Introducing a Game Approach towards IS Requirements Specification

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Abstract

Devising a system requirements specification is a challenging task. Even after several decades of system development research, specifications for large-scale, widely-used systems remain difficult. In this paper, we suggest a first step toward a requirements specification through a stakeholder involvement approach with game elements. We report preliminary findings from a practice case in which our methods are applied to the requirement specification phase of a project management system. The analysis showed that our game approach fostered innovative idea generation and captured implicit user expectations, and as a result provided a list of requirements from other perspectives than those of conventional specification analysis. The granularities of extracted system requirements need to be refined and transferred to detailed requirements for developers to use; however, our results imply that our stakeholder involvement method with game elements can be effectively utilized as a first step towards requirement specification.

1. Introduction

Devising system requirements specifications has been a challenging task in information systems (IS) design. Quite a few development projects report failures because of low system usage, low user satisfaction and no visible improvements in efficiency and effectiveness of business activities [37]. Although requirements analysis is considered a key in designing IS, current approaches often have limited capabilities.

Increased IS usage in society and business has made it more difficult to design usable, effective and ethically persuasive systems [20]. The market requires IS to fit global standards and satisfy wider audiences along with globalization. This means that a single system requires multiple usages for wider purposes. For example, a project management system for supporting software development projects could be used in different project sizes by a wide range of international users with different technical skills for different purposes ranging from quality management to progress reports. This current situation suggests that it is increasingly difficult for a single person or stakeholder to solve the complex problems of system requirements specifications on their own [12, 25].

One of the promising and practical approaches that satisfy users and meet their expectations is to involve stakeholders in the IS requirements specification process [30, 40, 42]. Several stakeholder involvement methods such as group brainstorming [7] and participatory design [1, 2] have attracted particular attention on this sphere.

In this paper, we introduce an IS requirements specification approach which involve stakeholders using game elements. It is applied in a large international system integration company to upgrade a project management system. Our approach is unique by involving stakeholders in the specification requirements process of a practical development project of a large company. Typically, stakeholder involvement methods have been deployed as test cases in small organizations, and their impact on the development phase and market introduction phase has rarely been reported. In our case, since we applied the method in the early phase of system development as a part of the practical development project, it was possible to validate the practicality and benefits of the method later although it is beyond the scope of this paper.

The rest of the paper is organized as follows. First, we review theories about stakeholder involvement approaches and game approaches within system requirements of the IS domain. Next, our stakeholder involvement method with game elements is introduced together with the study we have conducted. Then, we report the results and evaluate the impact and influences of the design elements of the method on the creation of requirement specifications. The paper concludes with a discussion about the game approach and possible future directions of the work.

2. Theory

2.1. Stakeholder involvement in requirements specification

978-1-4799-2504-9/14 $31.00 © 2014 IEEE
DOI 10.1109/HICSS.2014.459

In the first phase of system requirement analysis, requirement elicitation, it is not a completely new undertaking to involve stakeholders as seen e.g. in agile software development. IS planning research has also shown quite a few advantages of involving stakeholders [28]. The primary reason for this is participation and understanding. Requirement specifications are often formulated by either business or information technology specialists who have limited knowledge about business processes or technologies for making complete specifications [36]. This has caused a critical limitation of the current requirement specification approaches. If stakeholders are involved in the process, the development team gains deeper understanding of the whole development process as well as other stakeholders' perspectives [28]. Incorporating the ideas of many stakeholders and acquiring user feedback are beneficial in terms of ensuring useful functionalities and high acceptance among users [6]. For example, the use of stakeholders in brainstorming or participatory design approaches has been widely evaluated [6, 28] and a wide range of methods to let stakeholders participate in eliciting needs has been suggested [2, 5, 16, 18, 31], which are used mainly in the early design phase.

Second, involving stakeholders in system requirement elicitation can provide a creative mindset. It is more important than ever that IS companies develop systems that attract wider audiences for better work support and offer complete satisfaction. In order to survive in the competitive global market, the system should support wider human activities, which go beyond conventional daily task support. Since diversity is a source of creativity [27, 35], diverse stakeholders' participation can bring innovative solutions to unspecified challenges [41, 42].

The third benefit of stakeholder involvement is to achieve a mutually exclusive and collectively exhaustive (MECE) set of specification requirements with [31]. It is increasingly difficult, if not impossible, for a single person or group with limited knowledge capacity [11, 25] to solve complex problems such as system requirement specifications for wider audiences and needs. Participatory approaches can bring a team with diverse stakeholders to solve this challenge [ex.7, 28]. For example, Derrick [7] reported that group workshops with diverse stakeholders including users contribute to compile a list of requirements.

However, there are also concerns about involving stakeholders in requirement elicitation. Open discussion is one of them. In many groups, communities and societies, the opinions of those who shout loudest tend to be passed down as group opinions [8, 21]. In some socio-cultural environments, openly expressed opinions in formal meetings are not expected because of the social norm although they are also not prohibited [24]. Even in design workshops, which rely on open discussion, some find it difficult to express their opinions honestly to strangers or to members with different social or organizational status in a hierarchy [8].

Excess of creativity is another concern. Some simple stakeholder involvement approaches, such as group brainstorming, tend to generate ideas that are too creative and too detached from real-world problems, or not based on the issues in practice at all. There is a concern that some participatory approaches might result in generating a lot of irrelevant data [7].

Last but not least, professionals with different knowledge backgrounds differ in terms of preferences [33], culture, sense of values and terminology [3]. For such collaboration settings where several communities of practice [39] create a cluster of people with collective concerns and which are typical stakeholder involvement settings, even the ordinary communication process can become a challenge [11, 26]. It is difficult to lead a group flow experience [4] without the interference of cultural difference.

2.2. Game elements

Games have recently attracted attention as practical tools for business and social practices. Games can be utilized to create innovative ideas for challenging unspecified business issues [14] and to solve complex social challenges [22]. The benefits of introducing game elements to real-world problems can be realized through well-designed game frames with game space and tools, rules and game structure. For example, a game space provides players with another kind of space where ordinary life is temporarily suspended and new roles are given [14, 22]. Even in a society with strong hierarchy and social norms, 'the players can engage in behavior that might be risky, uncomfortable, or even rude in their normal lives' [14]. The rules of the game, with which players must agree to comply, also help to break hierarchies and social norms. By introducing rules, the game can provide equal participation possibilities and avoid free-riders [8], which otherwise would not apply in ordinary organizational settings.

Although the game provides a fictitious world, game tools based on real-world data keep participants anchored to reality in the fictitious world [2]. The game tools hold information about the game and help

players to concentrate on their task. Furthermore, game processes have a power to let players immerse themselves in the game world and naturally commit to the task [22] even though their conventional work environment might be totally different. That being so, game elements make a difference by substituting for and freeing participants from their real-world cultures and processes without violating social norms and hierarchies.

2.3. Design game

In participatory design, Brandt et al. [3] have suggested a series of design games, using a form of board games for the purpose of empowering workers. In order to ground the games in real-world problems, field materials from ethnographical observation are collected to form game materials such as cards and pieces. With such original tools rooted in the real world, players can ground their play in the real world easily and deepen their understanding of the field as the game proceeds and the design takes shape.

For example, in the 'Layout kits', suggested by Ehn [9], players allocate machinery on the factory's floor plan to reconsider a machine layout in the factory. Players handle machinery cards as a tool in the game. The game lets shop floor workers participate in relocation of machinery and it contributes to their ownership of and satisfaction with their workplace. Brandt and colleagues [2] suggested a series of design games, the user game, the landscape game, the technology game and the scenario game, to design a space. In these games, participants create a persona, design an activity space, design shapes and functions, and play use-scenarios [13, 38], respectively. For those design games, it is of critical importance to reach a state where all stakeholders are satisfied and can contribute without being influenced by a single authority or affected by a loud speaker as the core aim is worker empowerment and equal participation.

The value of stakeholder involvements resides, as mentioned in Section 2.1., in the discussion processes realized by participation and understanding, creativity, and MECE requirements. In promoting stakeholder involvement, it is essential to overcome several challenges of open discussion to make the most of involving stakeholders. In such settings, a certain framework for involving stakeholders can be beneficial. Previous work such as the game approach utilized to design innovative service processes [42] show the potential of using game elements in the stakeholder involvement requirement specification process to elicit implicit requirements from stakeholders and support collective creativity as a practical tool without their being distracted by several disadvantages. Game approaches encourage collaboration among cross-disciplinary teams and stakeholder involvement through tools grounded in the real world, providing a setting for open discussions without hierarchical influence and an immersive experience for interdisciplinary stakeholders.

3. Methods – idea generation with games

In this section, we introduce our stakeholder involvement method with game elements. Our game is created by the authors, based on the design games suggested by Brandt [2] to create a specification for the next generation project management system. In contrast to the previous series of design games, which aim at facilitating a user-centered design process for cross-disciplinary design groups and emphasize empowerment through user involvement, our game focuses on promoting participation & understanding, creativity and an MECE requirements specification for requirement elicitation to improve project management systems.

3.1. Settings

The stakeholder involvement practice in which we applied the game elements is a system reformation project of an existing project management support system, the *PMWB*. The PMWB was developed by an international system integration company with 10,600 employees, about 30 divisions (2012) and strong organizational hierarchies. The current PMWB version is used in 3-500 projects per year by the company and their direct customers. Their customers range from medium-size private enterprises to public organizations, and the development projects range from small (one to five developers) to large (300 developers) projects.

The project began in 2010, when the company investigated PMWB usage and conditions in about 250 projects in order to understand the advantages and disadvantages of the current system. They found that the current PMWB was not as widely used as expected and some projects did not use the PMWB at all, others had installed it, but not used it, and others again allowed only a few experts to use it. The PMWB development team was under pressure because of the unexpectedly low usage and low acceptance rate among users and the resulting poor return on investment of the system.

To solve this problem, the PMWB development team (the PMWB task force) was established in May

2012 to develop a next-generation PMWB as a three-year development project. Thus, the project is to be finalized at the end of 2014, and the new PMWB will be released in spring 2015 to corporate users. As a first step of 2012, they set a plan for making a list of system requirements. The PMWB task force was organized to include nine decision-makers of the company; a department chief, two project managers, five members and one supporter. All of the team members had different core tasks in addition to the task related to the PMWB reformation. In addition to the nine members, seven external advisers from a consulting company, an independent consultant for concept making, and a university researcher joined the team.

3.2. Preparation of the game

To create a stakeholder involvement game for devising a system requirement specification, we first collected data on site. Ethnographical investigation and interviewing [e.g., 29, 19] (total 22 hours) was conducted with three subjects. In addition, five independent interviews (total 4.5 hours) were made including the observed subjects. Almost all subjects except one were users of the PMWB, and their background regarding PMWB experience and job experience varied, as shown in Table 1.

Subject ethnography & interview	Job title	Work experience	PMWB experience & proficiency
A (10 hours, 1 hour)	Senior developer of the PMWB development and maintenance team	7 years	7 years High as core developer of the PMWB
B (10 hours, 1 hour)	Senior developer of the PMWB development and maintenance team	5 years	5 years High as core developer of the PMWB
C (2 hours, 1 hour)	Engineer in a public finance system	5 years	4 years Intermediate as user of the PMWB
D (- , 1 hour)	Senior developer in the software development system	6 years	6 years High as heavy user of the PMWB
E (- , 30 min)	Project manager, Management section	11 years	N/A as no experience

TABLE 1. DETAILS OF THE FIVE SUBJECTS

For the contextual inquiry, subjects A and B were selected as experienced users and C was selected as a less experienced user. Subject A had been involved in PMWB development for seven years and was currently a senior member of the PMWB development team as well as a user of the system. Subject B was also involved in the PMWB development team for five years and was currently a senior member of the team and user. Subject C has been a developer in the public finance system development team for four years, and was a PMWB user. The 20 hours ethnographical data out of 22 hours were collected from subjects A and B. For those data, observations for two hours each day for the five workdays, totaling 10 hours each, were conducted in order to cover a full week of work procedures. The remaining two hours were spent with subject C. An interview of one hour was held with each subject, independent from the contextual inquiry.

Additionally, interviews were conducted independently with subject D for one hour and subject E for 30 minutes. Subject D who was a developer in the software development system and user of the PMWB was selected as an experienced user. Subject E worked in the management section and developed a public system as an engineer and project manager for 10 years. In spite of his long system development experience, subject E had not used the PMWB before, and was thus selected as a less experienced user with long work experience.

The focus of the observations was to find characteristic usages in daily work tasks as well as identify problems [29]. The observation and interview data were collected by recording conversations, taking pictures, and making notes in a paper notebook. Only in the case of subject C, recordings were not permitted because of difficulty obtaining end-users' permission.

3.3. Game design

One university researcher (the author) and a member of the task force designed two games utilizing data collected on site; the needs game and the scenario game. In this game design, a game structure such as game tools, worldview, rules and goals were set in three steps (Fig. 1).

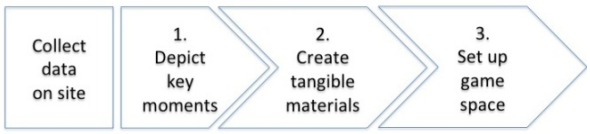

Figure 1. Three steps of game creation

First, the game tools for two games (Fig.2) were created based on the video, picture and interview materials collected on site. Second, identified problems, characteristic happenings on site and comments were depicted and selected, and finally transformed into tangible materials such as cards or video clips. They comprised 30 moment cards, the equivalent of 30-second video clips, 30 title cards, 30 comment cards, 30 event cards and 30 function cards. All cards were name-card size picture cards used as game materials. The video clips show target user's activities with the PMWB or other tasks in 30 seconds, and the moment cards show a moment

equivalent to each video clip. The title cards show expected needs depicted by ethnographers through contextual inquiry, and the comment cards show users' original comments such as feelings and opinions, collected during observation or interviews. The event cards show happenings or daily routines observed or mentioned during the observations or interviews which influence users' daily activities and usage of the PMWB. As shown, game tools such as cards and videos are deeply rooted in identified problems, challenges, and the needs of the end-users.

Figure 2. Game tools [Left: the moment cards, Right: the function cards]

Finally, the game space such as worldview, goal, and rules were designed as restrictions [14, 22] (Fig 1). Our game's world takes place in 2015, which is the near future when the new PMWB is to be released. The main character of the story is an engineer called Taka Kaneguchi who is a fictitious user persona [23], created by the organizers and based on the target user data collected from the field investigations. The main three rules we applied were (1) keep your turn (never skip your turn), (2) keep time limits, and (3) play is based on the provided materials. During the game, facilitators (the game designers) ensure that stakeholders follow the rules. Next we describe a game workshop that we conducted, and explain the procedure of two games.

3.4. Two design games: task and procedure

We conducted a game workshop at the end of March 2013 as a first step toward a requirement specification. For the workshop, six participants from the PMWB task force and the support team were carefully selected to reflect the PMWB development environment. The six participants were divided into two teams as shown in Table 2. Each team consisted of three participants with different backgrounds and roles. Given the stakeholders' practical constraints in terms of attending the workshop, the game duration was limited to one hour each, and the total duration of the workshop was three hours.

The first game is a needs game. It investigates a fictitious user, engineer Taka, through telling his story. The video clips, the equivalent moment cards, the title cards, the comment cards, and the event cards are prepared for use as game tools (Fig. 3.).

TABLE 2. GAME PARTICIPANTS

Team A Job title (age)	Young developer (late-20s)	Senior consultant (mid-30s)	Senior manager (mid-50s)
Team B Job title (age)	Young assistant (late-20s)	Group manager (mid-30s)	Senior manager (late-40s)

The game starts when the two moment cards are distributed to each player and other cards are piled on the table. The first player then picks two comment cards and one event card, and all team members watch the two 30-second video clips, which are equivalent to the first player's moment cards. After watching two video clips, the first player makes up a story based on the five cards s/he picked. Then, s/he places all five cards on the table in order and makes a title, using the title card or making his/her own title on sticky notes to reflect a need disclosed by the story (Fig. 3). The next player uses two other moment cards at hand, and two comment cards to overlap her/his story with the previous one. This means that the second player is required to use at least one card already placed on the table in the previous turn. Only when the player has difficulty making up a story is s/he allowed to pick one event card to make a move [9] in the story. The game is over when all moment cards are used or all team members agree that no new stories can be created. During the process, one previous player will keep a record of a story on the needs sheets, which is a storyboard, telling the flow of the story. In the needs sheet, a team member fills out a detailed story they created (Fig. 4).

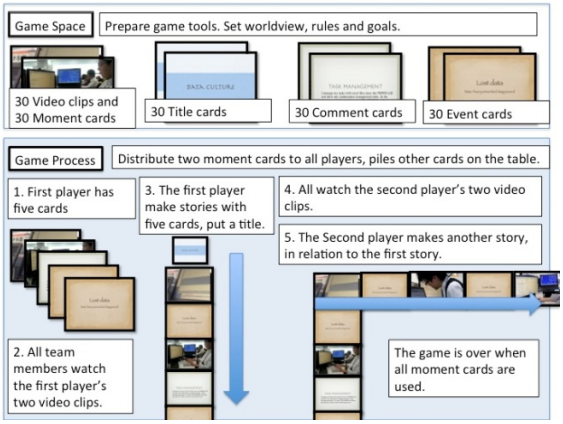

Figure 3. The game structure and process

Figure 4. A scene of the needs game

The second game is a scenario game. The scenario game fills a gap between the current situation and an ideal situation in the form of a story. Throughout the game, participants create use-scenarios in which the engineer Take uses the new PMWB in 2015. The game uses the needs formats created in the needs game, and the function cards (Fig. 2).

In the first round, all three players make up a story about the first prioritized needs. The first player draws one function card, makes up a story, starting from the current challenge and ending with the future story, focusing on how the future PMWB with the function can change the current situation. Then, the second player draws another function card and makes up another story for the same challenge. In this way, a team creates at least three stories for each need. Making up their own story means that all participants find a solution to the same need from different perspectives. In the end, the team accumulates multiple solutions for each need.

The two design games mentioned are successive games that should be played together. The structure is such that the experiences from the previous game are condensed; empathy for the users and the use-situations is developed; and the design concept is elaborated while the players create scenarios. One of the keys of the game is a process of creating stories. By describing a story - one of the key activities in the design games known as a multi-faceted design tool [38, 40] - the games aim at simulating targeted users' experiences and feelings by creating a story which can help them to understand challenges and design new systems [13]. All the more, those vividly described scenes will be shared by all stakeholders.

3.5. Research and analysis methods

This work has design science and action research characteristics. Like design science, it aims at creating successful artifacts and covers the three steps of the design science process, namely problem identification, objectives of a solution and partially of design and development [29]. At the same time, the authors get involved in the project as researchers and consultants, conduct the ethnographical inquiry as ethnographers, prepare the materials for the design game and organize the design game as facilitators [17, 34].

Three kinds of data were collected from the game workshop and analyzed with the mixed methods [15, 34]. More precisely, three hours of conversation and video data were described and analyzed, using protocol analysis [9], and the needs sheets and the storyboards described by teams during the games were collected as game outputs for the later phase of system development. In addition, questionnaires were administered after the workshop so the feasibility of the game method for research purposes could be evaluated.

4. Results

In our stakeholder involvements workshop, which aimed at finding a preliminary set of requirement ideas, participants extracted four critical challenges with 39 functions for use in a style of stories. Those ideas were generated collectively through game plays, deeply considering other stakeholders' points of view and understanding current PMWB usage based on the field data. In this section, we summarize the results of the game method, focusing on suggested ideas incorporated in stories regarding requirement specifications.

4.1. The four challenges

In the workshop, team A constructed four stories and team B constructed three stories, which externalized the multiple challenges of the current PMWB. The externalized four challenges from both team A and B shown in Table 3 are interpreted as needs related to routine work, rational usage, coordination and user experience.

First is the challenge of routine work. PMWB users often make progress reports and quality management reports by using reporting functions. Since the procedures are static, those activities tend to be routine work, even though they must always pay attention to outliers. For example, quality evaluation of developing functions could become a daily routine since the cycle of checking, calculating and evaluating bugs can be done in an automated and systematic way. The story A-1 externalizes the risk of following routine processes as an ordinary daily routine without checking details consciously. The stories show the importance of letting developers work as creative human workers rather than robot-like routine workers incorporated in a systematic work process.

The second challenge concerns coordination with tangible and intangible peripheral tools. The PMWB is designed as an independent project management tool, and does not coordinate with other software such as mail client systems or spreadsheet software, or tangible artefacts such as memos, paper calendars and notebooks. It was already obvious from the observation and interviews that the PMWB users often utilize quite a few applications to conduct their

tasks efficiently. For example, subject A often referred to a paper calendar at hand rather than the digital calendar offered by the PMWB while he was rescheduling a project plan on the PMWB. He opened quite a few applications while using the PMWB. He used multiple displays, often shifted displays from PMWB to mail client, memo pad and spreadsheet files, and returned to the PMWB. Similar practices were observed with other subjects as well. These stories tell us about the importance of the availability and multiple views of a few relevant data in relation to the PMWB. In this second story, the importance of peripheral materials such as papers, notebooks and other software and its coordination are advocated.

The third challenge concerns differences between new users and expert users. The stories showed that experts could utilize complete functions without feeling stressed and often carried out their tasks in combination with other applications in order to carry out tasks efficiently. Although these experts are not fully satisfied with the current PMWB, they at least know ways or can invent ways to get the most out of the system. On the other hand, new or non-experienced users make unnecessary repetitions or detours to finish their tasks, get stressed by the system's incompatibility with other software and face challenges in managing their tasks.

TABLE 3. RESULTS OF THE GAMES

Team A			
#	Stories	Challenge	Function name
1	The story is about a user who uses the PMWB on a daily basis. He questions the importance of the system for his daily work as he can manage well without it. He is required to use the PMWB as a development team member, however, so he uses it together with other applications.	Routine work	1. Improve usage in practice 2. Introduce milestones 3. Record trajectories 4. Introduce human helper 5. Introduce global standard 6. Improve interaction with people in situ
2	The story is about the user who uses PMWB rationally. He has no interest in using it for its own sake rather than completing the tasks.	Rational usage	1. Multi-project view 2. Initial setting support 3. Legacy function clean up 4. Improve share 5. Trace eye track 6. Localization
3	The story is about the expert's way of using the PMWB. He finds it important to combine it with other applications and tangible tools such as paper. He sometimes advises new users.	Coordination	1. Customization 2. Import 3. Customer focus 4. Project manager support 5. Support statistical analysis 6. Support digital documents
4	The story shows gaps between digital and analogue aspects of PMWB. It clarifies what PMWB can and cannot do by describing a system down event.	Coordination	1. Multifunctional view 2. Role allocations 3. Process visualization 4. Routine support 5. Auto input 6. All-mighty manual

Team B			
#	Stories	Challenge	Functions
1	The story is about the expert's way of using PMWB. He finds it important to use it with other applications and tangible tools such as paper. He sometimes advice new users.	User experience	1. Level up 2. Routine macro 3.Coordination 4. Multi-view 5. Global standard 6. Customer support
2	The story is about a critical event in which a user almost overlooked a system warning. Large part of his daily work has become routine work, which makes it hard to pay attention to details.	Routine work	1. Mile stone 2. All mighty manual 3. Role 4. Set up support 5. Space customize
3	The story is about a PMWB server breakdown and a help desk role. The story shows the procedures the user follows to solve the issue. He first checks several mails and applications, and makes a few reports to managers. There are many other procedures he should follow and his task list grows.	Coordination	1. Localize 2. Initial setting 3. Improve data usage 4. Automatic statistics support

The fourth challenge concerns user experience. The story shows that the PMWB offers only rational usage and cannot provide any good user experience or flow experience [4] for both novel and expert users. The primary reason why many people use the PMWB is simply because they are 'required to use' it and not because it helps them with their tasks. They would, however, like to gain more experience with the PMWB.

4.2. The 39 functions

In the workshop, team A created future stories with 24 new PMWB functions based on the four challenges depicted in the stories. Team B created stories with 15 functions based on the three needs. We will review a few functions as examples.

In order to overcome a challenge based on story A-1 in relation to routine work, team A suggested six functions. For example, function 1-3 (see Table. 3), *record trajectories*, makes it possible for users to record what they did in the project automatically so that they and other team members can trace the whole process from start to finish. The function aims at including reasons and developers' intentions in the system development records and consequently adds meanings to the daily tasks. Function 1-6, *improve interaction with people in situ*, supports the PMWB users' personal interaction with other members of the project team. The function aims at facilitating social interaction among team members, which is often critical for successful system development projects.

Team B suggested six functions for story B-1, challenging user experience. Function 1-1, *level up*, supports users by offering limited functions to match their job authority. Novel users can get limited access to the system and expert users can customize it to their own requirements. Function 1-2, *routine macro*, offers experience process maps to new users so that

they can follow the expert choices step by step in achieving a certain task.

5. Analysis and discussion

In this analysis section, we also pay attention to how the method characteristics such as stakeholder involvement and game elements give impact on idea generation for eliciting requirements of the new PMWB.

5.1. Impact of stakeholder involvements

In spite of limited field data (30 sets of varied cards) and game duration (one hour for each), players completed two games and generated seven different stories, consisting of four major challenges with 39 functions for the next generation PMWB. Here, we saw direct impact of stakeholder involvement on preliminary requirements elicitation. Importantly, as shown in the results, participants with different knowledge backgrounds shared understanding about the different user groups, tasks and challenges that the current PMWB also has to treat, as the game proceeded. Stories provided insights about the user at the varied knowledge level evenly to the team members. The preliminary analysis of the questionnaire results also supports these insights. The senior manager in team A commented, that he recalled a novel user's dilemmas through the game, which he had forgotten for a long time.

In addition to simple benefits of stakeholder involvement, our case also shows a benefit of diversity. In our case, three people with different knowledge backgrounds played different roles in developing the PMWB and contributed to the team diversity from different perspectives. For example, the task force often discussed how to support routine work but never looked for ways to avoid it. In the game workshop, they found disadvantage of routine work and even created a few solutions shown in Table 3. In the questionnaire, the young assistant in team B mentioned that she did not come up with the hidden issues behind routine work (#1, Fig.3.) in a brainstorm session, which the task force team conducted beforehand. The comment clearly showed that generated ideas through the game covered and added to the results of the brainstorming.

5.2. Impact of the game elements

We observed that the game elements added to the results in several ways, namely, grounding in real-world issues, open discussion regardless of hierarchical considerations and immersive experience to overcome cross-disciplinary challenges. They are of greater benefits to the creation of specification ideas through games.

Our stakeholder involvement method with game elements provided strong support for grounding people in real-world problems, grounded solely in the chosen topic. Participants focused on playing the game intensively for hours and hardly took any detours or adopted any fantasy suggestions as shown in the results (Table 3). It avoided divergent thinking [7], which is one of the biggest disadvantages of conventional free idea generation methods such as brainstorming. In contrast to such conventional free idea generation, our participants managed to avoid excessively unrealistic ideas resulting from the game elements. It was clear that the game cards and videos had strong impact on this and let the participants engage with real-world challenges. At the same time, elements of the game structure, e.g. its time-intensive duration, let the participants concentrate on the task at hand.

The game space and rules let all six participants have an equal say since they had to wait for their turn to tell their own stories and helped to achieve open discussion. Conversation data shows that they followed the rules and had no clear violation of each other's turn. That being so, participants, regardless of their organizational status, gave impact evenly to the game process, and their opinions were reflected in the team results. This avoided hierarchical obstacles and free-riders, which can be seen particularly in large organizations. The opinions of those who tend to be in a weaker position in hierarchical organizational settings were equally listened to and insightful ideas were evaluated. When a participant in a higher social position gave his/her opinion in another's turn, the rule stopped it, without causing tension. By introducing the game elements, the design game could include stakeholders equally and openly at the discussion table, reflect their different opinions evenly and let them commit to the requirement specification. The game elements force participants to follow the rules and roles without violating stakeholders' social status.

The game elements also provided an immersive experience to stakeholders. In spite of the importance of commitments [18], it is not an easy task to motivate all stakeholders to commit to the development process beyond their job descriptions. It is known that commitments and consequently involvement in the development process can easily be achieved under emergency situations such as natural disaster [41], but it is hard to create such urges artificially.

In our case, game elements as well as their job responsibility made them commit and engage with the workshop. All stakeholders who attended the workshop had a responsible position in relation to the project and an urge to complete it. The project schedule was already planned and a fixed schedule required them to develop the system in six months. Differently from typical stakeholder involvement cases, which tend to focus only on the initial design phase without having a real development plan, our case had a static plan, which continued after the workshop. Such practical constraints made participants more responsible for the outputs and they were actively motivated by their own tasks in the workshop. From our workshop data, it is difficult to show evidences of this immersive mindset. However, according to the questionnaire, they concentrated, enjoyed and excited so that their satisfaction level was high. It is also likely that game elements might contribute to their high satisfaction by making them immerse in the activity.

In order to determine the impact of the game elements, we need to conduct a deeper analysis of the workshop data, although the game output have already given us some hints about what the game can provide. One clear result was that the game elements made it possible to extract critical creative items for the new system. This was possible as all stakeholders played an equal role, making suggestions based on the real-world challenges without being trapped by irrelevant data.

6. Implications and future research

In this paper, we suggest a unique approach to IS requirements specification by applying stakeholder involvement methods with game elements. It is applied in a real development project of one of the world's largest system integration companies. Making system requirements specifications is a challenging task in IS design especially when the system has wider users such as project management system of a large IS firm. More over, in terms of meeting increased user expectations nowadays, conventional system specification approaches are limited.

Our case indicates that the suggested stakeholder involvement method with game elements have a strong potential for providing creative ideas and also externalized wide-ranging implicit user expectations of requirements specifications by utilizing selected tools, defined rules and goals. As a result, our preliminary requirements list, more precisely, an idea list covered critical aspects of system requirements that conventional specification analysis cannot provide, and had a useful impact on the preliminary step towards formal requirement specifications.

We should mention that not all the suggested functions and usage stories are fully innovative and that it is technically challenging to realize some of them within two years. For that reason, it could be arguable whether generated specifications ideas in the workshop were directly implemented to the system specification for the development in next year. There is still a wide gap between what we have as a result of the game approach and a formal model of requirements specifications. The granularities of extracted system requirements need to be refined and transferred to detailed requirements for developers to use. Clearly, more steps are needed to obtain detailed requirements of this preliminary requirements list.

This work has several limitations. First of all, it is a challenge to fill the gap between the low granularity and the high granularity formal requirement specifications. It is also important to determine how much stakeholder involvement is beneficial for deciding requirements. It might be that some phases should be dealt with only by developers and later reviewed by stakeholders. Most importantly, it is still a remaining challenge to assess quality of generated results such as narratives and generated law granularity specification as well as impact of stakeholder involvement and game elements. At this time of the development stage, only a partial evaluation could be possible to determine the value of our approach. We believe it is of critical importance to await proper assessment of the game value until the implementation of specification list is carried out. We should also point to the fact that creating an original game is a time-consuming task.

Our study has a range of implications for future research. One is to devise a formal requirement specification in developers' language based on our results. It will help to evaluate the validity of the game approach. Analyzing the consequences in the next phases of the development project is another. Comparative analysis with other requirement elicitation methods including other types of stakeholder involvement methods such as brainstorming is also of importance. The authors are currently in the process of conducting comparative analysis with several stakeholder involvement methods used in the project. In addition, testing our method in other settings or projects would also assist in evaluating the validity of the method and improving quality of the approach.

7. References

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