Evaluation of the UCD-LSI Method

- the iPeople Case Study-

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***Abstract*— Based on our analysis in a systematic mapping study, there is no method to enhance user-developer communication in the design and implementation phase of large-scale IT projects. We therefore defined the UDC-LSI method. It is substantial especially for newly designed methods to evaluate them within a real-world context. We study the utility (i.e. feasibility, effectiveness and efficiency) and usability (i.e. acceptance) of the UDC-LSI method, by validating the method in a real-world practical context retrospectively. Therefore, we analyze the as-is status of the iPeople project. Based on that we simulated an instantiation of the UDC-LSI method for the iPeople project and we evaluate this instantiation with project participants. We conducted a case study based on the guidelines of Runeson. The adaptation of the UDC-LSI method in the iPeople project showed that it is possible to instantiate the method for the project under study and revealed the important for a project-specific application of the method. The evaluation showed a positive effect of the UDC-LSI method on system success (effectiveness). Furthermore, the project participants confirmed the feasibility of the method, showed a high acceptance of the method and confirmed a positive effort-benefit ratio (efficiency).**

***Index Terms*— User-Developer Communication, User Participation, User Involvement, Case Study**

I. Introduction

The overall share of empirical studies in computer science is still small. However, according to [1] a method "must be evaluated with respect to the utility provided for the class of problems addressed." Therefore this paper reports on a case study aiming to study the utility and usability of the UDC-LSI method, by validating the method in a real-world practical context retrospectively. To our best knowledge there is no method that targets large-scale IT projects and has the goal to improve user-developer communication (UDC) in the design and implementation phase with the intention to improve system success. Thus, we designed the UDC-LSI method and wanted to find out what effects a concrete instantiation of the method in a real-world large-scale IT project would have. Therefore we conduct a case study in the iPeople project. We analyze the as-is status of the project with regard to the current development process, established communication structures, revolving issues and user-relevant decisions. The analysis show that there are issue in the development process and in the current communication structures with the end user. Thus an improvement of the UDC process is useful for the iPeople project. Since the iPeople project is the "oldest" project in the company, later developed, successful processes from the company are not used within this project. Thus a project specific adaptation of the UDC-LSI method is required. We also identified 18 user-relevant decisions, this is an indication that there are topics and decisions that should be discussed with end users. The system success assessment is heterogeneous, as we asked different roles and participants with different experience levels. However, the average assessment is medium for all system success aspects, thus there is room for improvement with regards to system success of the iPeople application. Building on that, we simulated an instantiation of the UDC-LSI method for the iPeople project based on detailed process descriptions and practical examples. Furthermore, we evaluate this instantiation with project participants with regard to utility and usability. This paper is structured as follows. We first present the case study design with the research questions, case selection and the research method. Afterwards, we describe the simulated instantiation and show and discuss the results of the evaluation. We then discuss the threads to validity and conclude with a summary of the case study.

II. Case Study Design

We designed and conducted case study according to instructions from Runeson [2]. The conducted case study can be categorized as a *single case study with one unit of analysis*: The *iPeople project.* The *object of study* in this case study is the *UDC-LSI method*. [1] states that the utility, quality, and efficiency of a design artifact must be rigorously demonstrated via well-executed evaluation methods. Thus it is essential for newly proposed methods to study utility (i.e. feasibility, effectiveness and efficiency) and usability (i.e. acceptance of the users) in a real world context. The retrospective validation of the UDC-LSI method was executed in a large-scale project of a software company that mainly focuses on development of mobile business apps.

We therefore raise the following research questions:

- RQ 1: Is it feasible to implement the UDC-LSI method in the unit of analysis?

The hypothesis H1 is, that the project participants consider is feasible to implement the UDC-LSI method in the project.

- RQ 2: Does an implementation of the UDC-LSI method increase system success?

The hypothesis H2 is that the application of the UDC-LSI method has positive effect on system success.

- RQ 3: Is the effort of executing the method worthwhile its value?

The hypothesis H3 is that the benefits of applying the UDC-LSI method outbalance the effort.

• RQ 4: How usable is the UDC-LSI method?

The hypothesis H4 is, that the project participants think the UDC-LSI method is usable.

The UDC-LSI method is defined for large-scale IT project and its purpose is to increase system success through the increase of UDC in the design and implementation phase. Thus, we need to identify a large scale-IT project with issues in UDC.

The *case company* sovanta AG is a strongly growing firm with currently about 60 employees. *The iPeople project* had an effort of about 750 person days, the amount of end users is 4500, the project run time is 2 years plus 10 month, there are many releases and the app has been rolled out in 28 countries.

The main purpose of the iPeople Business Application is to support managers in the personnel management. Thus it present Human Resource (HR) Key Performance Indicators (KPIs) to sales managers that meet monthly with their assigned branch managers. The *project stakeholders* are the business and IT side. The business side is mainly represented by one project manager from the customer. Each country has a key user for the iPeople system. Unfortunately, we only had access to the IT personnel, but not to the business side within the case study. The IT personnel are the project sponsor and project manager, six developer, and one UI/UX designer. The project fulfills the criteria (large amount of users, rollout in multiple countries, and project duration more than a year) of our definition of a large-scale IT project. The project is a customer-specific software development project, using a flexible, agile-like development, thus does not use traditional methods. However, there are issues in UDC, i.e. in the communication with the customer PM and key users. We believe that the described context is suitable to use for a case study context.

As suggested we use a mixed method approach with different data sources, i.e. archival data, interviews, attendance of meetings, and workshop sessions. It is important to use several data sources to limit the effect of only interpreting data from one data source. We therefore use data source triangulation, as well as methodological triangulation by combining qualitative methods (e.g. answers to open questions in interviews) and quantitative methods (e.g. questionnaires on Likert scales). Furthermore we take into account viewpoints of different roles. In particular, we used a formal and fully structured interviews with closed questionnaire to get objective and comparable answers for the evaluation of the UDC-LSI method. The qualitative data from open questions are summarized in categories [2]. Based on the results of the as-is study, we instantiated the UDC-LSI method for the iPeople project. We identified different user-relevant decision for discussion with the end users. First there are "design decisions" based on the requirements of the end users that have to be discussed in the design phase. Second, there are decisions to be discussed with the end users in the implementation phase. Both differ in the documentation and communication needs. Therefore, we present the adaptation process in two parts one for the design and one for the implementation phase. We build upon our proposed UDC-LSI method. For the evaluation part we conducted nine fully structured interviews with project participants. As suggested by [2], we included different roles. As suggested by [2], we mixed open and closed questions. The nine interviews were done in person. Eight interviews were done in German, one in English. After the presentation of the process and the example for each phase (design and implementation), we assessed the project participants' opinion. We mainly used closed questionnaires with Likert scale to ensure objectivity and comparability of the results. To ensure the right interpretation, we also included rationales and open questions. For data analysis we recorded all interviews and transcribed the open questions. The answers of the open questions, are translated into English and are summarized by counting similar answers. In total we recorded 737 min of interview time. In order to ensure a differentiate view of the project participants, we separated the method instantiation in four parts for documentation, communication and the design an implementation for our assessment .

III. Applying the UDC-LSI Method to Practice

Methods define processes, which can be textual description [1]. We therefore instantiated the UDC-LSI method through two detailed process descriptions and a corresponding practical example of the iPeople project. We evaluate each subtask (see figure 1), and exiting processes and tools that are already used within the company. We then present the simulated instantiation solution for the design and implementation phase.

Element 1 – Set up of Communication Structures with End User Representatives comprises three subtasks. The first subtask is to "define representatives for each 'class' of end users", where a stakeholder analysis is suggested. Theoretically there are four roles in 28 countries, which means ideally user representatives would be required for each role and country. However, we conducted a mapping of the usage profiles of all features by roles based on the iPeople product description. This mapping revealed that most features differ only little between roles. Therefore we decided that the already existing key user per country are suitable user representatives. The second subtask is to "map user requirements to one or more end user representatives", to ensure discussion of requirements/feature with the right user representative. Since we do not differentiate between different roles, it is not required to map the user requirements to the different user representatives. The last subtask of element one is to "define notification preferences with the end user representatives". Since we did not have direct access to the end users, we were not able to ask them about their notification preferences. Nevertheless, we define explicit triggers, where input is needed. Therefore we believe that the key user with their role to spread the iPeople solution within their countries, are interested in all user-relevant decision of the project.

Element 2 – Training of Developers on the Capturing of Decisions and Changes comprises four subtasks. The first subtask is to "develop a change story, incl. trigger points", which means to explain typical decisions of trigger points and examples. Since we build upon existing processes and tools it is not required to train the developers in detail. Within the evaluation the acceptance in particular the perceived ease of use of the method from the developers is high (see section IV).

In case of an implementation of the UDC-LSI method in the project, we believe a meeting with the project participants to

explain them the new processes will be sufficient. The second subtask is to "develop a format for capturing of decisions", we studied the existing processes throughout the company, and especially for the design process communicating design decisions via mockups/wireframes is already established.

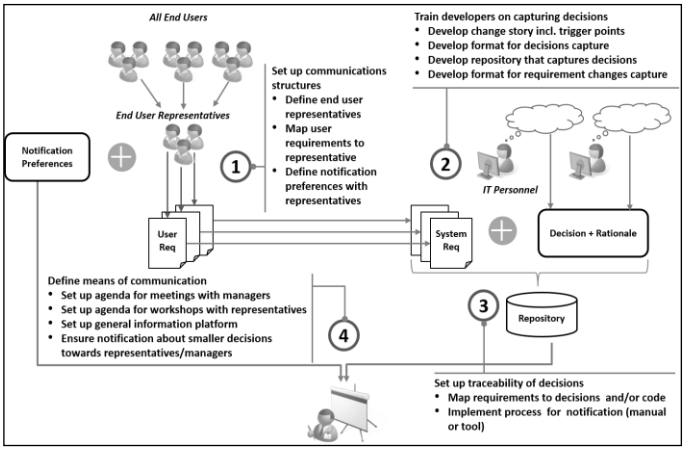

Fig. 3. UDC-LSI Method

The central project management tool during development is the JIRA tool holding all the relevant documents. In particular each requirement and feature is represented in a ticket in JIRA. The third subtask is to "define a format for changes in requirements". We observed that changes in requirements, occur mainly within the design phase, in the implementation phase, there are more detailed decision required. We suggest as pragmatic solution for the scribble doc, which is just to highlight changes with formatting the new parts (bold, italic). For the implementation phase, we suggest to record the results within JIRA tickets. The final subtask of element two is to "build up repository for decisions". Since the process differ in the design and implementation, we chose two different tools. For the design phase the scribble doc is the tool, whereas within the implementation phase, we use the standard project management tool, as IT personnel uses JIRA during development anyway. We suggest to document the results either in an updated version of the scribble doc or in JIRA. Nevertheless, it is possible to do a report of JIRA and send that around as meeting minutes.

Element 3 – Set up of the Traceability of Decisions has only two subtask. The first subtask is to "map each decision and change to a requirement", which differs for the phases design and implementation. In design mapping is done by guiding end user through wireframes, i.e. conceptualization of a requirement. Thus a mapping from requirement to feature is done implicitly. Each feature gets an ID in the scribble doc and a wireframe/mockup and the data definition describe the feature. In the implementation phase, we reuse the scribble doc ID to enable a communication based on visual representations towards the end users. The second subtask is to "implement the notification process for end users". Currently, there is no communication about design decisions with end user. For the design phase, we use already used process from the case company with two workshops to discuss and align the concept with end users. During implementation phase, we replace the ad-hoc communication with customer PM, by a structures two level process. For both phases we defined trigger. We use the existing project management structures in the IT personnel and the customer to support communication and documentation.

Element 4 – Definition of the Means of Communication has three subtask. The first subtask is to "set up a fixed agenda for meetings with managers". Currently, there is one monthly manager meeting, however when we analyzed typical user-relevant decisions of the iPeople project, most did not need that escalation level. Therefore, we do not suggest manager meetings for the iPeople project. However, in case of an escalation this meeting can still be used. The second subtask is to "have workshops with the end user representatives". There is no communication towards end user, but IT personnel is interested to get end user feedback. Furthermore, the as-is analysis showed a clear need to increase user–developer communication. Since the workshop concept is already used in other project of the company, we suggest to reuse that concept. Currently these workshops are done only by designers. However, we believe that is important to include all roles. The last subtask of the method is "setting up a general information platform". This element has not explicitly instantiate within the iPeople project, however both suggested repositories (scribble doc and the JIRA tool), can be used to circulate between all end users. To give a complete overview of the instantiation, we combined all adaptation decisions in Table II. Methods define processes and the process provide guidance on how to solve problems. These textual descriptions of the new processes are describe in the following for the design and implementation phase (see Figure 2).

Design phase. The new process at the beginning of the design phase starts when the IT personnel receives the requirements list of the customer PM. The first step D1a is to create a user interface (UI) concept, which means the design how the new requirement will be included in the existing application. These decisions are captured in wireframes for completely new requirements or in mockups for features that are included in existing UIs. In parallel there is step D1b, in which the developers assess the technical implementation of the feature. The results of the assessment is captured in data definitions. The following step D2 is to combine the wireframes or mockups with a content and data description in the scribble doc. Step D3 is to discuss the first version of the scribble doc with the 28 key users. Within this first workshop all requirements/features are presented through wireframes/ mockups including the content description and the data definition. There is a direct discussion with the IT personnel and the end users to align the current understanding and ensure to know the rationale and use cases for each feature. Step D4 is to update the scribble doc with the new information gained in the workshop. The result is the scribble doc 2.0. After the new description of all features, there is a second workshop with the 28 key users to agree on that concept and sign off the scope of this release or hotfix. After the sign off the estimate for effort are fixed.

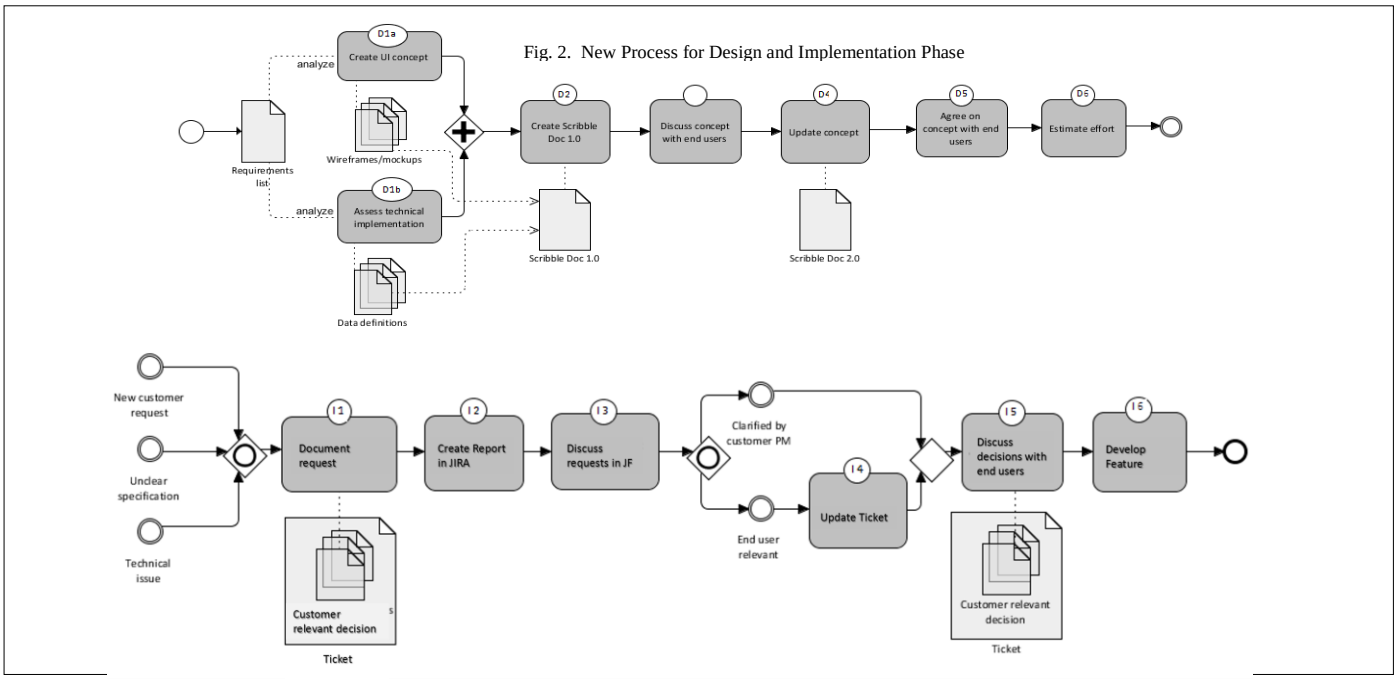

Fig. 2. New Process for Design and Implementation Phase

Implementation phase. During development three different events can occur: a new customer request from the customer PM is formulated, an unclear specification issue requires a decision, and a technical issue requires information from the customer. If one of these three events happens step I1 is to document the request in the new field "customer-relevant decision" within a JIRA ticket. The structure of the documentation is a questions, alternatives and implications of the alternatives. Step I2 is to prepare each weekly jour fixe with the customer PM. Therefore, the IT PM creates a report of all entries within the field customer relevant decisions of the iPeople project. As a first level, all requests from the report are discussed in the jour fixe with the customer PM and classified with the IT PM, designer and developers. In the discussion it is decided, whether the request can be clarified by the customer PM or should be discussed with the end user (step I3). Request that are clarified by customer PM, will be directly updated in JIRA. End user-relevant decisions will be collected. If there are about five user-relevant decisions or defined period of time (e.g., four weeks), a workshop with four to five selected key users takes place (step I4). The IT personnel presents the required decisions in the format question, alternatives, implications and includes the affected feature with a visual indication. In a joint discussion of the IT personnel with the end users a decision of an alternative is felt. Step I5 is to update the field customer-relevant decision in JIRA with the felt decision. The last step I 6, is to continue the development of the feature. In order to describe the instantiation as detailed as possible we extracted an example for each process.

Example Design Phase – Inactive employees

In the current iPeople solution, only active employees are displayed in the organizational tiles. The example is about the extension to also display inactive employees. The initial requirement from the first document is:

As-is state: Currently only employees with the employment state 3 = active are displayed in iPeople.

Target state: In the future all employees that have a data record in the table IT9006 should be displayed in the iPeople solution

It is obvious that this description is on one hand very specific, as a source (data base table IT9006) is given, on the other hand there is no indication for what this information is needed. This makes it hard for designers or developers to include that feature within the application. Based on this initial requirement, two steps occur in parallel. The designer is creating the UI concept, which is displayed in the screenshot is Figure 32. Therefore the designer decided to include a banderole indicating, whether an employee is inactive ("abwesend"). Furthermore, the designer describes the content on the screen, i.e. active and inactive employees. In parallel, the developers describes the data description. As there is no information within the initial requirement, the developer analyzes the data table IT9006, and results in the data description: "Inactive employees are all employees that are permanent workers, but do not effect company performance, i.e. in maturity leave, longer sickness, or temporarily laid off persons". This initial scribble doc 1.0 is then discussed with the 28 key users in an in-person workshop. Thus the IT personnel presents In the workshop the question is asked "for what do you need to display inactive employees? " In that case, the end user would explain that they want to have this feature, as they want to replace a last used paper-based list (cost center list). To ensure they can abolish that list, they need to get an overview of all outstanding cost. In the direct discussion, it reveals that not only inactive employees, but also laid-off people could still have outstanding bonuses or travel cost. The UI design has been updated with a third category "laid-off employees", which also get a banderole ("entlassen"). Furthermore, it is important that for this class no pictures are available, as the data privacy protection requires the deletion of pictures. In addition, the data description is adapted and the changes are clearly recognizable (e.g. bold, italic).This new version of the scribble doc is the presented to the 28 key users.

When all agree on the concept, the design decisions are final and the effort for implementation can be estimated.

TABLE I. INSTANTIATION OF THE UDC-LSI METHOD

	Criteria	Design phase	Implementation phase
Documentation	User-relevant decision	Design decisions how to implement requirements	Decisions based on new requirement. unclear specification or technical issue
	Format	Wireframes/mock ups and data definitions	New field within JIRA tickets (structured with question, alternatives, implication)
	Tool	Scribble doc	JIRA (existing project management tool)
	Traceability	Requirement –> feature > wireframe/mocku p + data definition → scribble doc ID	Scribble doc ID
Communication	End user representati ves	28 existing key users per country	1. Level: customer PM 2. level: 4-5 selected key user
	Trigger	Completion of first concept in scribble doc 1.0	1. Level: In each weekly jour fixe 2. level: at least 5 open decisions for clarification with end users
	Means of communica tion	Workshop series with 28 key users; participation of 1 designer. 1 front end and 1 backend developer	1. Level: existing telephone conference; participation of 1 designer. 1 front end and 1 backend developer 2. Level: Workshop with 4-5 selected key user; participation of 1 designer. 1 front end and 1 backend developer

Example Implementation Phase – Working time report

The example for the implementation phase is the feature: working time report. This feature had in the actual development six different specification, the last one change was specified even after development close. Therefore, it is clear that the specification has not been detailed enough. The requirement is to include KPIs about breaches of working time standards (e.g. not used breaks, overtime, etc.) in the detailed view of an employee. For example there should be a KPI to describe deviation of actual vs. allowed working time. Three different events can cause decisions in the implementation phase. First, the customer can request a new feature or an adaptation of a feature. An example of such an event is that the thresholds for the breaches should not be fixed values (e.g. show breach, if more than 25% of assigned employees have illegitimate overtime), but rather be customizable for each country. Second a technical issue can occur during development, for example it was not clear to the back end developer, where the mapping of actual breaches to possible breaches is defined in the back end system. Third, ambiguities in the specification might come up.

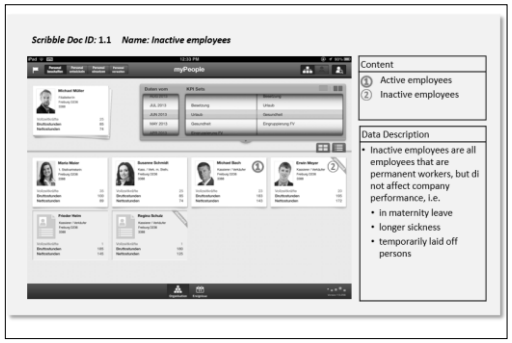

Fig. 4. Scribble Doc 1.0 of Inactive Employees

For example it was not explicitly specified what should be displayed in case a there is a breach in the working time report. The first step (I1), in case of these three events is to document the request within the new field in the JIRA ticket of the affected feature. We suggest to document the request in the format: question, alternatives and implications. The documentation within the ticket has two advantages. First the persons of the IT personnel, who receives the request has to put it into context. Second, the documentation with alternatives and implications requires to think about possible solution and consequences. For the example of an unclear specification event, the questions is "what should be displayed, if there is a breach in the working time report?" There are three alternative, the first one is the easiest from an implementation point of view, is to just display 0%. However, that might be confusing for end users as the standard threshold means actually under 25 % therefore 0% might be misleading. The other two alternative (show "-" or "n/a") both require more implementation effort, as the front end need to be adapted, but it might be easier to comprehend for the end users. The next step (I2) is to build a report in JIRA about all customer relevant decision of the last week. The clear advantage of using a separate field within tickets is that it is possible to filter against that field. Within the jour fixe the three customer relevant decisions are discussed with the customer PM (step I3). The discussion of the new customer request reveals that it is a change request, but as it is not too much effort. Therefore it can be implemented within the current release. The discussion about the technical issue showed that the customer PM needs to ask the customer IT department, where these mapping is available in the backend system. Thus, those two decision are classified in "clarified by customer PM". However, the last decision about the unclear specification needs input of the end users. The next step I4 is to discuss the end user-relevant decisions with four to five selected key users. Within the workshop the IT personnel explain the open question with alternatives and implications. In order to ensure that the key users know where to place the question the scribble doc ID, as well as a visual mockup or screenshot is shown. The discussion with the end users leads to the decision to use alternative 2. Nevertheless it is important that the end users also understand the consequences of higher implementation cost. After the decisions are made, it is important to update the JIRA tickets to ensure the traceability of the decision (step I5). When the result of the decision process is documented the implementation of the feature can continue. We still have no information, whether this instantiation is actually utile, i.e. feasible to implement and if there are positive effects on system success and if the effort is worth the value and usable, i.e. accepted by the project participants. Therefore, we evaluate this instantiation of the UDC-LSI method with the project participants in the next section.

IV. EVALUATION OF THE UDC-LSI METHOD TO PRACTICE

The general goal is to evaluate this instantiation of the UDC-LSI method in the unit of analysis (iPeople project) from the perspective of project participants. In particular, we wanted to understand the feasibility, effectiveness efficiency, and acceptance of the instantiation of the UDC-LSI method.

Feasibility (RQ 1). We analyzed the feasibility within three dimension: internal development process, for this system, with

this customer. All participants believe it is feasible to implement, however a small parts think only with high effort especially for communication in the design phase. The steps in the process that concern the documentation is considered easier than the steps that concern communication. The process suggested for the implementation phase can be implemented with lower effort than process for design phase. This is explained as the JIRA tool exists, but there were three medium effort rating since it requires a lot of writing. Overall the participants think it is low to medium effort since mockups already exists and process is proven in other projects. However, communication with 28 key users is rated with high effort, due to the availability of key users. Overall, the instantiation of the UDC-LSI method is also considered also feasible from a system perspective, vast majority (69%) even think is it good to implement. The only doubts are again in the communication part of design phase. The results also show that the process in design phase harder to implement than implementation phase. In total the results show a higher ratings than from the process perspective. This can be explained, since the system itself does not have such a high influence on the UDC-LSI method. Third category, whether it is feasible to implement the UDC-LSI method with this customer has the lowest rating regarding feasibility. However, there is still a majority of 47%, which believes it is good to implement. But especially the discussions with the 28 key users is considered by the majority to be very hard to implement with this customer. The only answer of "not at all" is from the IT PM, as her job would it to convince customer PM. Thus H1 is confirmed.

Effectiveness (RQ 2), For effectiveness, we mainly focus on system success aspects. We asked the project participants, whether they believe the aspect would increase, stay unaffected, or decrease with through the implementation of the UDC-LSI method in the iPeople project. The results based on the 5-scale Likert scale are presented in Table IV. We also included category of sum with negative (strong|low decrease), neutral (unaffected), and positive (strong|low increase). Overall the results show the majority of answers (69%) indicate an increase of system success aspects. About 30 % of specify that the aspects are unaffected and only one answer (2%) shows a low decrease. For the aspects user satisfaction all participants believe that it will increase in case the UDC-LSI method is implemented. A majority (67%) believes ease of use will increase, however three project participants believes it is unaffected, and as this is the job of the designer independently of measurements concerning UDC. For system use only a slight majority (56%) believe in an increase. But 44% believe it is unaffected, as the system usage of the business app is mandatory. The vast majority of 89% believes that project in time and budget will increase due to measurement of the UDC-LSI method, as the clearer scope will lead to better planning. However, one participant believes that the effort from a timing perspective is so high through the organization of the workshops, that project in time and budget will slightly decrease. For system quality 56% of the participants believe in an increase. However, 44% believe this aspect is already quite high and cannot be influenced by the suggested UDC-LSI method instantiation, but only through refactoring of the code. The last aspect data quality is considered to stay unaffected by the majority (54%). The rationale of the project participants is that the iPeople system only reads data from an existing backbone, thus changes in the iPeople project would not affect the data. Nevertheless, 44% believe it can be increased as a better understanding of the scope will ensure better usage of the data. Since the vast majority believes in positive effects and only one answer indicates a decrease. For some aspects the opinions are spread between unaffected and increase, however at five out of six aspects the majority expects an increase. Therefore H2 is confirmed. This means the UDC-LSI method has a high acceptance and thus a potential high system use of the method.

Efficiency (RQ 3. In order to answer RQ 3, we ask the project participants for their opinion on the effort-benefit ratio of the four parts of the instantiation of the UDC-LSI method. The vast majority (81%) of the project participants agree or strongly agree that the benefits of executing the instantiation of the UDC-LSI method compensate its effort. The agreement is a bit higher for the documentation parts (89% agree + strongly agree) than the communication parts (72 % agree + strongly agree). Between the two phases it is almost identical (design phase 83% agree + strongly agree and implementation phase 78% agree + strongly agree), with a slightly higher agreement toward the design phase. There are only two options that disagree or rather disagree both are from the project manager, who believes that the effort to get key user is too high and thus does not compensate for the effort. Since the vast majority agrees that for all parts of the UDC-LSI method the benefits outbalance the effort, hypotheses H3 is confirmed.

Acceptance (RQ 4), For acceptance, we build upon the Technology Acceptance Model (TAM). Therefore we checked for perceived ease of use, perceived usefulness, attitude towards using and the behavioral intention to use. According to TAM an agreement towards those criteria forecast actual system use, thus acceptance. We also included category of sum with negative ((strongly|rather) disagree), neutral, and positive ((strongly|rather) disagree). The vast majority of project participants agree (97%) that all parts of the UDC-LSI method are easy to understand and easy to use, therefore H4 is confirmed. The only two negative answers with the communication part of design and the implementation phase is from the project manager, she thinks that persuading the customer PM to have discussions "only" in the jour fixe and then with end users will not be possible in practice. An overview of the results is presented in Table III.

The vast majority of project participants agree (97%) that all parts of the UDC-LSI method are useful. The only negative answer is from a back end developer that thinks a more detailed description that the scribble doc would be required to actually explain user requirements. The vast majority of project participants agree (92%) that all parts of the UDC-LSI method are useful. The two negative answers are again from the project manager, who does not believe that the involvement of key user in the design or implementation phase is possible. All project participants have a positive attitude towards using (100%) Since the project participants agree to the perceived ease of use, perceived ease of use, have a positive attitude towards using and a behavioral intention to use, H4 is confirmed. Overall, the results showed a clear positive

assessment of utility (i.e. feasibility, effectiveness, and efficiency) and usability (i.e. acceptance by the future users) of the UDC-LSI method in the opinion of the project participants.

V. Threats to Validity

In the following we consider possible threads to validity based on [2]. *Construct Validity:* The case study design included a plan how the data of the different sources are used to answer the research questions. This helps to mitigate that the feedback of project participants reflects their true opinion [4].

TABLE II. Acceptance of the UDC-LSI method

TAM Element	Phase	Strongly disagree	Disagree	Rather Disagree	Neutral	Rather	Agree	Strongly Agree
Perceived Ease of Use	Sum	0	1	1	0	3	20	47
	Percent	0%	1%	1%	0%	4%	28%	65%
	Category Sum	2			0	70		
	Cateory Percent	3%			0%	97%		
Perceived Usefulness	Sum	0	0	1	3	9	13	64
	Percent	0%	0%	1%	3%	10%	14%	71%
	Category Sum	1			3	86		
	Cateory Percent	1%			3%	96%		
Attitude towards Using	Sum	0	0	0	0	1	9	26
	Percent	0%	0%	0%	0%	3%	25%	72%
	Category Sum	0			0	36		
	Cateory Percent	0%			0%	100%		
Behavioral Intention to Use	Sum	0	0	2	4	3	13	50
	Percent	0%	0%	3%	6%	4%	18%	69%
	Category Sum	2			4	66		
	Cateory Percent	3%			6%	92%		

We ensured construct validity, through data source triangulation. We also obtained data from different roles with different background and experiences levels in project to ensure a holistic view. For the instantiation the researcher independently applied method to ensure correct and complete instantiation. In the evaluation, there is a thread that interview questions could be interpreted differently by researcher and interviewee. But we explicitly presented definitions and the format of personal interviews enabled questions by the interviewee in case of a lack of clarity. The questionnaire and used presentation was checked for understandability by several researchers. All interviews we recorded with the consent of the interviewees that enable us to transcribe all open questions. .*Internal Validity:* A potential threat is that the project participants were biased towards acceptance of the method as they were only presented a hypothetical instantiation. But, we explicitly adverted in the interviews that they should assess the method objectively. *External validity:*. Apossible threat in the evaluation part is that we could only interview project participants from the IT team, we therefore missed the perspective of end users. We mitigated this by included roles that have similar background that possible users. *Reliability:* All assessments and interviews were done by one researcher, on one hand this ensured consistency [2], on the other hand another researcher could interpret the data differently. During design, data collection and analysis the researcher continuously documented every step that was done. Each step got peer reviewed by a second researcher.

VI. Summary of the Case Study

In this paper, we report on a case study studying utility and usability of the UDCL-LSI method in the real-world iPeople project. The simulated instantiation was presented and evaluated with regards to feasibility, effectiveness and efficiency by the project participants. Furthermore we evaluated the acceptance of the method. During the simulated instantiation, we analyzed the four part of the UDC-LSI method. An interesting results is that we needed *to define two different processes for the design and implementation phase*, since they differ in the nature of decisions, documentation and tool. The evaluation showed a *clear positive assessment of utility (i.e. feasibility, effectiveness, and efficiency) and usability (i.e. acceptance) of the UDC-LSI method.* The *feasibility is considered higher for the documentation part than the communication part*. This makes sense since to documentation part can be done internally within the IT company, whereas the communication part requires contact with the customer. *For effectiveness,* we study changes in the criteria for system success, overall *the majority* (39% strong increase and 30% low increase) believe *in an increase*. The efficiency evaluation checked whether the project participants believe that *the effort for executing the method outbalance the benefits, almost all projects participant agreed* to that statement (14% rather agree, 31% agree, 50% strongly agree). *For the acceptance* part we build upon TAM and asked for perceived ease of use, perceived usefulness, attitude towards using, and behavioral intention to use. *All four criteria have been evaluated positive by the vast majority of project participants*, we can therefore conclude that the project participants accept the USC-LSI method and would use it in the future. An *open issue is how the communication with end user representative should look like*. Especially, how many representatives are required and what format (i.e. personal or online meeting) is best to use could not be finally answered within this case study. Since we did not have the chance to discuss with end user this is up for future work.

Acknowledgment

Gunter, Horst, Lydia, Manuel, Maria, Michael, Neha, Nico, and Sven as well as all employees of the sovanta AG for their time and support during the case study.

References

[1] A. R. Hevner, S. T. March, J. Park, and S. Ram, "DESIGN SCIENCE IN INFORMATION SYSTEMS RESEARCH," *MIS Q.*, vol. 28, no. 1, pp. 75–105, 2004.

[2] P. Runeson and M. Höst, "Guidelines for conducting and reporting case study research in software engineering," *Empir. Softw. Eng.*, vol. 14, no. 2, pp. 131–164, Dec. 2008.

[3] R. Wieringa, "A Unified Checklist for Observational and Experimental Research in Software Engineering (Version 1)," 2012.

[4] R. Wieringa, "Writing a Report About Design Research," no. February, pp. 1–9, 2007.

[5] R. Wieringa and A. Moralı, "Technical action research as a validation method in information systems design science," *Des. Sci. Res. Inf. Syst. …*, pp. 220–238, 2012.