Engaging the Crowd of Stakeholders in Requirements Engineering via Gamification

Fabiano Dalpiaz[1], Remco Snijders[1], Sjaak Brinkkemper[1], Mahmood Hosseini[2], Alimohammad Shahri[2], and Raian Ali[2]

[1] Department of Information and Computing Sciences, Utrecht University, the Netherlands

[2] Faculty of Science and Technology, Bournemouth University, United Kingdom

Abstract   Requirements engineering (RE) is the discipline that focuses on obtaining a specification for a system that fulfils the expectations of the stakeholders. Unfortunately, the current state of the practice shows that only a few stakeholders are involved—mostly key clients and lead designers—, and active stakeholders are not highly engaged. This lowers the chances of obtaining a system that fully fulfils the stakeholders' wishes. Gamification is an opportunity to increase the engagement of stakeholders in RE by establishing feedback loops that reward the useful participants, i.e., those that provide valuable contributions (requirements) for the system under design. The related trend of crowdsourcing can be employed to maximize the number of participating stakeholders, by making RE a participatory activity where current and prospective users, developers, clients and analysts are involved. This chapter introduces the Crowd-Centric Requirements Engineering (CCRE) method that guides software producing organizations (SPOs) in involving a crowd of engaged stakeholders in RE. CCRE uses the *REfine* tool, a gamified platform for eliciting and refining requirements. In addition to presenting the method and its application to a case study, we define research challenges for the field.

1 Introduction

The involvement of stakeholders in design and engineering endeavors is renowned. In management science, it was early shown that user participation can overcome resistance to change (Zand & Sorensen, 1975). In requirements engineering (RE), the process that leads to the specification of a software system, user involvement can improve system acceptance (Kujala, 2003), diminish project failure (Emam et al., 1996; Kujala et al., 2005), deliver greater system understanding by the user (Damodaran, 1996), and improve customer loyalty and broaden the market (Kabbedijk et al., 2009). Recent surveys identify user involvement as the most important success and failure factor for information technology projects (The Standish Group, 2009).

The problem of stakeholder engagement is particularly hard for software producing organizations (SPOs), which guide the creation and evolution of software solutions that are delivered to multiple clients, as opposed to ad-hoc software solutions that are

tailored for one specific customer. The increased difficulty is due to the volume and diversity of requirements from the many clients, the challenge of aligning these requirements with the SPO's vision of and road map for the product, as well as the business concern of focusing on the key clients that generate most of the revenues (Lucassen et al., 2015a).

We propose to rely on two pillars to maximize the engagement and participation of stakeholders in RE for software products: (i) *gamification* (Deterding et al., 2011) as a means to improve motivation, and, ultimately, quality (Eickhoff et al., 2012); and (ii) *crowdsourcing* to achieve higher, broader involvement through the outsourcing of a function to an undefined network of people by means of an open call (Howe, 2006).

We go beyond existing works in the intersection of crowdsourcing and RE. The StakeRare method (Lim & Finkelstein, 2012) uses the StakeSource 2.0 tool (Lim et al., 2011) to involve the crowd in requirements identification and prioritization. A similar approach is the CrowdREquire platform (Adepetu et al., 2012). However, these platforms do not provide explicit means to motivate participants. On the other hand, the game-based collaborative tool iThink (Fernandes et al., 2012) helps collect new requirements and gain feedback on existing requirements; we make a step further by proposing an RE method where this type of tooling can be employed.

In this chapter, we present our method for crowd-centric, gamified RE that reconciles the desire of large user involvement with the business concerns of an SPO to satisfy key clients and to lead the evolution of its software products. The Crowd-Centric Requirements Engineering (CCRE) method that we describe realizes our vision of a more participatory RE (Snijders et al., 2014) by employing the *REfine* gamified online platform for requirements elicitation and refinement (Snijders et al., 2015).

The rest of the chapter is structured as follows. In Section 2, we describe the method that we followed to construct the CCRE method. Section 3 describes the method as well as the *REfine* tool that supports it. In Section 4, we present research directions in the field, based on empirical studies that we conducted. We conclude in Section 5.

2 Method Design

We followed a design science research approach (Peffers et al., 2007) for building and evaluating our proposed CCRE method and its support tool *REfine*. Literature played an essential role, for it was used not only to create the baseline of our method, but also to develop questions for a panel of experts, who provided us with in-depth insights for devising CCRE. All details of the design process are in (Snijders et al., 2015).

Ten experts participated in individual semi-structured interviews. Six experts worked in the software industry as advisors, technical directors or product managers, while four were researchers. The questions concerned three key topics: describing the current RE process, identifying room for improvement in RE, and defining success and failure factors for implementing crowdsourcing and gamification.

Each interview was recorded and summarized, after which the recommendations of the experts were extracted by tagging the key statements that the interviewees made.

While some recommendations were literally stated, others were interpreted and re-phrased by the researchers. This extraction led to 112 recommendations. Interviewees put focus on varying areas, which was reflected in their recommendations. For example, one interviewee focused highly on offline representation of users, whereas another interviewee was mainly interested in crowdsourcing and gamification aspects.

After an initial mapping of the recommendations on categories that resulted from our literature study, several categories contained many recommendations (e.g., user involvement and gamification elements) and a number of recommendations were overlapping (e.g., "Involve users, to understand what the real problems are" and "Involve real users, not representatives"). These results were then organized into a revised set of categories and recommendations, while keeping track of the number of times a recommendation was given. The 68 resulting recommendations were the direct input for our method development.

3 The CCRE Method

Based on the expert recommendations, we carried out a rigorous method engineering process (Brinkkemper, 1996) to augment traditional methods for RE with elements that enable realizing the vision of crowd-centric requirements engineering. The resulting CCRE method includes seven phases, as shown in Figure 1. A complete explanation of all activities within the phases can be found online (Snijders et al., 2015).
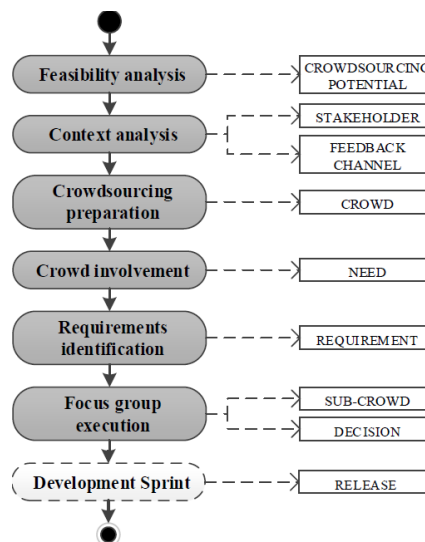

Figure 1. The CCRE method. Iterations exist also between and within the phases. The bottom-most phase shows the connection to development, but is not part of CCRE itself.

3.1 Feasibility analysis

The goal of this phase is to determine the applicability of CCRE for the specific situation. It is therefore positioned as the very first step of CCRE, to prevent allocating resources to low-potential endeavors. Applicability is determined in terms of the potential of crowdsourcing and gamification for the product at hand.

Firstly, the scope of the method is defined: what is the area that CCRE will be applied to? While in one situation it might be useful for the long-term product roadmapping, in another context CCRE may be applied only to the product user interface.

Three other aspects are then determined (i) the SPO's future vision for that specific scope, (ii) the degree of openness of the SPO to the crowd's inputs, and (iii) situational factors that affect the effectiveness of crowdsourcing and gamification. The potential for crowdsourcing is concluded and results in a go/no-go decision.

CCRE would be unsuitable for a product with very few clients, and for which the SPO has clear vision and low openness to the crowd. On the other hand, CCRE would suit a product with numerous customers, low vision, and high openness.

3.2 Context analysis

This phase analyzes the context of the requirements elicitation, by identifying candidate stakeholders to involve in crowdsourcing (users, developers, analysts, clients, regulatory bodies, etc.) as well as the existing channels they can currently use to provide feedback.

A primary interactive platform is selected and a community manager is appointed to moderate the inputs and oversee the process. Our *REfine* tool is a possible platform that was designed for CCRE. Secondary channels have to be monitored too (e.g., e-mail, forums, etc.), for some users are likely to bypass the primary channel.

3.3 Crowdsourcing preparation

Before initiating the actual crowd involvement, the crowd has to be formed, its characteristics assessed and its members prepared for the process. To mobilize stakeholders, the existence of the interactive platform has to be communicated and an incentive to be part of the community has to be provided through a marketing campaign.

The CCRE method should provide adequate incentives, through the choice and implementation of gamification elements. The adequacy of the elements is domain specific (Nicholson, 2012). The experts we interviewed suggested exploration, group forming, roles and rewards as useful techniques. The literature study has identified important elements such as accelerated feedback cycles, clear goals and rules of play, a compelling narrative, challenging tasks (Gartner, 2011), situated motivational affordance, universal design for learning and player-generated content (Nicholson,

2012). Pointsification in the form of points, leaderboards and achievements can provide a short-term incentive (Hamari et al., 2014).

Our gamified platform *REfine* is illustrated in Figure 2. Apart from the home-, about-, leaderboards- and contact pages, *REfine* contains three important pages: the needs overview, need details, and user profile. On the menu bar, besides the hyperlinks to other pages, the user status bar shows the coins and points of the user.
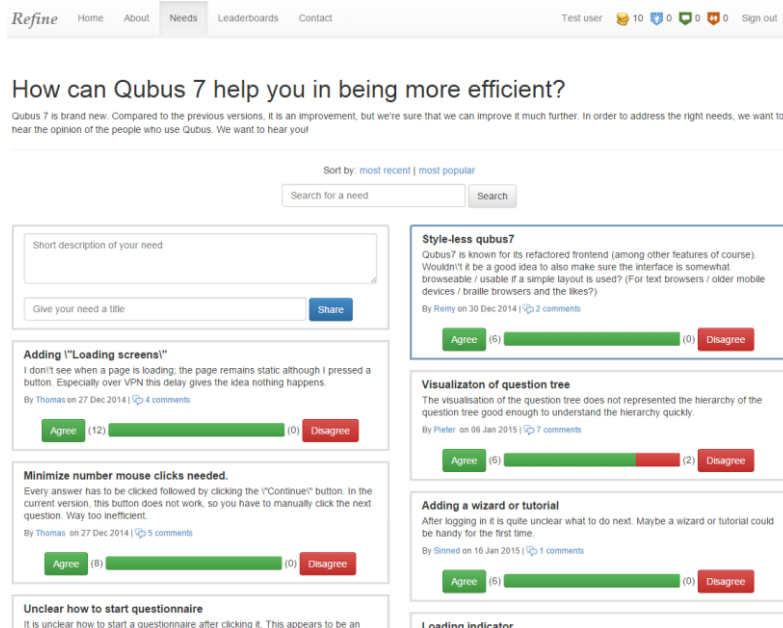

Figure 2. The needs overview of *REfine*

Six types of gamification elements are implemented, each positively contributing to one or more social factors (Hamari & Koivisto, 2013):

— *Roles* contribute to network exposure and reciprocal benefit: *ideator* of new needs, *commenter* on existing needs, and *assessor* by voting (like/dislike) on needs. The proficiency in a role is represented by points.
— *Resources and points* contribute to recognition and reciprocal benefit. Points are directly earned by adding needs, commenting, and voting, and indirectly when other participants vote or comment on her created needs. Resources are expressed via coins that are required to perform actions.
— *Leaderboards* contribute to recognition. There are three types of leaderboards: (i) for each of the roles; (ii) for individual needs; and (iii) global.
— *Group formation* contributes to network exposure and social influence. Group formation is stimulated by the transparency of the stakeholders' background, and the separation of leaderboards per need.
— *Exploration* supports network exposure. Althoughminimally implemented in *REfine*: stakeholders can branch needs suggested by others and explore those traces.

— *Endorsements* favor social influence, recognition, and reciprocal benefit. Votes and comments have the function of endorsements that support/detract a proposed need and provide more details/opinions, respectively.

3.4 Crowd involvement

This is the phase where crowdsourcing and gamification happen. The crowd of stakeholders share their needs with each other, through the use of the interactive platform.

Since the aim is to let stakeholders learn from others and reach consensus, the crowd can discuss the suggested needs, using comments and need branching/merging. This latter functionality (supported by *REfine*) prevents users from hijacking existing needs and instead motivates them to improve them. This discussion activity enables explicit requirements negotiation, a largely overlooked phase in traditional RE.

The crowd should also be able to communicate if they agree or disagree with the suggested needs. In line with the work of Berander and Andrews (2005), CCRE proposes that the simplest appropriate technique should be chosen for prioritization.

During crowd involvement, the crowd should be engaged and tuned by the community manager to ensure that the incentives fit the crowd's characteristics.

Stakeholders will probably bypass the chosen channel; as such, feedback mining techniques should be adopted to gather valuable needs. Social media analysis techniques such as opinion mining (Dave et al., 2003) and sentiment analysis (Pang & Lee, 2006) could be employed to process such semi-structured feedback.

3.5 Requirements identification

The needs that were suggested, discussed, and voted upon are candidate requirements for the product. Product managers and requirements engineers of the software product are involved, due to their knowledge about technical and business feasibility.

While sometimes mapping a need to a requirement may be easy, in other cases the need may be still vague (e.g., "I want to have a more usable interface"). In the latter case, the involvement of the product management is key to understanding the need, refining it, and generating concrete solutions, working towards a product requirement.

In requirements identification, we distinguish between mainstream requirements, which are supported by a significant part of the crowd, and minority requirements, which have a smaller backing but are important for certain subgroups of the crowd. Requirements priority (Wiegers, 1999) is based on their business value if implemented, the penalty if excluded, the implementation costs, and the risk for the business.

3.6 Focus group execution

Focus groups are organized for the requirements with higher business priority and stakeholder value. The focus groups further develop the requirements by exploring alternative design options. The most active stakeholders for those requirements are invited, including the ideator and most active contributors; while the SPO develops design options for the requirements and evaluates their quality, ruling out the low-quality ones.

4 Research Challenges

We present research directions that originate from a case study with CCRE in Section 4.1 and from empirical studies with domain experts in Section 4.2.

4.1 Challenges from a case study with CCRE

We have applied CCRE to a beta version of the Qubus 7[1] Governance Risk and Compliance (GRC) tool, a web platform for compliance auditors to conduct their assessment activities at customers. The study involved 19 participants (product managers, developers, experts, clients, end-users, prospective clients) which expressed 21 needs, 37 comments and 130 votes through *REfine* over the course of one month. Three mainstream needs and one minority need were analyzed by the SPO, and three of them were further discussed in focus groups with the top contributors according to the need-specific leaderboards. More details are available in (Snijders et al., 2015).

The users of *REfine* found the process as difficult, more useful and more engaging compared with previous feedback experiences. They felt motivated and thought that their input would be taken into account, but they thought that their priorities were not clearly presented to the SPO. They stated that the most common activities they performed were reading the needs and providing suggestions. The participants took little notice of the points and leaderboards on the platform, but largely agreed with the statement that the game elements made the experience more pleasant. Voting and commenting were considered very useful, while the utility of branching needs was rated neutrally.

In line with the findings by Hosseini et al. (2015), the experiment showed the difficulty in engaging a large number of participants, especially clients and end-users of the software product.

An interview with two members of the Qubus product management revealed further challenges for our method and tool, including little incentive to return to the platform, and the risk that novice participants would suggest trivial needs.

---

[1] http://www.qubussoftware.com/

We also consulted three external software product managers with experience in RE that responded on statements after a presentation of the method, prototype and the requirements obtained from the case study. They identified further challenges, observing that the quality of requirements would not be significantly better than the quality of the experts' methods, and the requirements may not be detailed enough for a focus group or Product Backlog. This risk could be mitigated through the use of tools that increase the quality of requirements expressed via simple formalisms such as user stories (Lucassen et al., 2015b). The risk of a non-representative crowd was also mentioned, as well as the different vocabulary of developers and end-users.

4.2 Challenges from empirical studies

The use of crowdsourcing and gamification poses several general challenges, such as the quality of the obtained results from the crowd and the compatibility of gamification design with user types and work environment. Besides the well-known challenges, the application of gamified crowdsourcing for RE introduces nuances and peculiarities mainly about the quality of requirements elicited and their trustworthiness. The challenges presented in this section have been extracted from two different empirical studies, the first one involving 14 users and 34 experts in RE (Hosseini et al., 2015) and the second involving 12 employees and managers, and 30 experts in gamification (Shahri et al., 2014).

Challenges of applying crowdsourcing for RE. Crowdsourcing typically introduces a diverse crowd into RE, and such diversity may render decision-making processes harder to achieve, as several conflicting requirements may be stated by the crowd. Furthermore, such diversity makes it difficult to aggregate the results and developing an agreed approach which satisfies all is naturally difficult. In addition, the lack of systematic approaches to aggregation also makes it difficult to trace an individual's requirements in the final aggregated requirements model.

Involving a crowd with different levels of competence is also necessary for comprehensiveness of elicited requirements and their accommodation of both novice and more expert users. Without a proper balance among stakeholders with different competence levels, requirements engineers may only be able to elicit certain types of requirements, neglecting requirements from other types. Creating and measuring such a balance poses another challenge for requirements engineers.

Collaboration among stakeholders can also lead to dominance of certain opinions and clustering among the crowd providing the requirements. Dominance of crowd members happens when they have some authority, e.g., managers and their employees in the same forum, or when they use a persuasive and influential language to deceive others (e.g., assertions). Clustering among stakeholders arises when each cluster tries to enforce their own viewpoints/needs on the requirements elicitation system.

Finally, keeping the crowd informed about their activities during RE processes via feedback channels can prove to be difficult as feedback should be timely, meaningful

and comprehensible and should not interrupt stakeholders' activities or cause them information overload, which is, for some, as bad as the lack of information.

Challenges of applying gamification for RE. Gamification of RE processes has technical and organizational costs and expenses. Also, as gamification is not a "one-size-fits-all" solution, it can adversely affect the process instead of supporting it.

The engineering of gamification is challenging in the set of expertise it requires, necessitating the involvement of people from different domains, such as behavioral economics, psychology and human-computer interaction. Such diverse expertise is key to ensuring properties such as compatibility of game mechanics with the nature of requirements being elicited and the organization norms and culture.

Gamification is considered to be a performance-changing approach towards adding motivation in a given work environment. An ad-hoc design of gamification can have major effects on the users and lead to lower performance compared to a non-gamified process. This could mean, among other things, fewer elicited requirements, e.g., when stakeholders prefer to be commenters and not ideators in order to get points faster, and inappropriate requirements prioritization, e.g., when top requirements in the list get more hits because they are more easily available.

Stakeholders should also be able to choose to not use gamification and this introduces new challenges as well, e.g., when gamification is rooted in the requirements elicitation system and is an integral part of it, and when a stakeholder or a user is an introvert who does not embrace some of the applied game mechanics. In the latter case, the introvert stakeholder may actually perform less efficiently, e.g., identify fewer requirements, in order not to appear in leaderboards and get social recognition.

Gamification can negatively influence the trustworthiness of elicited requirements as certain users may only participate for the sake of the rewards. Furthermore, gamification can also adversely affect stakeholders' intrinsic motivation in the RE process, meaning that gamification may replace intrinsic motivations with some game elements, which usually have a shorter motivation life span, and when these game elements are removed from the requirements elicitation system, stakeholders may no longer feel motivated and engaged.

Finally, gamification should adapt to the characteristics and preferences of different stakeholders' characteristics, such as age, gender, culture and competitiveness of game mechanics, if a successful implementation of gamification is to be achieved. Different people are motivated in different ways and the gamification process should adapt accordingly to their personal characteristics and preferences.

5 Conclusion

In this chapter, we argued that the quality of the RE process, and of the resulting requirements, can be significantly improved by opening participation in RE to *all* stakeholders, including current and potential end-users, developers, clients, etc. In order to conduct this participatory RE process, we presented the CCRE method that employs

gamification as a mechanism to engage stakeholders into an organized crowd, and to keep them motivated throughout the RE process.

Our results show that the discussions between the involved stakeholders produced requirements that were perceived as useful, and that *REfine* helped the refinement process leading to more accurate requirements. More evidence, however, should be collected through the conduction of experiments that isolate the treatment factor (gamification) from other factors such as the user interface.

To have a more holistic view in this study, we recognize the need to address further aspects of the method. The first one concerns the diversity in personality of the stakeholders. The personality traits discussed in (Costa & MacCrae, 1992) should be considered while designing a gamified platform for requirements elicitation, as the success of the design highly relies on the perception of the stakeholders using it (Shahri et al., 2014). For example, while extrovert users may openly express their requirements in a forum where managers can see their feedback, introverts may refrain from doing so. As a result, the design of gamification should provide various features appropriate for motivating both introverts and extroverts. Another aspect concerns whether the gamified platform is being used to elicit requirements for a new software system or for evolution of an existing software system. For developing new software systems, the gamification design should consider game elements that stimulate more creativity in the users. For example, the choice of *time pressure* as a game element can hinder creativity because it may increase stress on those performing the gamified task. The last point concerns the involvement of a larger sample of stakeholders in the gamified platform. Utilizing a large crowd allows for the discovery of several aspects related to crowd dynamics, such as collective behavior and increased diversity (Hosseini et al., 2015). For example, a highly diverse set of stakeholders can lead to elicitation of more relevant, meaningful requirements and an increase in creativity, while it can also result in difficulties in reaching a consensus and may also yield more inconsistent requirements.

We have also sketched research directions that derive from a case study with CCRE and from other empirical studies. Future work has to focus on those directions, with particular attention to be paid on the development of group dynamics also through the proactive support of tools such as *REfine*. We see gamification and crowdsourcing as a paradigm shift towards openness and engagement in RE, but their effectiveness requires reconsidering and tuning current RE methods for such a context.

References

Adepetu, A., Ahmed, K. A., Al Abd, Y., Al Zaabi, A., & Svetinovic, D. (2012). Crowdrequire: A requirements engineering crowdsourcing platform. In *Proceedings of the AAAI Spring Symposium: Wisdom of the Crowd*.

Berander, P., & Andrews, A. (2005). Requirements prioritization. In *Engineering and managing software requirements*, (pp. 69–94). Springer.

Brinkkemper, S. (1996). Method engineering: engineering of information systems development methods and tools. *Information and software technology*, *38*(4), 275–280.

Costa, P. T., & MacCrae, R. R. (1992). *Revised NEO personality inventory (NEO PI-R) and NEO five-factor inventory (NEO FFI): Professional manual*. Psycho- logical Assessment Resources.

Damodaran, L. (1996). User involvement in the systems design process-a practical guide for users. *Behaviour & information technology*, *15*(6), 363–377.

Dave, K., Lawrence, S., & Pennock, D. M. (2003). Mining the peanut gallery: Opinion extraction and semantic classification of product reviews. In *Proceedings of the 12th international conference on World Wide Web*, (pp. 519–528). ACM.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gameful- ness: defining gamification. In *Proceedings of the 15th international academic MindTrek confer- ence: Envisioning future media environments*, (pp. 9–15). ACM.

Eickhoff, C., Harris, C. G., de Vries, A. P., & Srinivasan, P. (2012). Quality through flow and im- mersion: gamifying crowdsourced relevance assessments. In *Proceedings of the 35th internation- al ACM SIGIR conference on Research and development in information retrieval*, (pp. 871–880). ACM.

El Emam, K., Quintin, S., & Madhavji, N. H. (1996). User participation in the requirements engi- neering process: An empirical study. *Requirements engineering*, *1*(1), 4–26.

Fernandes, J., Duarte, D., Ribeiro, C., Farinha, C., Pereira, J. M., & da Silva, M. M. (2012). ithink: A game-based approach towards improving collaboration and participation in requirement elicita- tion. *Procedia Computer Science*, *15*, 66–77.

Gartner (2011). Gartner says by 2015, more than 50 percent of organizations that manage innovation processes will gamify those processes. URL http://www.gartner.com/newsroom/id/1629214 [Last Accessed: 19 Februrary, 2016]

Hamari, J., & Koivisto, J. (2013). Social motivations to use gamification: An empirical study of gamifying exercise. In *Proceedings of the European Conference on Information Systems*.

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work?–a literature review of empiri- cal studies on gamification. In *Proceedings of the 47th Hawaii International Conference on Sys- tem Sciences (HICSS)*, (pp. 3025–3034). IEEE.

Hosseini, M., Shahri, A., Phalp, K., Taylor, J., Ali, R., & Dalpiaz, F. (2015). Configuring crowdsourcing for requirements elicitation. In *Proceedings of the IEEE 9th International Confer- ence on Research Challenges in Information Science (RCIS)*, (pp. 133–138). IEEE.

Howe, J. (2006). Crowdsourcing: A definition. [Online]. URL http://www.crowdsourcing.com/cs/2006/06/crowdsourcing a.html [Last Accessed: 19 February, 2016]

Kabbedijk, J., Brinkkemper, S., Jansen, S., & Van der Veldt, B. (2009). Customer involvement in requirements management: lessons from mass market software development. In *Proceedings of the 17th IEEE International Requirements Engineering Conference*, (pp. 281–286). IEEE.

Kujala, S. (2003). User involvement: a review of the benefits and challenges. *Behaviour & infor- mation technology*, *22*(1), 1–16.

Kujala, S., Kauppinen, M., Lehtola, L., & Kojo, T. (2005). The role of user involvement in require- ments quality and project success. In *Proceedings of the 13th IEEE International Requirements Engineering Conference*, (pp. 75–84). IEEE.

Lim, S. L., Damian, D., & Finkelstein, A. (2011). Stakesource2.0: using social networks of stake- holders to identify and prioritise requirements. In *Proceedings of the 33rd international confer- ence on Software engineering*, (pp. 1022–1024). ACM.

Lim, S. L., & Finkelstein, A. (2012). Stakerare: using social networks and collaborative filtering for large-scale requirements elicitation. *IEEE Transactions on Software Engineering*, *38*(3), 707– 735.

Lucassen, G., Dalpiaz, F., Van Der Werf, J. M., & Brinkkemper, S. (2015a). Bridging the twin peaks: the case of the software industry. In *Proceedings of the Fifth International Workshop on Twin Peaks of Requirements and Architecture*, (pp. 24–28). IEEE.

Lucassen, G., Dalpiaz, F., van der Werf, J. M. E., & Brinkkemper, S. (2015b). Forging high-quality user stories: Towards a discipline for agile requirements. In *Proceedings of the 23rd IEEE International Requirements Engineering Conference*, (pp. 126–135). IEEE.

Nicholson, S. (2012). A user-centered theoretical framework for meaningful gamification. In *Proceedings of Games+ Learning+ Society 8.0*.

Pang, B., & Lee, L. (2008). Opinion mining and sentiment analysis. *Foundations and trends in information retrieval*, *2*(1-2), 1–135.

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A design science research methodology for information systems research. *Journal of management information systems*, *24*(3), 45–77.

Shahri, A., Hosseini, M., Phalp, K., Taylor, J., & Ali, R. (2014). Towards a code of ethics for gamification at enterprise. In *Proceedings of the IFIP WG 8.1 Working Conference on the Practice of Enterprise Modeling*, (pp. 235–245). Springer.

Snijders,R.,Dalpiaz,F.,Brinkkemper,S.,Hosseini,M.,Ali,R.,&Özum,A.(2015). Refine: A gamified platform for participatory requirements engineering. In *Proceedings of the 1st IEEE International Workshop on Crowd-Based Requirements Engineering*, (pp. 1–6). IEEE.

Snijders, R., Dalpiaz, F., Hosseini, M., Shahri, A., & Ali, R. (2014). Crowd-centric requirements engineering. In *Proceedings of the Second Workshop on Crowdsourcing and Gamification in the Cloud (CGCloud)*, (pp. 614–615). IEEE.

The Standish Group (2009). CHAOS summary 2009: The 10 laws of CHAOS. Tech. rep.

Wiegers, K. (1999). First things first: prioritizing requirements. *Software Development*, *7*(9), 48–53.

Zand, D. E., & Sorensen, R. E. (1975). Theory of change and the effective use of management science. *Administrative Science Quarterly*, (pp. 532–545).