one of the biggest daily newspapers in the Nordic countries with a daily circulation of 430 thousand and more than one million daily readers. The newspaper claims that it is Finland's leading advertising media, with more than 400 thousand ads printed yearly. We were engaged by their business development team to develop the functional requirements for version two of the META-IS. The system allows customers to purchase and design display advertising for the daily newspaper, its *Nyt Weekly Supplement* and the associated *Monthly Magazine,* as well as to Oikotie its classified on-line service. It is targeted to serve five customer segments, including regular and infrequent small scale advertisers, medium scale advertisers, large scale advertisers, and the media and ad agencies, as well as internal organization users. Our task was to develop requirements for the second version of the system. The firm had almost completed development of the first release when they approached us, however, version one had not yet been released at the time of our study so no users had actually seen it.

Potential users for the system are thought to include tens of thousands of individuals. This presented us with an opportunity to address the needs of a system designed for use by WAEUs. The potential users for the system have diverse needs, many

are outside the organization, and many, especially those characterized as infrequent advertisers, may have little historical relationship with the firm, the products, or the technology. For these users, a substantial portion of the value of the firm's product might be embedded in the system, particularly if the system becomes their primary interface with the firm, which the firm considered a desirable potential outcome.

Data gathering and Modeling

We began the data gathering process by identifying project participants. We wanted to interview about 30 people for this project because earlier RE research suggested that a sample of that size is sufficient to gather 90% or more of the potential ideas about a concept from a population [22]. We also wanted our sample to be representative of the five customer segments for the system that were identified by the firm and to include potential "lead users," i.e., users who are likely to be willing to quickly embrace new features and systems [63, 64, 75]. To that end we selected a sample of outside customers and inside users nominated by the firm and distributed among the user segments as shown in table 3.

Table 3 Participant sample

Regular small scale advertisers	5
Irregular small scale advertisers	4
Medium scale advertisers	5
Large scale advertisers	5
Users from within HS	5
Media and ad agency users	6

Table 4 Sample demographics

GENDER	AGE	MARITAL STATUS	EDUCATION	PROFESSIONAL STATUS
Men: 60%	25-34: 23 %	Married: 40 %	< baccalaureate: 60%	Professional: 33%
Women: 40%	35-45: 57%	Not Married: 60%	Baccalaureate: 17%	Managerial: 40%
	>45: 20 %		Post graduate: 23%	Executive: 17%
				Entrepreneur: 20%

The project steering committee for META-IS Version 2.0 had done some preliminary analysis as part of the project feasibility study. They were able to provide us with a list of seven key areas in which they anticipated focusing revisions for Version 2.0. This list is shown in table 5. We used this list to provide stimuli in our interviews with participants.

Table 5 Stimuli list provided by the client

1. Customer portfolio
2. Request for free space
3. Campaign planning
4. Solution configuration
5. Filing ads
6. Preparing picture ads
7. Advertising Archive

We interviewed each of the participants individually and in-person. During the interviews, the interviewer made digital audio recordings and took notes in an electronic spreadsheet. The interviews were structured, using the laddering method [55, 56] developed for CSC. Participants were presented with a list of the stimuli and asked to rank order them in terms of their importance to them. Then, one at a time, for the two highest ranked stimuli, the interviewer asked the participant to describe a feature that would be important to him/her. He then asked "why would that be important to you?" to elicit consequences that the participant expected from the feature. He continued with a series of "why would that be important?" questions to elicit a chain of consequences the

participant expected to result from the feature and values or objectives that were furthered by the feature. To elicit more concrete system attributes, he asked the participant a series of questions about "what would there be about the system that would make you think that it would do that?" This data was recorded in the notes as a series of chains.

An example chain is shown in table 6. This participant was an "infrequent, small scale user." The chain resulted from participant responses to the "customer portfolio" stimulus, i.e., was related to potential features relating to the maintenance of a portfolio of information in the system about the customer. Items near the top of the chain describe specific attributes or features of the system that the participant wants, e.g., the ability to link online directly with the advertiser's contact person in the firm. Items in the middle refer to consequences the participant expected, e.g., being able to briefly discuss something with the contact person. Items near the bottom refer to values or objectives that the participant expected to be affected by the feature, e.g., satisfaction from getting personal service from the firm through the system.

Table 6 Example chain collected from participant interview.

Interview 12, Chain 6	
Participant segment	Infrequent, small scale user
Stimulus	Customer portfolio
Attributes	I could check out own reservations
	You would get a notification of your own reservations → Branch to Chain 7
	It would remind me to confirm advance reservations
Consequences	I could get a notification
	I could conform or cancel through it
	Within limits of working time
	It would free my assistants' memory capacity to something else
Values/goals	use of time

The 30 interviews resulted in the collection of 244 individual chains of data, an average of 8.13 per participant, containing 2566 individual statements. The quantity of data collected per participant compares favorably to that of other studies using laddering for strategic IS planning, e.g., approximately twice as many chains and statements per person as in [56]. This suggests that the method was well received by participants, and supports earlier suggestions by Browne and Rogich [10], echoed by Chiu [14], that laddering is a very suitable data gathering method for RE.

Model Aggregation and Presentation

244 chains containing 2566 distinct statements would be difficult, if not impossible, for decision makers and designers to interpret directly. It was important to aggregate this data to produce a meaningful, but smaller, set of rich, unified aggregated models that managers and designers could grasp.

Interview participants express their preferences and reasoning, using unique language. In prior studies, for example [55, 56], the first step in aggregating the models was to cluster statements with similar meaning, but different language, so as to give them common labels, then to use quantitative clustering to cluster the statements into approximately 5-10 clusters, and finally to use the clusters to create graphical network models. In this study we wanted to preserve the integrity of the individual chains because they represented the reasoning of each individual or "the voice of the customer" [22]. To accomplish this we devised a method to cluster the chains qualitatively into *themes* without breaking them up, i.e., without clustering some of the individual statements from a particular chain into different clusters.

The objective was to create the top layer aggregated representation of participant models, CSC maps [55, 56, 57]. In an all day session, two of the authors discussed the 244 chains and agreed that five conceptual themes could capture all of the chains. They were: 1) Agility of Real Time, 2) Budget Management, 3) Ad Creative Work, 4) Research-Campaign Planning, and 5) Communication. The themes represent different kinds of user needs. The two researchers worked independently to sort the 244 chains into the themes, with an initial agreement of 68%, and then went through the chains together to resolve differences by consensus. Later, a third analyst independently created themes and sorted the chains, agreeing with the consensus sorting in 62% of the cases. Given the complexity of the data (2566 statements and 244 clusters) and of the two-step clustering scheme (independently creating categories and sorting), we considered this to indicate a satisfactory level of reliability.

Next we created CSC maps by transforming the chains clustered into each theme into a network map. These maps contained features (attributes) and reasons why customers saw them necessary or interesting (consequences) and finally goals or values driving the customers. Next, the analysts examined the chains in each of the themes to determine, interpretively, what *subthemes* could be found in them. These were recognized by consensus. Finally, they developed graphical network models or critical success chains (CSC) maps through rounds of sketches.

These CSC maps were implemented as the top level in a three dimensional electronic spreadsheet-based presentation tool that included links to allow the user to drill down from a CSC map to the chains from which it was constructed and further down to

listen to the original data collection, i.e., recorded segments of the original participant statements.

One such model is shown in figure 1. It describes the Agility of Real Time theme. On the left, the drawing refers to system attributes suggested by participants. Attribute consequences are shown in the center. Linked participant goals and values are shown on the right. The themes are subdivided into two levels of subthemes, for example, in the "agility of real time" theme, "immediate feedback" is a higher level subtheme and "order confirmation" is a second level subtheme or "feature." The first level subthemes are linked by lines to indicate links among attributes, consequences, and values that were found in the original chains collected from participants.

Each subtheme is annotated with links, e.g., "R52," to selected key statements shown in the context of their original chains. This is the second level in the presentation tool. Figure 2 shows an example of one chain from the Agility of Real Time theme. From this chain a user can click on selected key statements to hear digital audio recordings of original participant statements, from the data collection interview, the tool's third level.

The high level network models, individual chains, and audio recordings were implemented together in an electronic spreadsheet and packaged on a DVD for use by decision makers and designers. The finished presentation tool contained 824 MB of data.

In the next section we describe how we used this presentation tool to facilitate consensus reaching activities by managers and designers

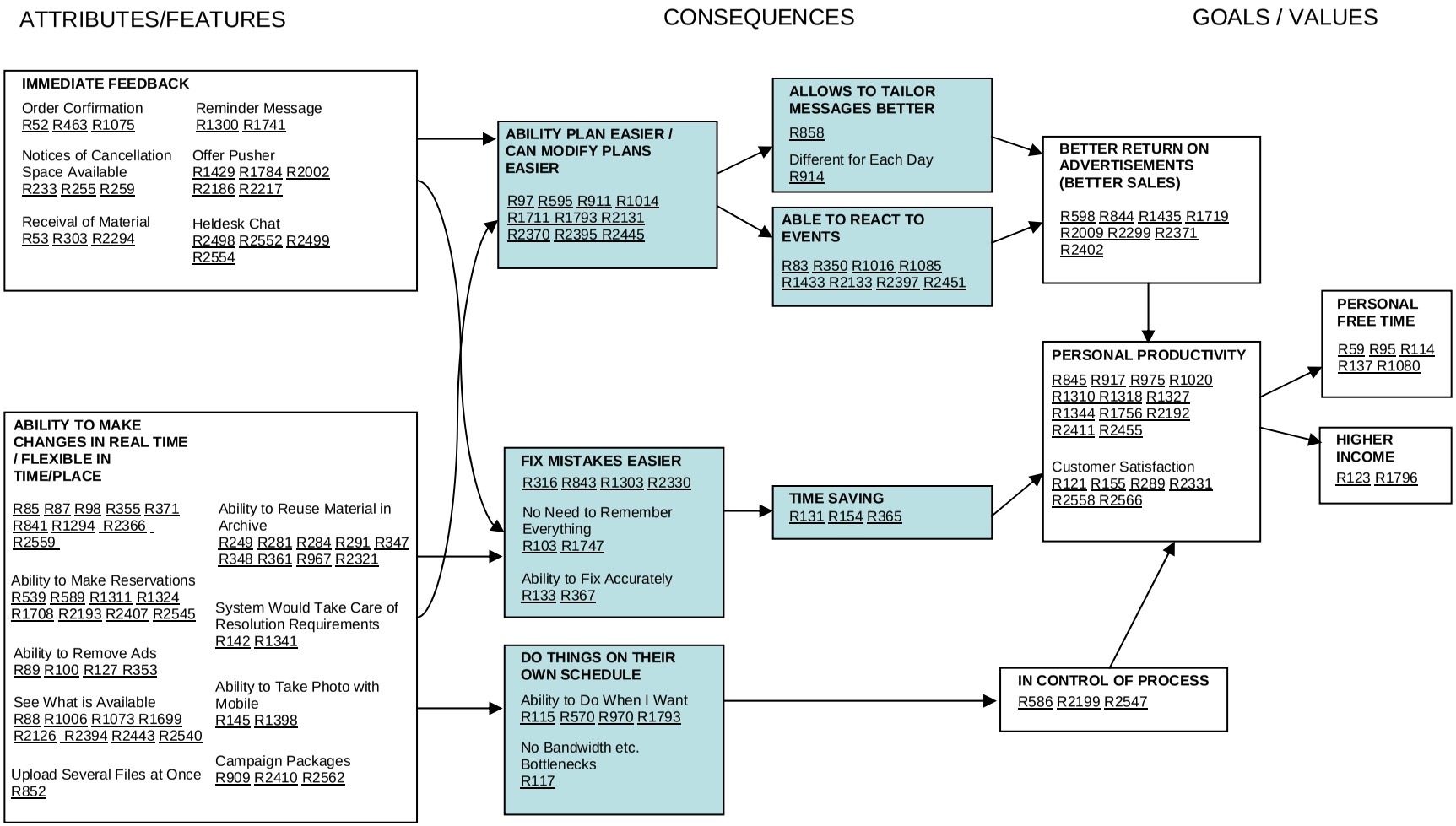

Figure 1 The presentation tool, top level. CSC map of the "agility of real time" theme, showing first and second level subthemes and links among first level subthemes. Unshaded boxes on the left refer to attributes and features, shaded boxes refer to consequences, and unshaded boxes on the right refer to values and goals.

2.request for free space			2.request for free space		
Chain 6		0:28:05	Chain 7		0:29:50
1		Agility of Real Time	1		Agility of Real Time
	R1073	I could check out own reservations		---------	----------
	R1074	C1 you would get a notification of your own reservations		R1081	C1 if you ask some information in meeting
	R1075	it would remind me to confirm advance reservations		R1082	otherwise I don't see any value in it
	R1076	I could get a notification		R1083	to be able to answer questions
	R1077	I could conform or cancel through it		R1084	bring in additional information
	R1078	within limits of working time		R1085	is it possible
	R1079	It would free assistents memory capasity to something else		R1086	transparency
	R1080	use of time		R1087	it would not interrupt
				R1088	it would not disturb others

Figure 2 The presentation tool, second level. A typical chain detail from the "agility of real time" theme. Unshaded rows near top refer to preferred attributes and features. Shaded rows refer to consequences. Unshaded rows near bottom refer to user values and goals.

Understanding and consensus-reaching activities

We used the presentation tool to facilitate consensus reaching activities that included a manager/developer workshop and a post-elicitation user survey. Our objectives included presenting the tool to managers and developers, so that they understood how it was an expression of customer preferences and reasoning [22], training them in its use, so that they understood how to use it to obtain rich information [15, 18], and measuring the importance or value of the requirements that we had elicited from the user participants.

Workshop

The workshop was held on a single day in March 2003. Workshop participants included both managers and developers, including the project manager for project development, marketing director, a developer, system manager, business development manager, and the META-IS project manager.

The workshop program led with a survey of workshop participants, in which they were asked to list features that they thought the new system should have. Our objective was to help the participants get into the spirit of the workshop and to focus their thoughts the second release, rather than the first one, the release of which was imminent, with the usual last minute attention that that requires. In addition we wanted to differentiate new ideas developed from ideas that were already considered by the group. The results of the survey showed us that the workshop participants had already done a considerable amount of thinking about the requirements. The survey revealed a total of 117 features in total for the seven initial stimuli presented above in table 5.

Next, to help workshop participants understand the tool and become familiar with it, we presented the tool and gave them tasks to complete. Starting slowly initially, the participants soon grasped the idea of the tool and could work quickly.

At the end of the workshop, participants completed we surveyed the participants about their views of the workshop usefulness and the features presented in the tool. The results, shown in table 7, suggest that the workshop participants were well satisfied that they now understood the goals of the customers as presented in the presentation tool. Although they didn't think that the presentation tool showed them very many new ideas, they thought it was quite useful. Specific participant feedback helped to explain this. One participant wrote that "the workshop showed us that we are going to the right direction and it helped us to formulate the features better." Another expressed her happiness at being able to do something and said that the tool provided an easy and expressive way to describe and analyze the requirements. In general the participants seemed very happy with the richness and interactive design of the presentation tool.

Table 7 Summary results of post-workshop survey.

Question	Mean response
Now afterwards workshop do you understand the goals of the customers described in maps (1-5)?	1.80 (very well – well)
Did new ideas rise up during the workshop (1-5)?	3.80 (some – not many new ideas)
Was the workshop useful in your opinion? (1-5)?	1.40 (very useful – useful)

Requirements validation with a survey questionnaire

The data collection, analysis and presentation tool that we developed provided managers and developers with rich information about customer preferences and reasoning, but we couldn't use it to say much about the relative importance of ideas that we had gathered. None of the data or analysis served well for this purpose. Our next task was to conduct a post-elicitation survey of potential customers to determine the relative value of the requirements items that we had acquired and, secondarily, to validate the collected data.

We conducted the post-elicitation survey, using an independent sample of 33 people, identified by the firm and distributed as shown in table 8. A copy of the survey instrument can be seen in appendix 1. We contacted each survey participant by telephone and then three times by email. This resulted in 24 survey answers with one partially completed answer (73% response rate). We paid each of the participants an incentive of 50€ either as a gift certificate or as a charity donation in their name.

Table 8 Sample distribution for post-elicitation survey.

Regular small scale advertisers	4
Irregular small scale advertisers	4
Medium scale advertisers	4
Large scale advertisers	5
Media and ad agency	6

The results of the survey are summarized in tables 9 and 10, which was intended as part of a report to the managers and developers. Table 9 reports on the ten most valuable second level subthemes or "features," presented in descending order of value, according to the respondents, starting with the most valuable feature, "order

confirmation." The survey value score represents a weighted value, aggregated across the participants. It is a sum of weighted participant rankings, where a participant's highest ranked feature was awarded 10 points, the next highest 9 points, and so on. On the right, the (first level) subtheme, e.g., "immediate feedback" in the first item, is indicated. In addition, for each feature the table also reports on a summary of participant reasoning for wanting the feature and the first level theme, or MAP, to which it belongs. Table 10 lists 11 other features that were rated at least 10th on average by participants. Details of the ranking results appear in appendix 2.

Survey respondents also rated the five top level themes. The results are shown in table 11. The most important theme, or map, was clearly the Agility of Real Time followed by budget management and research-campaign planning in a near tie with each other.

Business report

Based on the results of our study, we made the following recommendations in a business report to the firm: Focus resources to develop features mentioned in the top ten features list (table 9) and in the top three themes (table 11). These are the features and themes most valued by the customers.

Table 9 Results of the post-elicitation survey.

RANK	FEATURE	DESCRIPTION REASONING	VALUE SCORE	SUB-THEME	THEME MAP
1.	Order confirmation	It makes it easier to make and modify plans, to react to events. This leaves me better in control of the process and that helps me get a better return on my advertising investments.	120	Immediate Feedback	Agility of Real Time
2.	Ability to make changes in real time / flexible in Time and place	I can fix mistakes or modify plans easier. I can react to events easier. I can save time by working anywhere. This helps me to get a better return on my advertising investment and it improves my own personal productivity.	80	Ability to make changes in real time	Agility of Real Time
3.	Receipt for submitted material	I can fix mistakes or modify plans easier. I can react to events easier. I can save time by working anywhere. This helps me to get a better return on my advertising investment and it improves my own personal productivity.	77	Immediate Feedback	Agility of Real Time
4.	Ability to remove ads	I can fix mistakes easier and I would be able to fix accurately specific ads and also campaigns. This would save time for me and would enable me to react to events. This helps me to get a better return on my advertising investment and it improves my own personal productivity.	67	Ability to make changes in real time	Agility of Real Time
5.	Reusing material and making repetitions	I would be able to reuse material stored in the personal archive and this would empower me to create ads easier but in the same time keep the consistency of style and content. This would mean better, faster and cheaper ad creation that would save money and in the same time enable me to do better creative campaigns.	47	Personal archive	Ad Creative Work
6.	Circulation, readership information etc.	I would like to know more about reach information in order to get more effective placement for my ads or for finding best value for my ads purchase. This would enable me to easier to evaluate campaign performance and would make possible for me to be more flexible and create better campaigns. These would all save my time and money.	44	Reach Information	Research-Campaign Planning
7.	Competitors' ads	I would like to see what my competitors are doing in advertising to have more knowledge of effective campaigns and get creative ideas. This would enable me to easier to evaluate campaign performance and would make possible for me to be more flexible and create better campaigns. These would all save my time and money.	43	Ad Library	Research-Campaign Planning
8.	Ability to make reservations	I would like to reserve advertising space on-line and in real time. This would enable me to do things on my own time. This would also able me to plan easier be more in control of the process and raise my personal productivity. This would in the end result higher income or more personal free time.	41	Ability to make changes in real time	Agility of Real Time
9.	Helpdesk Chat	I would not need to wait hours to receive an answer for a specific question and I could continue working. This would mean better personal productivity and customer satisfaction.	39	Immediate feedback	Agility of Real Time
10.	Who reads sections of newspaper	I would like to know more who is reading specific sections of the newspaper in order to get more effective placement for my ads or for finding best value for my ads purchase. This would enable me to easier to evaluate campaign performance and would make possible for me to be more flexible and create better campaigns. These would all save my time and money.	36	Reach Information	Research-Campaign Planning

Table 10 Additional features rated at least 10th on average by participants.	
Background information	Searchable by industry / company etc.
Ability to reuse material in archive	Searchable contact directory
Flexibility in pricing	Notices of cancellation space available
Automated tracking expenditure & usage and cost structure	Ability to see pricing possibilities
Tailored customer oriented information	Add link to company information in ad
WYSIWYG	

Table 11 Weighted total ratings, based on ratings by 33 participants, where themes were awarded 5 points when ranked 1st, 4 points when rated 2nd, etc.

Theme	Mean of inverted ranks
Agility of Real Time	40.6
Budget Management	21.4
Research-Campaign planning	20.4
Ad Creative Work	15.3
Communication	8.6

Application roadmap

Using the WARE presentation tool, the META-IS project team developed a feature release roadmap for META-IS that described features, priorities, and development schedules for the next three years. It called for the release of version 2.0 by February 2004, version 2.1 in fall 2004, version 2.2 in winter 2004-2005, and version 3.0 in late 2005. Almost all of the features included in the roadmap can be traced back to the study data; 42 of the 59 functional features were specifically recommended in the business report along with seven that came from other sources.

Client Feedback

According to the client the study helped them in several ways:

1. It clarified the focus of the project by identifying features that the customers valued.
2. It helped to justify the project to the steering committee, by providing strong evidence that the developers were responding to "the voice of the customer."
3. It provided priorities among features for development.

4. The results helped communication between business and technical people in the organization as the reports were referenced frequently in communications.
5. The drill down feature to listen to participants' voice recordings was used by technical staff involved in detailed design, who felt that it helped them acquire a deep intuitive feel for the user preferences.

DISCUSSION

Our use of WARE at *Helsingin Sanomat* to elicit requirements for META-IS was characterized by support for addressing all seven of the problems of RE for WAEU that we identified in the introduction above.

Context. WARE uses a two-step data gathering method that does not require the participant to have prior knowledge of a predecessor system, the firm, or the technology. Study participants respond to a stimulus that they have already identified as important to them and are consequently able to think of features and attributes, their potential consequences, and how these might affect their values relatively independently of the technology that might be used to implement them.

Reach. WARE provides information to managers and developers that is sufficiently rich the need to interact with participants is minimized. The DVD tool that we provided to the firm allows the user to drill down from the highest level aggregated model to individual participant chains and even further to observe the data collection event, in a sense, by listening to the relevant interview recording segment. The economy of the data collection effort also allows for sufficient number and diversity of participants. The cost of an additional participant is approximately one hour of participant and analyst time, plus incidental expenses.

Modeling. WARE permits the modeling of user preferences flexibly and without strong assumptions. The chains consist of user statements linked in one direction, represented here as to the right, to reasons and in the other direction, to the left, to attributes. The modeling process makes no assumptions about whether the links represent causality or some other kind of relationship, directionality, the possible existence of feedback, etc. Consequently, the modeling adapts well to any kind of user personal constructs.

Model aggregation. Model aggregation in WARE permits individual models to be quickly and flexibly aggregated across individuals. The analysts in this study used two stage interpretive clustering to aggregate user models using concepts that came from study of the individual participant chains. Like the individual modeling process, this procedure imposed no assumptions on model aggregation.

Presentation. WARE allows developers to see the data at various levels of aggregation, including high level aggregated models of themes and subthemes, as well as individual chains of participant reasoning. In addition, it allows the developer to "see" a view of the raw data in the form of digital audio segment recordings of participant statements. This helps the developer understand the users' views about what features and attributes they need.

Consensus making. In its use at *Helsingin Sanomat,* WARE supported consensus making through a three step process: (1) manager-developer workshop to discuss the gathered requirements and their presentation in the WARE tool, (2) a post-elicitation opinion survey, using an independent panel of participants, to establish the value or importance of the individual gathered requirements, and (3) a business report that

summarized the findings and made recommendations, and (4) the subsequent development of the application roadmap.

Requirements-design interface. As used at *Helsingin Sanomat,* WARE provided limited support for the implementation of the gathered requirements in the design phases of the project. The presentation tool presented the requirements to designers in a semi-structured form intended to (1) optimize the clarity of the preferred functionality by presenting several views of preferred attributes with reasoning and (2) present a logical structure for the preferences, by organizing the features into a hierarchical structure of subthemes and themes, aggregated models, and individual models.

CONCLUSIONS

This paper makes several contributions to the literature on requirements elicitation and requirements engineering.

1. It identifies seven problems for RE that are specific to systems intended for use by WAEUs, i.e., that are more important for requirements determination when the intended end users are WAEUs than when they are users within the organization.
2. It proposes objectives for a method that would address these problems.
3. It reviews RE, IS and manufacturing literature to determine how these problems have been addressed in the existing literature. It finds that they have been partially, but incompletely, addressed and that they have not hitherto been systematically addressed for the purpose of optimizing RE for such systems.
4. It proposes a method for systematically addressing these problems in a way that addresses all seven problems.

5. It demonstrates the practicality and efficacy of this new method in a case in which it is used to develop the features of a major innovative system for use by WAEUs.

Earlier in this paper we reviewed three RE methods that come close to addressing the seven identified problems, i.e., that each supported solutions for four or five of the seven problems. When compared with the three methods, WARE provides support for solutions to all seven of these problems. Consequently, we expect its use may contribute to better understood and better defined requirements for new systems.

The presentation tool is a major contribution of the new method. By presenting the requirements at several layers of aggregation, including high level maps of themes and subthemes, middle level individual chains of participant preferences and reasoning, and low level audio segments of participant interviews, the presentation tool became a communication device that helped to tie several parts of the development process together. Managers and technical developers used it as a reference point to help them communicate among themselves. Because requirements in the tool are described functionally, are well structured, and are explicitly tied to user reasoning, it was easy for everyone to understand and helped avoid manager—engineer miscommunication. Later, developers were able to use the priorities established in the post-elicitation survey to prioritize the requirements in the tool to develop an application release roadmap with clear release date targets. In the design phase, project team members used the features, along with the individual participant chains and the audio segments to clearly understand what the users were saying that they wanted and why.

Limitations and extensions of this research

We've identified several problems with RE for WAIS and have designed a method to address these problems. We've demonstrated that the method can be used effectively for its intended purpose. The present study doesn't and isn't intended, however, to make any claim that WARE is superior to any existing method. Any such claim would entail a different kind of study, i.e., a well designed empirical test. Such a test of such a complex phenomenon would be a major undertaking in itself. Traditionally planning and development methodologies are "tested" in practice and through subsequent case studies to extend and improve them. Sometimes this process takes decades, for example in the case of critical success factors [25, 62].

What we have accomplished in this study might be referred to as "design research [33]," in which an artifact is demonstrated to satisfy *proof-of-concept* demands. Having identified a problem, a solution to the problem, and demonstrating that the solution is fit for its intended purpose, is sufficient to make a research contribution, even without formal hypothesis testing. The positive feedback from our client and the successful use of our research output to produce a practical solution to the client's problems might be seen as evidence of the method's fitness for use.

That said, we should note about this issue that nothing in WARE prevents its use in combination with other methodologies. Indeed the best IS professionals freely use components from methodologies where appropriate. For example, it would not be surprising to find a team using focus groups to arrive at stimuli for WARE or for WARE analysis to be followed up with prototyping to further clarify the efficacy of a bundle of

features suggested by WARE participants. Alternately, IS developers might very practically reach into this case to pluck out one or more activities from WARE to augment another method [17, 34, 35, 47, 53, 66].

This project represents a first attempt to develop WARE. Our experience with this project leads us to believe that the method can be further improved. Users in the client firm suggested that the presentation tool, could be better designed, so that it requires less training to use. They also suggested that the top level CSC maps should be redesigned to make them more visually appealing and useful. The client firm consensus was that the presentation tool should be as intuitive and easy to use as popular office automation software suites. Certainly this represents an opportunity: as WARE matures, we think that there could be substantial value in a software product to support the method.

Earlier research to develop new methods for IS planning that used a WARE predecessor, critical success chains, included an ideation workshop, where business managers and technical professionals worked together to transform user application preferences and reasoning into ideas for feasible applications and application bundles. At that level of aggregation, support for ideation among competent professionals was clearly necessary because user preferences and reasons don't constitute feasible project ideas. At a much lower aggregation level, user ideas for functional features are already quite specific. We didn't include an ideation workshop in this case because we expected the resulting user ideas to already be sufficiently specific to be actionable and we wanted to avoid loading WARE with too many costly procedures at this first stage. In subsequent research we plan to incorporate an ideation feature to enhance the quality of the delivered attributes and features.

One concern of the authors and the client in this case is that the process didn't result in any really surprising or brilliant new feature ideas. Such ideas would, in themselves, have provided the process with a valuable *raison d'être*, however, they weren't necessary for the process to be valuable. *Helsingin Sanomat* managers and developers found the process sufficiently valuable as a means to identify, understand, communicate, prioritize, and justify new features for the system. While surprising features aren't necessary for successful RE, indeed the most important features of a new system may already be, if only vaguely, known, the ability of an RE method to capture hitherto unknown ideas would be valuable. We think that two WARE enhancements may improve the chances of such capture. The first is better identification of potential lead users. It is well known that a small percentage of potential end users are most likely to adopt a new innovation and to adapt it to their needs [63]. Such potential lead users are characterized by having more curiosity and propensity to accept risk. If we can select participants for our study who are more like Roger's lead users we may get more surprising ideas. In a subsequent project, the authors are prescreening potential user participants for their propensity to be lead users.

Another methodological enhancement that might help to provide surprising ideas is to increase the diversity of the interview stimuli. In the current project, the stimuli were provided by the firm. If the stimuli originated from the interview participants or from an independent panel of participants, the stimuli and thus the resulting ideas might be more diverse. In a subsequent study by the authors stimuli have been developed using an independent panel of participants facilitated by a decision support system.

A final area in which we would like to see enhancements is that of integrating the results of WARE with the design process of development. An effective integration solution would be one where the outputs from RE can be used directly in the system design process. Software engineers have indeed focused on this problem and the results of their efforts have lead to the development of CASE tools [65]and the like. Integration of RE and design, starting from the gathering of unstructured feature ideas, as in WARE, is more ambitious. Successful integration would be heartily welcomed in the RE community [7, 43]. In a subsequent project the authors are working to integrate the results of RE, in the presentation tool, directly into a CASE tool, so that the results more easily applicable by developers.

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APPENDIX 1. POST-ELICITATION SURVEY QUESTIONNAIRE

HELSINGIN SANOMAT SERVICES

1. How well e-advertising services of Helsingin Sanomat fit your needs?
[5=very well, 4=well, 3=modestly, 2=not very well, 1=not at all]
2. It is important for me that e-services of Helsingin Sanomat are tailored according to my our firm's needs.
[5=fits very well, 4=fits well, 3=fits modestly, 2=does not fit very well, 1=not at all]
3. It is easy to handle advertising issues with Helsingin Sanomat.
[5=fits very well, 4=fits well, 3=fits modestly, 2=does not fit very well, 1=not at all]

HELSINGIN SANOMAT AS DEVELOPER OF ADVERTISING SERVICES

4. Helsingin Sanomat notices customers in developing of advertising services
[5=very well, 4=well, 3=modestly, 2=not very well, 1=not at all]
5. I gain from participating in development work of Helsingin Sanomat's customer services
[5=very much, 4=some, 3=I do not know, 2=not very much, 1=not at all]
6. Helsingin Sanomat is an innovative developer of e-advertising services...
[5=fits very well, 4=fits well, 3=fits modestly, 2=does not fit very well, 1=not at all]
7. Helsingin Sanomat is a leading developer of of e-advertising services in Media field.
[5=fits very well, 4=fits well, 3=fits modestly, 2=does not fit very well, 1=not at all]
8. How many times have you participated in development of advertising services for Helsingin Sanomat excluding this survey?
[5=regularly, 4=several times (over 3 times), 3=sometimes (2-3 times), 2=once, 1=not ever]
9. How many times have you participated in development of advertising services for Helsingin Sanomat's competitors?
[5=regularly, 4=several times (over 3 times), 3=sometimes (2-3 times), 2=once, 1=not ever]

DEVELOPMENT OF MEDIANETTI

Please rank following features, 1=most important etc., within each sub group. After first round please rank 10 most interesting features for you from all choices.

AGILE AND REALTIME INFORMATION RECEIVAL
Immediate Feedback
  Order Confirmation
  Notices of Cancellation Space Available
  Receival of Material
  Reminder Message
  Offer Pusher
  Helpdesk Chat
Ability to Make Changes in Real Time / Flexible in Time/Place
  Ability to Make Changes in Real Time / Flexible in Time/Place
  Ability to Make Reservations
  Ability to Remove Ads
  See What is Available
  Ability to Reuse Material in Archive
  Campaign Packages
  Ability to Take Photo with Mobile
  System would take care of resolution requirements
  Upload several files at once
BUDGET MANAGEMENT
  Automated Tracking Expenditure & Usage and Cost Structure
  Dynamic Campaign Pricing
  Flexibility in Pricing.
  Ability to See Pricing Possibilities
  Last minute Ad Price Change Information
AD CREATIVE WORK
Personal Archive
  Reusing Material and Making Repetitions
  Thumbnails
  Searchable
  Sufficient Time (1 year)
  Customizable information attached to Ad
Wizard
  Templates
  Wizard - The System Would Guide Me
  Reminders How You Can Do It Better
  Technical information
  WYSIWYG
  Ability to try fonts, frames etc.
  Add link to company information (in ad)
RESEARCH-CAMPAIGN PLANNING
Customer Database History
  Tailored Customer Oriented Information
  Ability to See Past Campaigns
Reach Information
  Circulation, Readership etc.
  Who reads sections of newspaper
  Background Information
  Wizard to Suggest Placement
  Industry History
  Media uses
Ad Library
  Competitors' ads
  International ads
  Searchable by Industry / company etc
Media Selection Advice
  Information / Warnings
  Knowledge How to Use Specific Media
  Reservation Situation / Queue Status Information
COMMUNICATION
  Searchable Contact Directory
  Direct Call Links via WAP
  Customer Gatherings etc.
  Trend Information
  Standard Package / Rate Offers - Tailored Messages
  Approval of Ads Internally
  Terminology Information to End-customers.

APPENDIX 2 PARTICIPANT VALUE SCORES FOR ALL FEATURES

Cumulative value ranking for features by 30 participants, where the top ranked feature from a participant received 10 points, the 2nd received 9 points, and so on. Please note that when mean value of a feature falls below 1.00 it means that the feature was, on average, not ranked in the top 10. In addition the survey question is indicated as well as theme name.

Feature	Theme Map	Sum	Mean	Std. Dev.
Order confirmation	Agility of Real Time	120	5.00	4.718
Ability to make changes in real time / flexible in time & place	Agility of Real Time	80	3.33	3.964
Receival of Material	Agility of Real Time	77	3.21	4.303
Ability to remove ads	Agility of Real Time	67	2.79	3.551
Reusing material and making repetitions	Ad Creative Work	47	1.96	3.355
Circulation, readership etc.	Research-Campaign Planning	44	1.83	3.171
Competitors' ads	Research-Campaign Planning	43	1.79	3.007
Ability to make reservations	Agility of Real Time	41	1.71	2.971
Helpdesk Chat	Agility of Real Time	39	1.62	3.716
Who reads sections of newspaper	Research-Campaign Planning	36	1.50	2.904
See what is available	Agility of Real Time	34	1.42	2.483
Background information	Research-Campaign Planning	34	1.42	2.858
Ability to reuse material in archive	Agility of Real Time	33	1.38	2.428
Flexibility in pricing	Budget Management	33	1.38	3.160
Automated Tracking Expenditure & Usage and Cost structure	Budget Management	32	1.33	2.884
Tailored customer oriented information	Research-Campaign Planning	31	1.29	2.596
WYSIWYG	Ad Creative Work	31	1.29	2.758
Searchable by industry / company etc.	Research-Campaign Planning	30	1.25	2.707
Searchable contact directory	Communication	28	1.17	2.531
Notices of cancellation space available	Agility of Real Time	26	1.08	2.701
Ability to see pricing possibilities	Budget Management	26	1.08	2.685
Add link to company information (in ad)	Ad Creative Work	24	1.00	2.187
System would take care of resolution requirements	Agility of Real Time	23	0.96	2.095
Offer pusher	Agility of Real Time	22	0.92	2.263
Reminder Message	Agility of Real Time	21	0.87	2.383
Technical information	Ad Creative Work	20	0.83	2.531
Approval of ads internally	Communication	20	0.83	2.036
Searchable [personal archive]	Ad Creative Work	18	0.75	1.962
Last minute ad price change information	Budget Management	16	0.67	2.180
Information / warnings	Research-Campaign Planning	14	0.58	1.381
Templates Ad Creative Work		13	0.54	1.318
Reservation situation / Queue status information	Research-Campaign Planning	13	0.54	1.474
Sufficient time [archive]	Ad Creative Work	12	0.50	1.719

International ads	Research-Campaign Planning	12	0.50	1.794
Wizard to suggest placement	Research-Campaign Planning	12	0.50	1.719
Ability to take photo with mobile	Agility of Real Time	12	0.50	1.719
Reminders how you can do it better	Ad Creative Work	10	0.42	1.530
Campaign packages	Agility of Real Time	8	0.33	1.090
Industry history	Research-Campaign Planning	7	0.29	1.233
Ability to see past campaigns	Research-Campaign Planning	6	0.25	.847
Direct call links via WAP	Communication	6	0.25	.897
Upload several files at once	Agility of Real Time	6	0.25	1.225
Knowledge how to use specific media	Research-Campaign Planning	4	0.17	0.565
Wizard – The system would guide me	Ad Creative Work	4	0.17	0.816
Standard package / rate offers – tailored messages	Communication	4	0.17	0.565
Ability to try fonts, frames etc.	Ad Creative Work	4	0.17	0.816
Trend information	Communication	2	0.08	0.282
Media uses	Research-Campaign Planning	0	0.00	0.000
Customizable information attached to ad	Ad Creative Work	0	0.00	0.000
Thumbnails [of ads]	Ad Creative Work	0	0.00	0.000
Terminology information to end-users	Communication	0	0.00	0.000
Customer gatherings [information]	Communication	0	0.00	0.000
Dynamic Campaign pricing	Budget Management	0	0.00	0.000

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Working Papers on Information Systems | ISSN 1535-6078

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