29th Annual INCOSE international symposium
Orlando, FL, USA
July 20 - 25, 2019

Inclusion of human values in the specification of systems: bridging design and systems engineering

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Abstract. This paper investigates a method for ensuring that systems engineers generate requirements related to human values. It looks at the work of a project team that designs and develops complex systems in a company recognized for the application of Systems Engineering to deliver innovative systems. The research data was drawn from a real project. We developed a tool that prescribes a structure to analyze human stakeholders and to describe use case scenarios. The tool enabled the systems engineers to generate twenty-five new requirements all of which were added to the system specification. Thirteen of these requirements contain aspects related to human values. Initially, the specification included only two requirements related to human values. We conclude that the importance of specifying human values has increased among the engineers of the team. Further investigation is ongoing in order to evaluate the potential of generalizing the new tool, its efficiency and effectiveness.

Introduction

Large organizations are putting design thinking much closer to its centre. This shift is a response to the increasing complexity of modern technology and modern business. Gartner, a research and advisory company and a member of the S&P 500, has listed on their Hype Cycle for Emerging Technologies, for the third year in a row, a trend towards human-centric technology (Gartner 2015, 2016, 2017). Increasingly, corporations and professional services firms are working to create design-centric cultures. "Technology will continue to become more human-centric to the point where it will introduce transparency between people, businesses and things" (Gartner 2016). This is happening because the technological complexity of products, services, and processes are constantly increasing. People do not deal well with high levels of complexity. They need their interactions with technologies and other systems to be intuitive and highly gratifying. Design thinking is an essential tool for simplifying and humanizing. It helps to create those kinds of interactions. Such qualities cannot be extras, they need to be core and spread to the whole organization (Kolko 2015). The design thinking process is a system that overlaps perspectives. Viability represents the business perspective; desirability echoes the user's perspective; and feasibility contains the technology perspective (Chasanidou et al., 2015). The "sweet pot for innovation" is at the intersection of these perspectives, i.e. when all three perspectives are present and balanced (Brown 2009).

University College of Southeast Norway conducted a study in 2016 involving both the academia and the industry. It investigated how to foster innovation when applying Systems Engineering to design complex systems. They concluded that there is a strong need to ensure the integration of human values in Systems Engineering (Falk et al., 2016).

System Engineers can use principles of sociotechnical design to integrate human values (Cherns 1976, Clegg 2000, Norman et al., 2015). It is the responsibility of the systems engineer to specify the needs of the stakeholders, including their human values (Muller 2009). We found during our research that system engineers specify the human values through the lens of Human Factors (ergonomics) and Health, Safety and Environment (HSE). Regardless, we found that ISO 13407:1999 Human-centered design processes for interactive systems (revised by ISO 9241-210:2010) is not followed nor known at the company.

Schwartz (2012) states that when we humans think of our values, we think of what is important to us in life. Each human holds and ranks numerous values. A high ranked value for one may be of minimal importance to another. According to the value theory (Schwartz, 1992, 2006), the conception of *all* values specifies six main features: 1) Values are beliefs; 2) Values refer to desirable goals; 3) Values transcend specific actions and situations; 4) Values serve as standards or criteria; 5) Values are ordered by importance and; 6) The *relative* importance of multiple values guides action. What distinguishes one from another is the type of goal or motivation that it expresses. Environmental factors such as culture and social aspects, as well as personal factors such as education, mental status, physical status, and preferences, influence human values (Muller 2009). In this research, we define these underlying values and motivation as human values. The pursuit of the human values relevant for the human stakeholders is driven by the questions: 1) What are the emotional, cultural and social wishes of the stakeholder? 2) What shall the stakeholder be proud of? 3) How shall interactions with the system look, sound and feel? And 4) How shall the actor perceive the interactions?

The application of systems in design has been that design needs to learn from systems thinking while the need of systems field to learn from the field of design seems minimal (Collopy 2009). Sevaldson (2017) argues that systems' approaches to design have partly failed in design because of the attempt to apply several complexes, prescriptive, and analytic theories in a field that practices generative, adaptive and dynamic design and the application of design approaches (generative, adaptive and dynamic) in systems engineering is difficult due to the opposite nature of the fields. While systems' approaches focus on "objectively measure" results, design approaches consider "subjectively perceived" results more than systems approaches do.

This research seeks an answer to the question "How to ensure that systems engineers include human values in the early specification of systems?" In order to find a solution, the researcher applied the design thinking framework because such an approach keeps the focus on the human aspects of the problem to be solved. We did the following:

1. Created a tool to analyze human stakeholders and describe use case scenarios;
2. Redid the stakeholders' analysis of human stakeholders and re-described the use case scenarios involving human stakeholders;
3. Generated stakeholders requirements and system requirements based on the results of the previous step and;
4. Updated the system specification with the new requirements.

We did participatory research in addition to semi-structured interviews with the team members and used qualitative and quantitative data to draw conclusions. The case study of this research is the design and development of a real system. It is a multidisciplinary project of an autonomous product/service for the global maritime vessel fleet. The client of the project estimates the overall cost of development to be more than 12 million USD, being roughly half of it associated with the project team that participated in this research. The tool consists of a set of two one-page graphic templates created to perform analysis of stakeholders and describe the use case scenarios. These templates are:

1. The human stakeholder canvas, to analyze each of the human stakeholders,
2. The use case scenario canvas, to describe use case scenarios.

The former is set to be the basis to generate requirements at the stakeholders' level and the latter to be the basis to generate systems requirements. The benchmark to evaluate the results of the application of the tool is the latest status of the stakeholder requirements and the system requirements before the application of the tool.

Background

The company that participated in this research is an engineering consultancy company. For more than 20 years, it designs and develops technically advanced products that are highly innovative from both functional and performance points of view. The company provides expertise in mechanics and mechatronics, electronics, control systems, and software. Currently, it supplies a wide range of markets including defence, aerospace, oil and gas, health and general industries. Figure 1 shows the vee model (Blanchard 2011, Buede 2016) adapted for the company's development processes and it serves as a good example of the application of systems engineering. The company recognized the need to include human values in project design and the need to develop products or systems that create additional value to customers through a focus on delivering appropriate user experiences. The belief that a good balance between business, human values and technology will result in more successful projects goes in hand with the Design Thinking approach.

The "Elicit Stakeholder Requirements & Concept of Operations" (Fig. 2) and the "establish system requirements" (Fig. 3) phases of the process govern the specifications on which this research focuses.

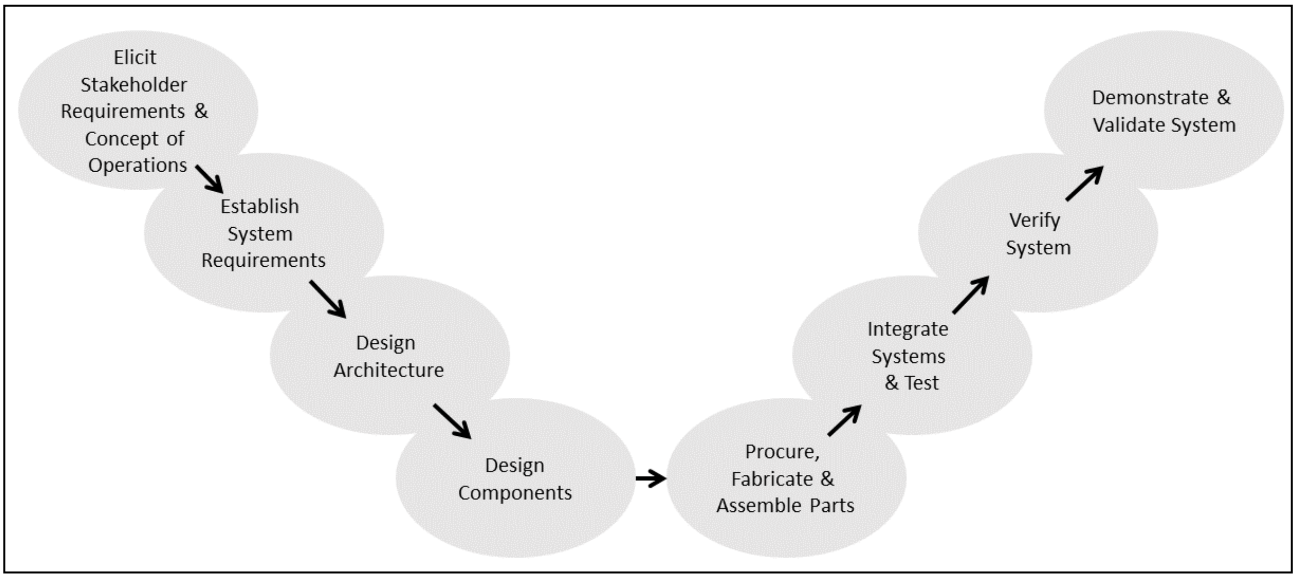

Figure 1. Illustration of Systems engineering processes at the company

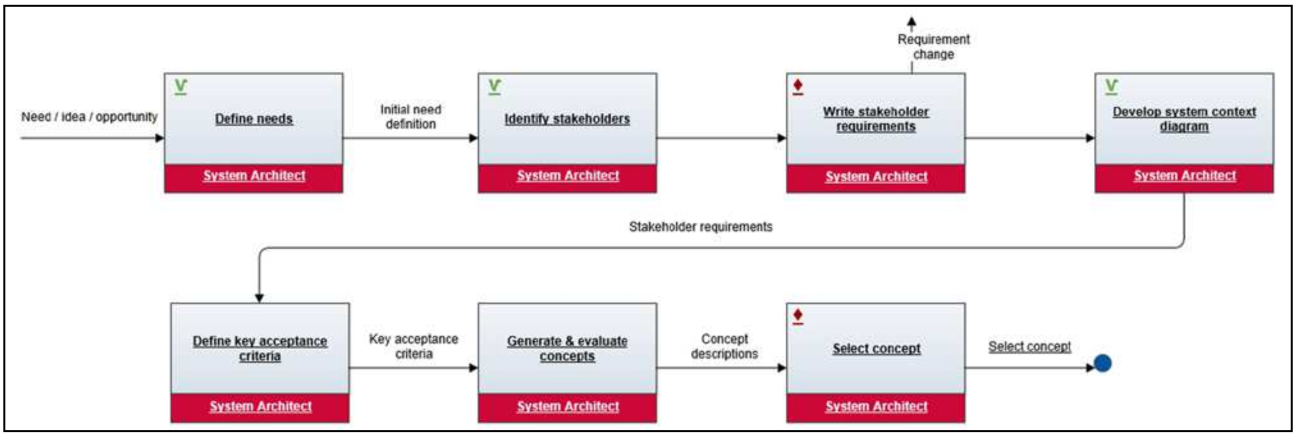

Figure 2. Tasks of the "Elicit Stakeholder Requirements & Concept of Operations" phase

The system architect is responsible for both phases and consequently for the blocks of each phase, while the system engineers are the ones who execute the tasks represented by the blocks. The arrows between the blocks represent the outputs and inputs from each task. The upward directed arrow on the blocks "write stakeholder requirements" (Fig. 2) and "write system requirements" (Fig. 3), illustrates that is an iterative task because stakeholder requirements and/ or system requirements can change during the process. The content produced during these two phases is stored using a software tool called Enterprise Architect. It is a visual modelling and system design tool, based on the Unified Modelling Language (UML) of the technology standards consortium Object Management Group (OMG). At the time of the research, there was no specific method or tool to execute the tasks of these phases.

Prior to this research, the system engineers did not have a prescribed tool to carry on the tasks of analyzing human stakeholders nor describe the use case scenarios involving human stakeholders. To collect stakeholder needs and requirements, system engineers use several techniques or methods such as structured brainstorming workshops; interviews and questionnaires; technical, operational, and/or strategy documentation review; simulations and visualizations; prototyping; modeling; feedback from verification and validation processes; review of the outcomes from the system analysis process; use case diagrams; activity diagrams and; functional flow block diagrams (SEBoK 2018). None of the ones mentioned above are used with focus on human values.

The aim of the "elicit stakeholder requirements & concept of operations" phase is to understand the problem from different stakeholders' perspectives describing the needs and features required by them in their language. Based on that, the system engineer generates stakeholders' requirements and rate them according to their importance. The context diagram represents the system of interest as a "black box", which shows the relevant borders, actors and systems interacting with it as well as the major information flow between the entities and the "black box". The key acceptance criteria consists of three to five most important stakeholder requirements. If they are not fulfilled the project will be a failure. They should be defined explicitly, while the project team should be regularly reminded of them. Concepts and optimal solutions are generated and selected, applying the most important requirements and impact on the critical project parameters: cost, time and quality.

At the "Establish System Requirements" phase, the system engineer aims to understand what the actors do by describing as many as possible use cases spanning through the system's complete

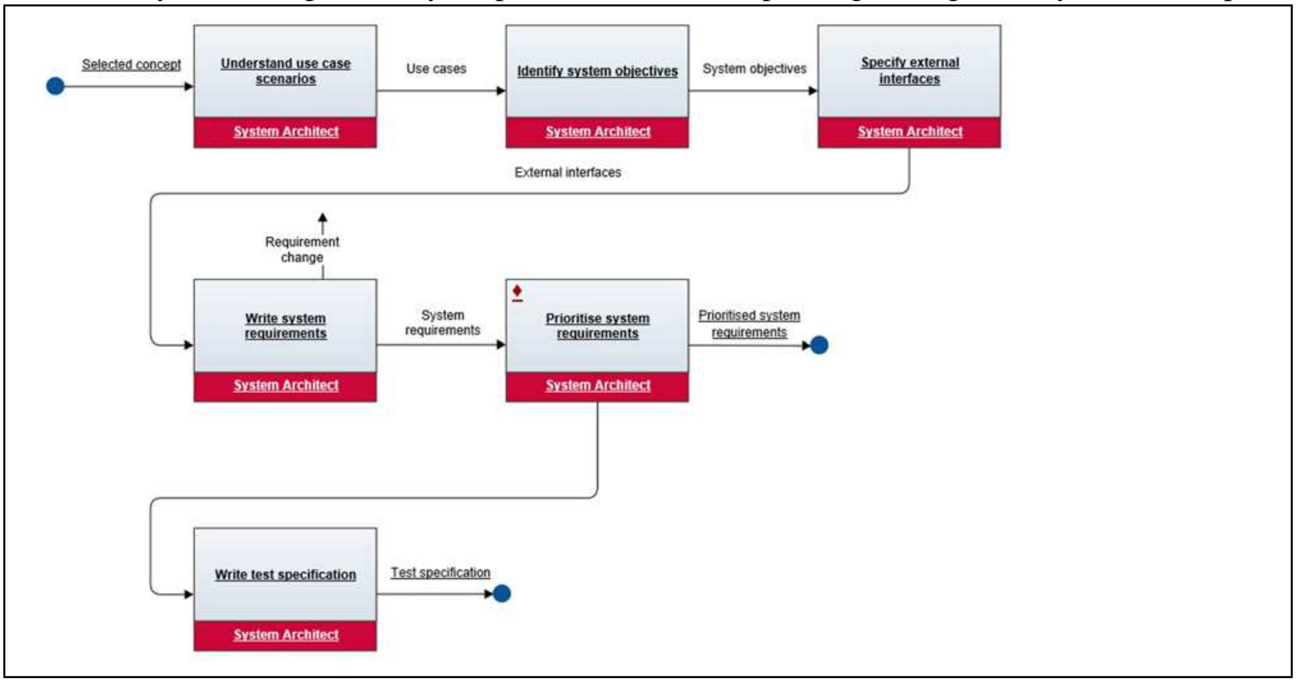

Figure 3. Tasks of the "Establish System Requirements" phase

lifecycle. It is in this phase that the system engineer defines the non-functional requirements (characteristics) for the system. Based on the system context diagram from the previous phase, the system engineer defines in detail the external interfaces. The written system requirements should be decompositions of the stakeholder requirements, detailing them from stakeholder language to engineering language. The goal is to ensure consistency of system requirements created in previous steps, maintain traceability and a more detailed written agreement of the targets of the product development at any stage of the project, and prioritize the system requirement to help to focus on the important parts and support later decisions. This phase is also partly a high-level description of the test needs.

Methodology

A case study (Yin 2017) using participatory action research (Baum et al., 2006) was used to explore the research question within real-world settings. The case study method compromises in-depth and holistic investigation of phenomena that cannot be studied independently from the context in which it occurs (Pare 2004). This study drew on both qualitative and quantitative methods such as surveys and unstructured interviews. It used unstructured interviews because it enabled the researcher to obtain the required information while giving participants the freedom to respond and elaborate responses. This study illustrates a more traditional use of case studies in process evaluations, but the research method has also been used for analyzing and documenting the intervention (Yin 2011).

The interviews with team members supported the conclusions of the research. Six team members actively participated in the survey and interviews that were facilitated by the researcher. The discussions included two formal group meetings with eight and ten system engineers external to the case study. In these group meetings, the researcher presented the development of the research project and collected feedback. Minutes of meeting were recorded. Approximately three months after concluding the group discussions and the application of the tool, participants were asked to respond to the survey. This allowed the researcher to test the use of the tool after its implementation and receive ongoing feedback.

Table 1. List of responders of the survey.

Participant	Role	Experience
3	System engineer	<3 years
1	Designer	>10 years
1	System Architect	3 to 10 years
1	Project Manager, Mechanical	3 to 10 years

In this research, design thinking provides a framework for using participatory research approaches to facilitate the implementation of the tool. The researcher closely followed the efforts of the individuals that were involved in all phases of the study. The amount of requirements generated based on the application of the tool is the data used to draw conclusions. The results of the application of the tool can be measured by the number of new requirements generated based on the analysis of human stakeholders and description of use case scenarios involving human stakeholders, especially those related to human values that were originated on “desirability” and on “experience”.

Study case

The team is designing and developing a solution for the global maritime vessel fleet. The solution is part of an autonomous and multidisciplinary product/service. It consists of:

- A high performance and environmental friendly hard coating and the application of it;
- A solution to maintain autonomously the condition and performance of surfaces coated with the hard coating, and;
- The global infrastructure that supports the necessary logistics to provide the service.

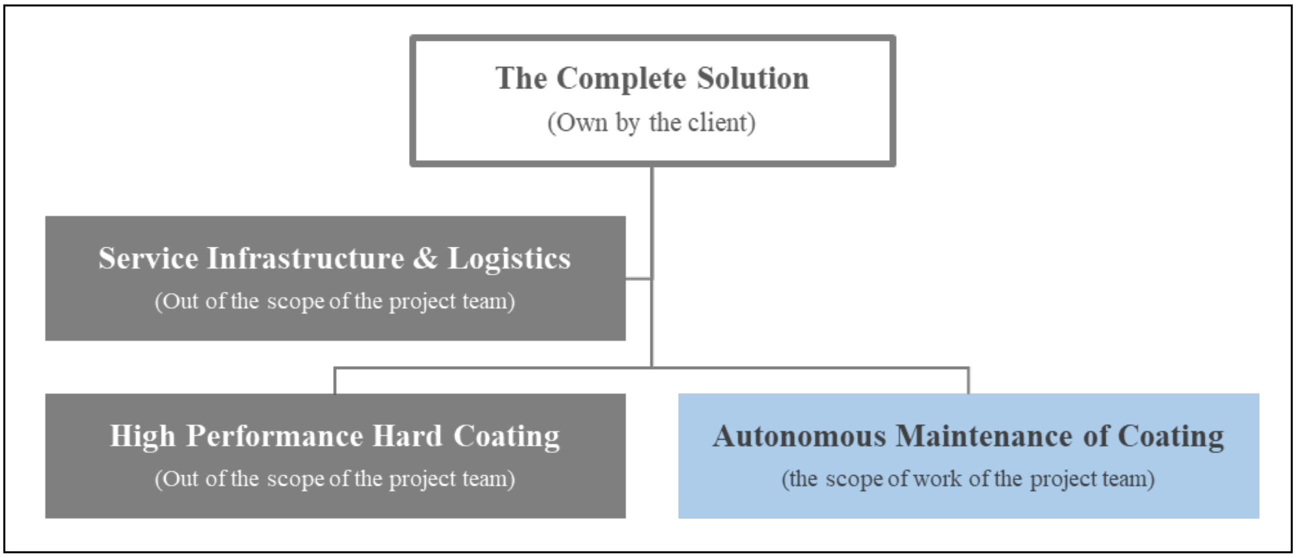

Figure 4. High-level structure of complete solution

In this case, the team is responsible for the design, development and test of the work package Autonomous Maintenance of Coating (Fig. 4). It is a highly complex project and requires expertise from many different disciplines including mechanics, mechatronics, electronics, software, artificial intelligence, materials, production technology, design management, marketing, ergonomics, usability and user interface and experience. The number of members of the team has changed during the execution due to specific needs of the project, the project plan, unexpected issues and availability of resources. A number of members is central to the project, namely the project manager, the system architect, the design leader, the technical leaders of mechanical systems, embedded systems, production and assembly, and test and validation. The professional experience of the members ranges from three to twenty years. The system engineers selected to use the tool have less than three years of experience and had not been part of the project before. The project began two years before this study was completed and it is expected to be finished in three years after. The project was planned using a stage gate approach whereas the next stage depends on the successful results of the current one. The overall project includes 1) the feasibility study; 2) concept detailing; 3) design and production of a prototype to test basic functionality; 4) design and production of a 2nd generation prototype to test increased functionality; 5) fully functional prototype and an early version for industrialization and; 6) commercial release. This study took place on stage 3.

Design Thinking Framework

The researcher applied the design thinking approach (Fig. 5), especially the human-centred design process (Brown 2009, Tschimmel 2012). This approach helped the researcher to understand the

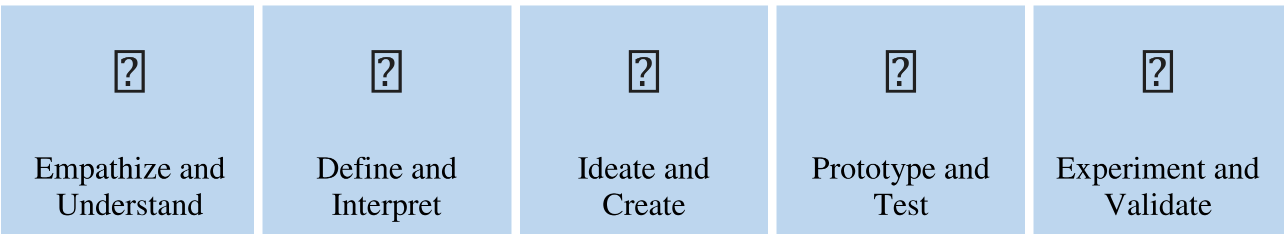

Figure 5. Illustration of the Design Thinking approach applied

company's development process, how system engineers perform their work and to find a solution to ensure that the specification of systems will include requirements specifying human values. The solution found was a new tool to analyze human stakeholders and describe use case scenarios. The researcher created a tool in collaboration with the system architect of the study case, and with the consultancy of another system architect and four potential users, external to the project.

Empathize and understand

The researcher has worked in the company since the introduction of the systems engineering approach eight years earlier, thus having supported and participated in the process. The program manager who was responsible for the introduction of the approach realized that system engineers very often overlook human aspects when specifying and developing systems. Human values are specified in ergonomic terms, i.e. requirements specifying human factors that eventually refer to standards. In addition to these reasons, the researcher and the active team members participating in this research, improved their understanding of defining and specifying the system through unstructured interviews. This shared approach towards generating understanding created empathy amongst the team members (Miettinen et al., 2016). The processes and tools in use to specify systems were mapped and analyzed aiming to find the causes of a poor generation of requirements related to human values.

Define and Interpret

Based on the findings of the previous phase, the researcher defined the problem landscape by identifying causes that would justify the absence of requirements that specify how human interaction with the system should be perceived and experienced. The following causes were found:

- The engineers applying systems engineering approaches tend to translate human values into HSE and/or ergonomic requirements;
- The approach of system engineers is mainly functional and aims for objectively-measured results;
- The lack of awareness of the significance of well-defined human values.

The system architect explained: *"I know I should take 'more' the human values into the specification, but it is just very easy not to…"*

The program manager stated: *"Systems engineers are educated to ignore the subjective, fluffy requirements!"*

Ideate and create

Based on the findings of the previous phases, the researcher designed the tool that facilitated analytical processes of the human stakeholders and the descriptions of use case scenarios. It takes into account the team's current protocols, which are strongly based on traditional systems engineering. The design of the tool considers the main features that characterize the toolbox in use at the company, which is:

- Suitable to print on A3 paper sheets;
- Supported with digital versions such as PowerPoint slide and/or Excel spreadsheet;
- A self-explanatory one-page structure that enables an immediate overview;
- Visually consistent with the current design guidelines.

The tool consists of two one-page graphic structures that prescribe a new way to analyze stakeholders (Fig. 6) and to describe use case scenarios (Fig. 7).

Prototype and test

The tool was introduced to a selected system engineer (engineer "A") for testing. The system architect introduced engineer "A" to the existing model of the system, who used the tool to analyze the human stakeholders and describe the use case scenarios related to human stakeholders. The researcher facilitated and closely followed the work, focusing on the process of applying the tool rather than on the content generated. This phase served to test the tool as well as to train engineer "A". The canvasses were improved, taking into account the observations and findings of the training, in addition to the input of engineer "A", the system architect and other engineers involved previously. The improved versions of the canvasses consisted of the tool used to gather the data of this research.

Experiment and validate

The application of the tool consisted of two well-defined phases:

1. The use of the tool to analyze the human stakeholders and describe the use case scenarios related to human stakeholders, and;
2. Generate requirements based on the content created with the tool.

Application of the tool. Engineer "A" applied the tool to redo the analysis of the human stakeholders and to re-describe the use case scenarios. Engineer "A" applied the tool on the model of the system existent prior to this study. The model included detailed information about the system in terms of stakeholders (identification and main interests), categorization of stakeholders and relations between them, concepts of operations, use case scenarios, customer views, stakeholder requirements, system requirements, requirement analysis and functional breakdown structures. The system architect reviewed the content generated and agreed on which content to process further, i.e. to generate requirements.

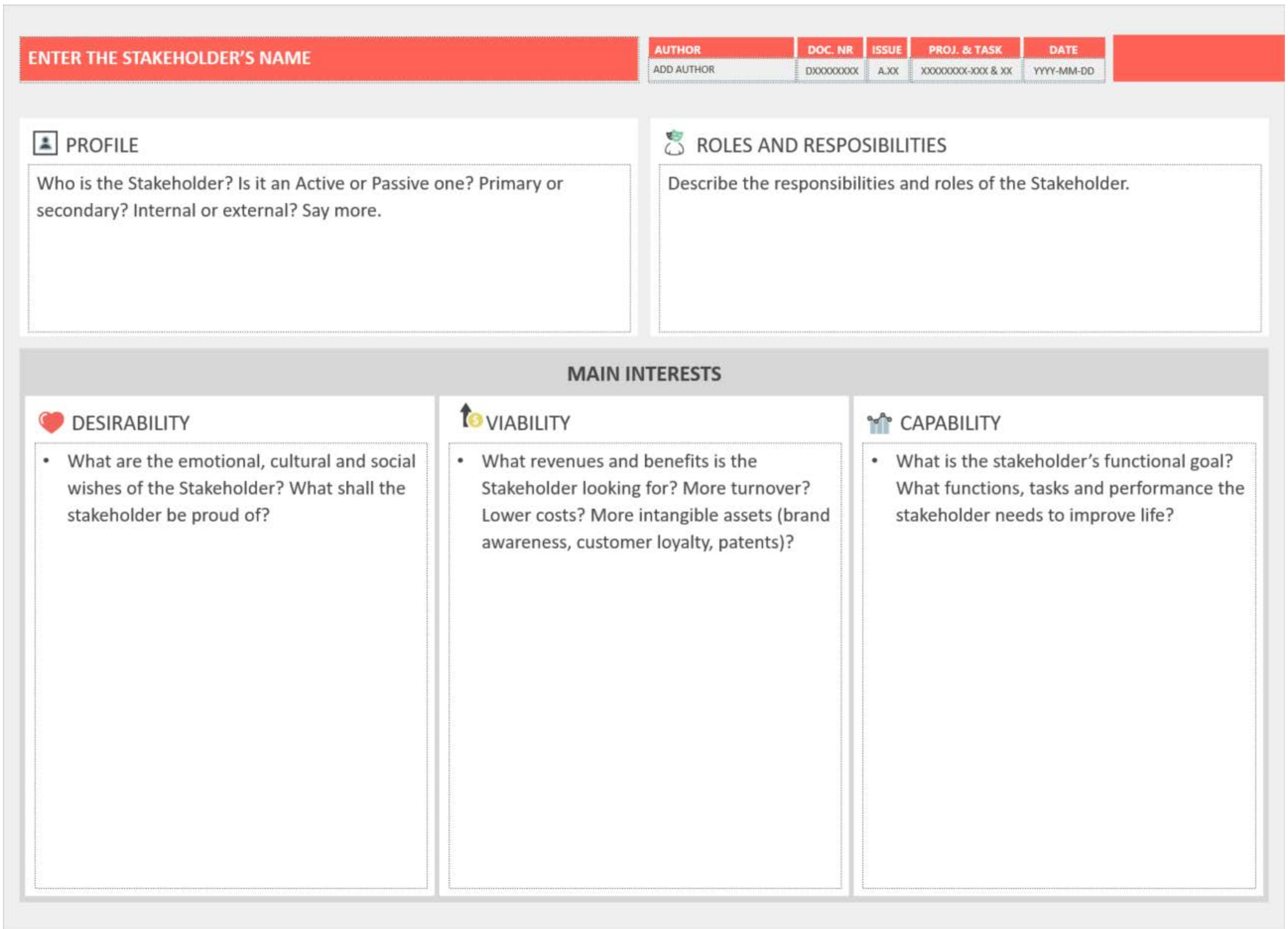

Figure 6. The human stakeholder canvas

Generating requirements. To perform the second phase of the application, the researcher supported by the system architect, introduced another system engineer to the project and tool. For reasons of simplification, this individual is referred to as engineer "B", who created text-based requirements based on the content generated from phase one, i.e. the application of the tool to re-analyze human stakeholders and re-describe use case scenarios.

Requirement traceability is recommended to increase the systems specification quality and avoid undesirable problems such as building functionality no one uses or insufficient change impact analysis (Walden et al, 2015). In order to comply with best practices of requirements traceability, the engineer identified the source of each requirement in relation to the content generated with the new tool and grouped the requirements originated from the analysis of human stakeholders' canvasses as stakeholder requirements and those that originated from the use case scenarios as system requirements. The system architect reviewed all requirements, validated and added a number of them to the specifications. Consequently, engineer "B" updated the system model reflecting the new data about human stakeholders, stakeholder requirements, use case scenarios and system requirements,

Feedback of the participants. Qualitative data was collected, consisting of close dialogues and open discussions with the participants throughout the complete study, especially during the phase of empathy and understanding. Observations were conducted of the participants, for example, by supporting, participating and facilitating the activities of the application of the tool. Afterwards, participants completed a survey focusing on their perception of the tool and the value added to the project. Participants also commented on their raised awareness of the importance of inclusion of human values in the early specification of systems.

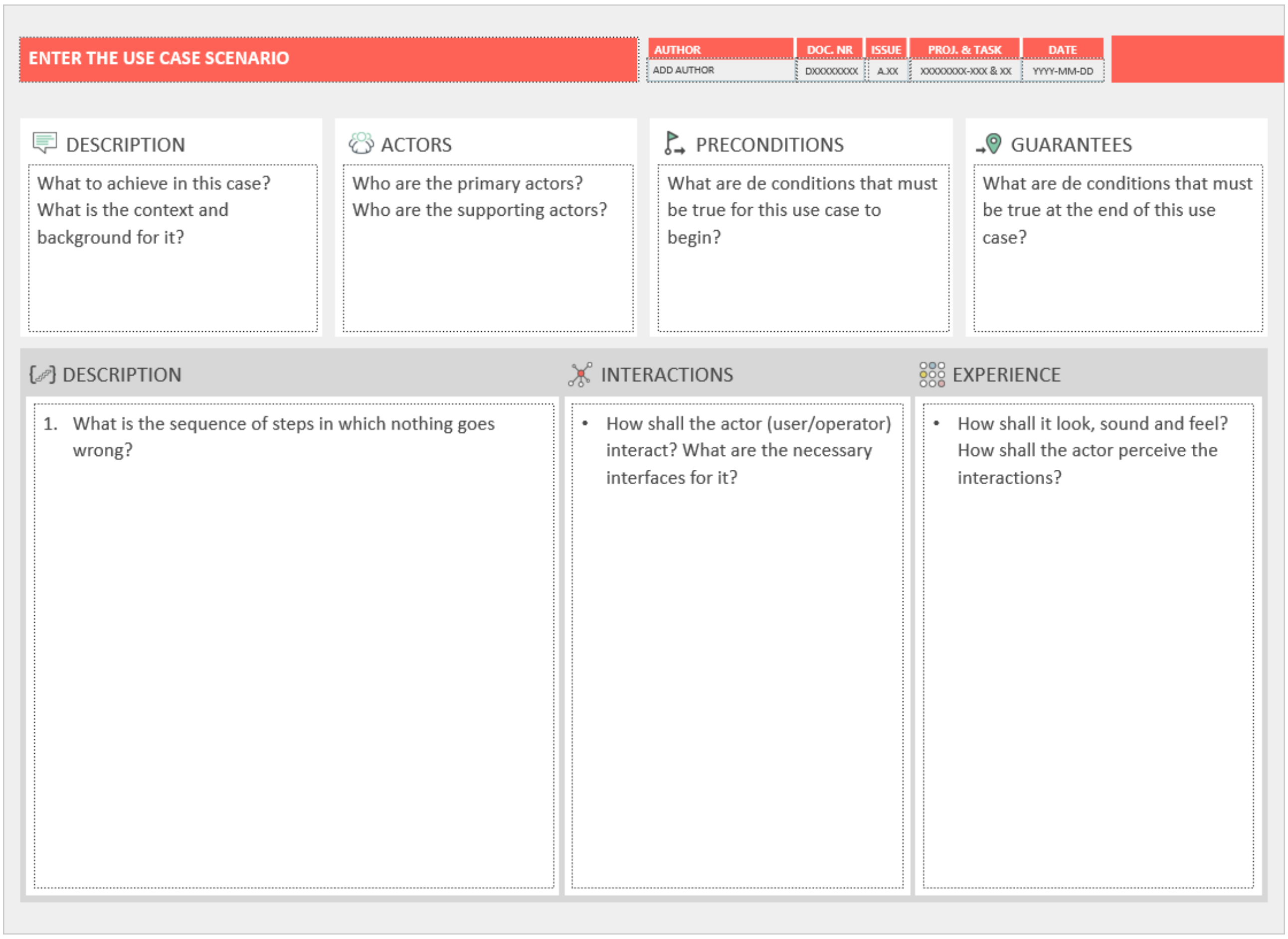

Figure 7. The use case scenario canvas

Results

The results of this research can be divided into three outcomes, namely the tool, the generated requirements and the feedback received from participants.

The tool

The new tool consists of:

1. The human stakeholder canvas – a graphic structure that prescribes a formal way to list the human stakeholders and their main interests (Fig. 6), and;
2. The use case scenario canvas – a graphic structure to describe the use case scenarios involving or interfacing humans (Fig. 7).

In comparison to the previous method of listing and analyzing stakeholders, the new tool proposes the distribution of the stakeholder's main interests in three categories, namely desirability, viability and capability (Fig. 6). A Microsoft PowerPoint template was created to ease the application of it. This template can be printed and used analogously. The canvas is self-explanatory and did not require significant training efforts of the engineers in order to apply it.

Compared with the previous description of use case scenarios, the new tool adds two fields which are the description of the human interaction that supports the use case and how the actors shall experience not only the interaction but also the complete use case (Fig. 7). As for the other canvas, the researcher created a Microsoft PowerPoint template that can be printed and used analogously. It is self-explanatory and required no training efforts to be used.

Generated requirements

Engineer "A" analyzed a total of seven stakeholders and eleven use case scenarios, i.e. the number of elicited human stakeholders and described eleven use case scenarios related to human stakeholders existent on the system model prior to the application of the tool. Based on these, engineer "B" generated text-based requirements, which are 55 stakeholder requirements that resulted from the stakeholder analysis, and 54 systems requirements that resulted from the use case scenarios. All requirements were recorded according to the origin, source and validity. The origin of requirements refers to the type of canvas, i.e. human stakeholder or use case scenarios. The source refers to which "box" on the canvas the requirement can be traced. A requirement was recorded as valid if it was a new one, i.e. not existent in the system model. Table 2 shows the number of requirements generated based on the application of the tool, and the number of requirements considered valid and the number of valid requirements related to human values. The valid requirements were added to the system specification. The specification was review and approved by the project team and the client.

Table 2 exhibiting a random sample of generated requirements

Text-based requirement	Origin	Source	Is it valid?	Is it related to human values?
The system needs to be perceived as a Green-solution in the global market	Stakeholder (The Client)	Desirability	YES	YES
The solution needs to make service and support available 24/7	Stakeholder (The Client	Capability	YES	NO

It must be possible to lift the containers on to vessel's deck	Use case scenario (Handling, Storage and Transport)	Steps	YES	NO
The HMI and the GUI must be user-friendly, ensure clear communication and provide information easy to read	Use case scenario (Run Start-up Procedures)	Human Interaction	NO	NO
Status of booking must be possible to check at all times	Use case scenario (Scheduling of Inspection & Cleaning)	Experience	YES	YES

Feedback of participants

Besides the participants involved in the researched case study, two other engineers working at the company have used the tool in different projects. All participants were part of unstructured interviews and answered a survey. Figure 8 shows the responses to a section of the survey that aimed to know if the engineers perceived the new tool as being broader and deeper than the previous one. Figure 9 shows the responses of a group of questions which aimed to find how the engineers perceived the new tool in terms of application and results specifically for each of the canvasses and Figure 10 shows how likely the engineers will recommend tool and how much they value it from an overall perspective.

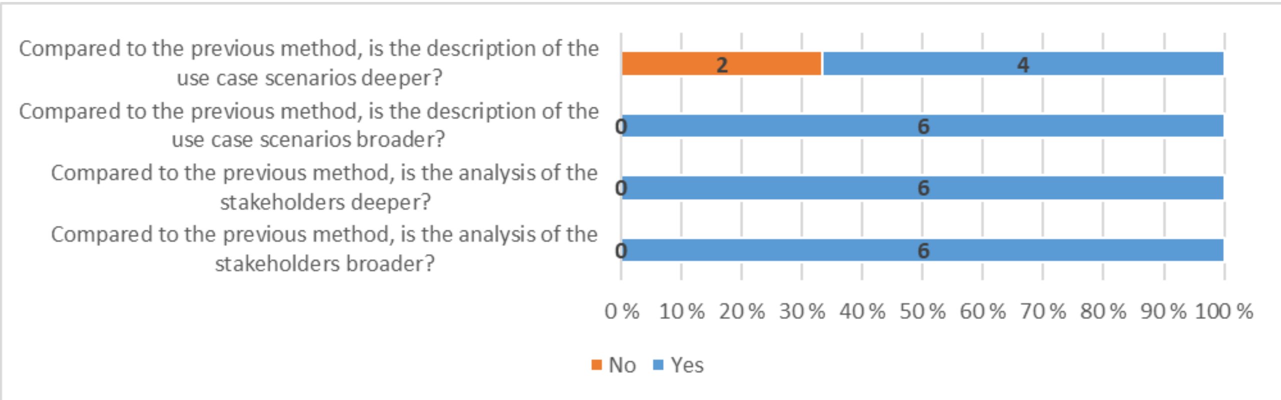

Figure 8.

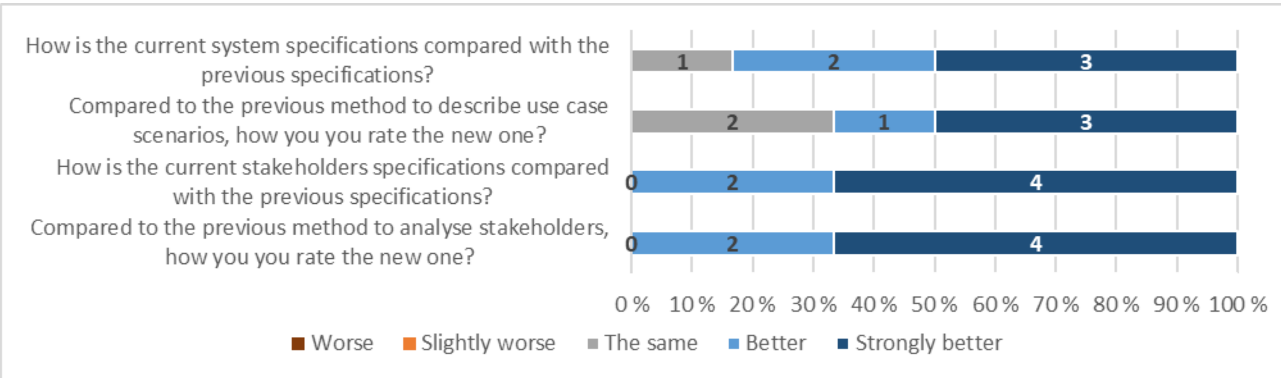

Figure 9.

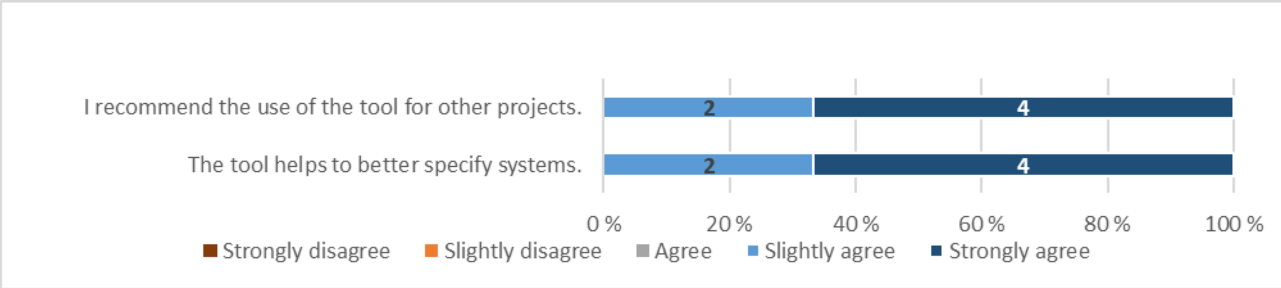

Figure 10.

Conclusion

This research has investigated how to ensure that systems engineers include human values in the early specification of systems. We have introduced a new tool, and tested the tool in a a real innovation project. The total number of stakeholder requirements prior to the experiment were 41 (See table 3). One of these specifies human values, representing only 2%. The number of new stakeholder requirements generated by using the new tool was 55 (see Table 4). This surpasses the number of requirements prior to the experiment. Only 11 of the 55 are valid, i.e. requirements that were added to the specification because they are new and relevant for the system. Seven of the valid requirements contain aspects related to human values, representing 64% of the requirements added. The total number of requirements related to human values increased from one to 8, i.e. from 2% to 15% of all requirements.

Table 3 shows the number of requirements existent (benchmark) prior to this study

Requirement	Total number of requirements	Number of requirements relate to human values
Stakeholder requirements	41	1
System requirements	107	1

Table 4. Number of generated requirements

Requirement type	Generated requirements	Valid requirements	Valid requirements related to human values
Stakeholder requirements	55	11	7
System requirements	54	14	6

55% of the valid requirements stem from “desirability”. With desirability we mean "what are the emotional, cultural and social wishes of the stakeholder", see Figure 6. On one hand, this could show the importance of the tool to help to specify human values, knowing that engineers tend to translate them into HSE requirements. On the other hand, one could expect 100% of these to be from desirability, with viability being secondary and capability as means to an end as suggested by Osterwalder et al. (2014). The engineers were not trained within the context of this research to identify the relationship between a requirement and a human value. There is a risk of misinterpretation by the engineers which values the stakeholders actually hold. Taking the system requirement “The solution needs to make service and support available 24/7” as an example: it is a new requirement but is not recorded as related to human values (Table 2). One might argue, however, that from a client's perspective, this requirement can be related to "trust" and be considered a human value.

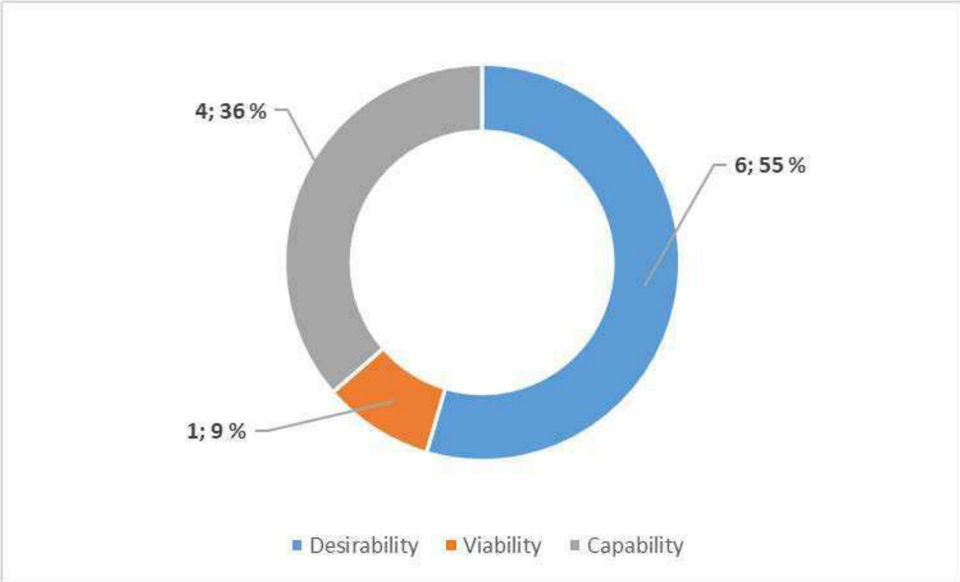

Figure 11. Source of valid stakeholder requirements related to human values

There were 107 requirements on the system level. Less than 1% of these specify human values. Of the 54 generated requirements, 14 were considered valid (Table 4), and therefore added to the system specification. Of the 14 valid system requirements, 8 do not specify human values, representing 57%. All new requirements that do not contain aspects related to human values are sourced on the use case scenario canvas (Fig. 7), specifically from "preconditions" (75%) and from "steps" (25%), see Figure 12. Neither "preconditions" nor "steps" are new to the description of use case scenarios. This result indicates that the new tool provides a broader or more detailed description than before, helping to generate more requirements. Almost half of the system requirements, 43%, contains aspects related to human values. All of these are sourced on the two boxes added to the regular use case scenario description, i.e. "human interaction" and "experience" (Fig. 13). Systems requirements containing aspects related to human values increased from one to 7, i.e. from 1% to 6% of all system requirements. This increase is similar to the one verified with the stakeholder requirements.

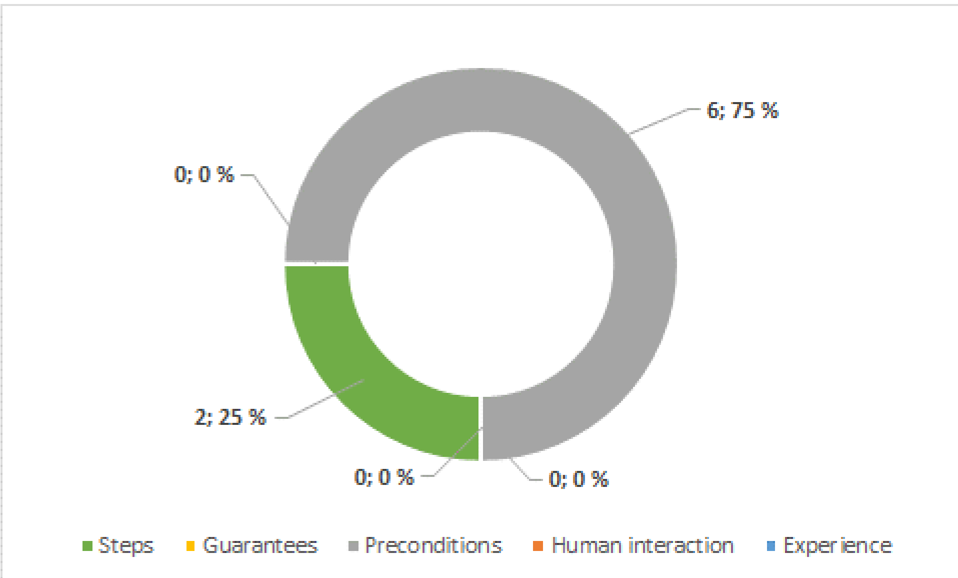

Figure 12. Source of valid requirements that do not relate to human values

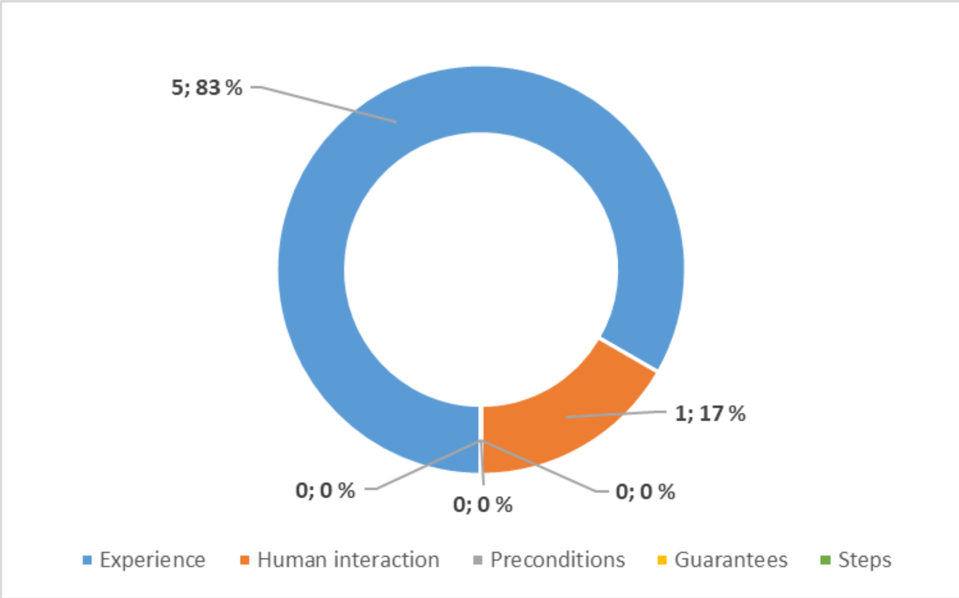

Figure 13. Source of systems requirements related to human values

The participants involved in this study have reported that the tool helped them to better analyze the human stakeholders and to better describe the use case scenarios related to human stakeholders. Consequently, the number of requirements related to human values in the system's specification has increased from one to eight at the stakeholders' level and from one to seven at the system's level.

The application of the tool in the context of this study does not consist of new work in terms of eliciting stakeholders. The tool was applied to an initial number of stakeholders and use case scenarios. It aimed at re-analyze the existing human stakeholders and re-describe existing use case scenarios. This approach explains why the 55 generated human stakeholders' requirements did not simply replace the existent 44. Moreover, the tool presents a way to ensure that human stakeholders are taken care of when specifying systems, reducing the impact of human values being perceived differently between systems engineers.

It is important to note that the research does not provide a quantitative analysis showing that poor generation of requirements for human values is not happening on other projects or teams, i.e. that poor generation happened only on the current case. Both the system architect and the researcher observed that poor generation of requirements happens across projects and with different teams, but this happens only in connection with human values. Probably the reason is that some of the requirements related to human values are difficult to objectively verify and required a "subjective perceived" verification.

Even though our results indicate that the application of the new tool helps systems engineers to include human values in the early specification of systems, further investigation is ongoing in order to evaluate the potential of generalizing the tool, its efficiency and effectiveness. One aspect that will require special attention is the mindset of the systems engineers applying the tool. It is beneficial for the goal of caring about values of the human stakeholders that engineers look at the system from the outside. They should focus on how the system shall be perceived and not only looking from the inside, that is, looking at what the system is meant to deliver. Investigating the requirement 'Status of booking must be possible to check at all times' from an inside perspective, the requirement is a basic functionality. However, from an outside perspective, it defines how the user perceives the system. It does it by removing the anxiety of the user that results from not knowing the status of an operation. Furthermore, knowing the status of an operation at all times helps to build confidence and trust in the systems. Trust is a value that defines the success or failure of a system or business for the matter.

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Biography

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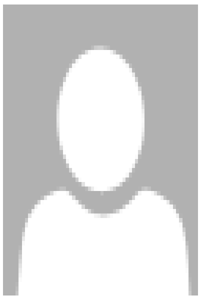

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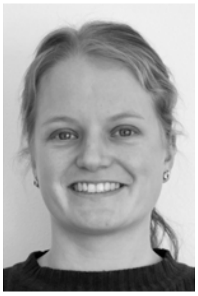

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