Gamifying the Involvement of Stakeholders (in Requirements Engineering)

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Agenda

1. Stakeholders involvement in RE
2. The potential: crowdsourcing, gamification
3. Designing a new method
4. The CCRE method
5. Results from a case study
6. Outlook
1. Stakeholders involvement in Requirements Engineering (RE)
1. Stakeholders involvement in RE

- Software projects keep failing, or being challenged
  - Results from the 2014 Chaos Standish Report

![Pie chart showing the distribution of project outcomes:
- 52.7% Successful
- 31.1% Challenged
- 16.2% Cancelled]
1. Stakeholders involvement in RE

What are the key determinants for success/failure?

- **Project Success Factors**
<table>
<thead>
<tr>
<th>Factor</th>
<th>% of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. User Involvement</td>
<td>15.9%</td>
</tr>
<tr>
<td>2. Executive Management Support</td>
<td>13.9%</td>
</tr>
<tr>
<td>3. Clear Statement of Requirements</td>
<td>13.0%</td>
</tr>
<tr>
<td>4. Proper Planning</td>
<td>9.6%</td>
</tr>
<tr>
<td>5. Realistic Expectations</td>
<td>8.2%</td>
</tr>
</tbody>
</table>

- **Project Challenged Factors**
<table>
<thead>
<tr>
<th>Factor</th>
<th>% of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lack of User Input</td>
<td>12.8%</td>
</tr>
<tr>
<td>2. Incomplete Requirements &amp; Specifications</td>
<td>12.3%</td>
</tr>
<tr>
<td>3. Changing Requirements &amp; Specifications</td>
<td>11.8%</td>
</tr>
<tr>
<td>4. Lack of Executive Support</td>
<td>7.5%</td>
</tr>
<tr>
<td>5. Technology Incompetence</td>
<td>7.0%</td>
</tr>
</tbody>
</table>

- **Project Impaired Factors**
<table>
<thead>
<tr>
<th>Factor</th>
<th>% of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Incomplete Requirements</td>
<td>13.1%</td>
</tr>
<tr>
<td>2. Lack of User Involvement</td>
<td>12.4%</td>
</tr>
<tr>
<td>3. Lack of Resources</td>
<td>10.6%</td>
</tr>
<tr>
<td>4. Unrealistic Expectations</td>
<td>9.9%</td>
</tr>
<tr>
<td>5. Lack of Executive Support</td>
<td>9.3%</td>
</tr>
</tbody>
</table>

Taken from the 2014 Standish Chaos Report
1. Stakeholders involvement in RE

- But what can stakeholder/user involvement deliver?
  - More accurate requirements
  - Avoiding expensive and unnecessary features
  - Improved acceptance (Kujala, 2003)
  - Better requirements quality
  - Chance of project success higher (Kujala et al., 2005)
  - Improve loyalty
  - Broaden the market (Kabbedijk et al., 2009)
1. Stakeholders involvement in RE

- Context of this research
  - **Requirements Engineering**: the branch of software engineering concerned with the real-world goals for, functions of, and constraints on software systems (Zave, 1997)

- **Software Producing Organizations (SPOs)**: they create software products that are sold to multiple clients, and are maintained over time
  - As opposed to tailor-made software
  - Either B2B or B2C
2. The potential: crowdsourcing, gamification

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2. The potential: crowdsourcing, gamification

- **Involving the crowd!** Relying on a crowd of humans to get things done!
  - Feature requests (Win10) →
  - Crowdwork (Mturk) ↓
2. The potential: crowdsourcing, gamification

- **Gamify it!** The trend is manifest
  - 4Square, Stackoverflow, LinkedIn, etc.

- Gamification: “the use of game design elements in non-game contexts” [Deterding et al., 2011]

- **Intrinsic** kinds of motivation
  - Personal gratification
  - Social status
2. The potential: crowdsourcing, gamification

Hypothesis: applying gamification and participatory design to RE leads to higher quality requirements

... by means of
- Increased engagement of the participants
- Participatory design → users as designers
- Higher productivity
- Entertainment!
3. Designing a new method
3. Designing a new method

- Ten semi-structured expert interviews to obtain suggestions to make the CCRE vision concrete
  - 6 in industry (advisors, technical directors, product managers)
  - 4 researchers (RE)
  - 7 from Netherlands, 2 United Kingdom, 1 Belgium

- Areas discussed in the interviews
  - RE process: current status
  - Potential for improving RE
  - Success and failure factors for gamification/crowdsourcing
3. Designing a new method

- Results: 68 advices

- **Vision and openness (4):** do not discuss strategic decisions, most customers don’t know what they need, …

- **Crowdsourcing (4):** consider minorities’ opinions, spread ideas that are created by others, …

- **Crowd formation (5):** communicate openness and what you do with the feedback, …
3. Designing a new method

- **Crowd control (5):** moderate discussions, do not steer involved users, …
- **RE activities (19):** involve the crowd in prioritization, ask clarifying questions, …
- **Gamification elements (7):** weigh points over time, reward quality and not quantity, …
4. The CCRE method

(Snijders et al., 2015)
4. The CCRE method

- Overview
  - From feasibility to focus group
  - Fits in agile development (sprints)
  - Highly iterative, despite figure
- Every phase has many activities
  - Omitted here for simplicity
- Traceability with the advices
4. The CCRE method

The Refine tool as an interactive platform

How can Qubus 7 help you in being more efficient?

Qubus 7 is brand new. Compared to the previous versions, it is an improvement, but we’re sure that we can improve it much further. In order to address the right needs, we want to hear the opinion of the people who use Qubus. We want to hear you.

Style-less qubus 7
Qubus 7 is known for its retouched front-end among other features of course. Wouldn’t it be a good idea to also make sure the interface is somewhat browser-friendly and can be used on simple layouts as well? (For text browsers / older mobile devices / braille browsers and the like?)

By Perry Adamson on 30 Dec 2016 | 2 comments

Minimize number mouse clicks needed.
Every answer has to be clicked followed by clicking the “Continue” button. In the current version, this button does not work, so you have to manually click the next question. Way too inefficient.

By Thomas Brekenk on 27 Dec 2016 | 5 comments

Unclear how to start questionnaire
It is unclear how to start a questionnaire after clicking it. This appears to be an issue.

By Perry Adamson on 20 Dec 2016 | 2 comments
4. The CCRE method

I+II. Feasibility analysis & context analysis

A. Define the **scope** of the game, i.e., the requirements engineering session
   ▸ What is to be discussed?

B. Determine the **vision and openness** of the SPO
   ▸ CCRE is not always adequate

C. Identify the stakeholders

D. Choose an **interactive platform** for RE
4. The CCRE method

III. Crowdsourcing preparation

A. Initiate a marketing campaign
B. **Invite all stakeholders** to the platform
C. **Assess crowd characteristics**
   - How representative is it? How diverse?
D. Develop and communicate the **game mechanics**
E. Ask a question to trigger the discussion
4. The CCRE method

IV. Crowd involvement

A. Let the crowd interact
   - Suggest need
   - Discuss need
   - Vote for needs (+, -)
   - Merge/fork needs

B. Provide immediate rewards (via game mechanics)
4. The CCRE method

V & beyond... From needs to requirements

A. The SPO selects a requirements subset to further discuss
   - Choice is made based on the requirements potential
   - Consider mainstream and minority

B. Invite the **most active stakeholders** to focus groups

C. Focus groups lead to software development
5. Results from a case study
5. Results from a case study

- The Qubus software product
  - A governance, risk, and compliance tool developed by KPMG
  - Under the hood, it hosts a workflow management system
  - Object of our study: needs for version 7 beta
5. Results from a case study

I. Feasibility
   - Very open organization
     + No product roadmap
     + Agile development, low user involvement
     = High potential for CCRE

II. Context Analysis
   - Stakeholders = managers, developers, clients, users, experts
   - Few, informal feedback channels
   - Chosen platform = Refine
5. Results from a case study

- Gamification in the *Refine* tool
  - Gamification elements (for the crowd!)

<table>
<thead>
<tr>
<th>Social Factors</th>
<th>Network exposure</th>
<th>Social influence</th>
<th>Recognition</th>
<th>Reciprocal benefit</th>
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<tr>
<td>Roles</td>
<td>✓</td>
<td></td>
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<td></td>
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<tr>
<td>Resources &amp; points</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>Leaderboards</td>
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<td>Group forming</td>
<td>✓</td>
<td>✓</td>
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<td>Exploration</td>
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<td>✓</td>
<td>✓</td>
<td></td>
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<tr>
<td>Endorsements</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

- Point system (game mechanics)
5. Results from a case study

III. Crowdsourcing preparation

- Three-steps invitation: internal stakeholders, clients & users, off-stage actors
- Small crowd involved (19 people)

IV. Crowd involvement

- Suggest, discuss, vote for needs, …
- 21 needs, 37 comments, 130 votes
- Little moderation
- Additional stakeholders added
5. Results from a case study

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
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<tr>
<td>Community manager</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>8</td>
<td>21</td>
<td>21</td>
<td>41</td>
<td>41</td>
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<td>Product management</td>
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<td>67%</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>12</td>
<td>13.5</td>
<td>27</td>
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<tr>
<td>Development team</td>
<td>4</td>
<td>100%</td>
<td>0.8</td>
<td>3</td>
<td>3.8</td>
<td>15</td>
<td>14.8</td>
<td>59</td>
<td>26.8</td>
<td>107</td>
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<tr>
<td>Experts</td>
<td>4</td>
<td>100%</td>
<td>1</td>
<td>4</td>
<td>1.3</td>
<td>5</td>
<td>2.5</td>
<td>10</td>
<td>16</td>
<td>64</td>
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<tr>
<td>Client</td>
<td>1</td>
<td>100%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Users</td>
<td>1</td>
<td>6%</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>11</td>
<td>11</td>
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<tr>
<td>Off-stage actors</td>
<td>6</td>
<td>86%</td>
<td>1.8</td>
<td>11</td>
<td>0.5</td>
<td>3</td>
<td>4.2</td>
<td>25</td>
<td>20</td>
<td>120</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>50%</td>
<td>1.1</td>
<td>21</td>
<td>1.9</td>
<td>37</td>
<td>6.8</td>
<td>130</td>
<td>19.6</td>
<td>373</td>
</tr>
</tbody>
</table>
5. Results from a case study

V. Requirements identification

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Rel. business value</th>
<th>Rel. penalty</th>
<th>Total benefit</th>
<th>Total benefit %</th>
<th>Rel. costs</th>
<th>Costs %</th>
<th>Rel. risk</th>
<th>Risk %</th>
<th>Rel. priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 Loading screens</td>
<td>1</td>
<td>10</td>
<td>11</td>
<td>30%</td>
<td>4</td>
<td>18%</td>
<td>2</td>
<td>13%</td>
<td>0.304</td>
</tr>
<tr>
<td>#2 Role in answerset</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>14%</td>
<td>3</td>
<td>14%</td>
<td>2</td>
<td>13%</td>
<td>0.205</td>
</tr>
<tr>
<td>#3 Minimization mouse clicks</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>27%</td>
<td>7</td>
<td>32%</td>
<td>5</td>
<td>31%</td>
<td>0.071</td>
</tr>
<tr>
<td>#4 Improved visualization of question tree</td>
<td>4</td>
<td>7</td>
<td>11</td>
<td>30%</td>
<td>8</td>
<td>36%</td>
<td>7</td>
<td>44%</td>
<td>0.050</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>25</td>
<td>37</td>
<td>100%</td>
<td>22</td>
<td>100%</td>
<td>16</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

VI. Focus group preparation
- Top three requirements were chosen
- Five stakeholders participated, including the most active ones

VII. Focus group
- One requirement omitted, one split, little discussion needed
5. Results from a case study

- **Questionnaire:** comparing CCRE with previous experiences in communicating requirements

- **Engagement:**
  - 1 to 5 scale
  - Average: 3.88 (more engaging)

- **Usefulness:**
  - 1 to 5 scale
  - Average: 4.19 (more useful)

- **Difficulty:**
  - 1 to 5 scale
  - Average: 2.69 (as difficult)
5. Results from a case study

- Questionnaire: perceived experience/usefulness of **Refine**

### Motivation
- 0: 1
- 1: 4
- 2: 12
- 3: 13
- 4: 4

**Average:** 3.47

### Unclarity of priorities
- 0: 6
- 1: 3
- 2: 11
- 3: 15
- 4: 2

**Average:** 2.82

### Taken into account
- 0: 2
- 1: 1
- 2: 11
- 3: 3
- 4: 10

**Average:** 4.12

### Difficulty
- 4: 24
- 8: 13
- 10: 1

**Average:** 1.92

### Voting
- 0: 1
- 1: 3
- 2: 13
- 3: 13

**Average:** 4.71

### Commenting
- 0: 1
- 3: 4
- 4: 10
- 5: 10

**Average:** 4.41

### Branching
- 2: 13
- 3: 8
- 4: 1
- 5: 2

**Average:** 2.94
5. Results from a case study

- Interviews with product management of Qubus

Pros
+ Approachable
+ Structured
+ Improved user adoption is expected

Cons
- Little inventive to return
- No need life cycle (in the prototype)
- Risk of trivial needs with novice participants
5. Results from a case study

- Evaluation with experts from the industry (generality)
  - 1 = strong disagreement
  - 7 = strong agreement

<table>
<thead>
<tr>
<th>Statement</th>
<th>Exp 1</th>
<th>Exp 2</th>
<th>Exp 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crowdsourcing useful for elicitation</td>
<td>7</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Crowdsourcing useful for negotiation</td>
<td>6</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Crowdsourcing useful for prioritization</td>
<td>2</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Crowdsourcing useful for specification</td>
<td>6</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Crowdsourcing useful for validation</td>
<td>6</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Gamification effective for engagement</td>
<td>7</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Gamification effective for innovation</td>
<td>7</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>CCRE improves the process quality</td>
<td>6</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>CCRE gives useful requirements</td>
<td>6</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>CCRE gives higher quality requirements</td>
<td>6</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Detailed enough for focus group</td>
<td>7</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Detailed enough for Product Backlog</td>
<td>7</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>
6. Outlook
Summary

- User involvement is crucial to project success
- Potential: crowdsourcing and gamification
- The CCRE method
  - Supported by the Refine tool
  - Encouraging results from a case study
Future work (a.k.a., weaknesses)

- Large-scale studies with more stakeholders
- Long-term incentives (real-life gamification)
- How to assess the effect of gamification?
  - Ongoing work using user stories
Acknowledgments

Collaborators

- Remco Snijders, Sjaak Brinkkemper (Utrecht University, NL)
- Raian Ali, Mahmood Hosseini (Bournemouth University, UK)
- Atilla Ozum (KPMG Advisory, NL)
Thanks for listening!

Questions?

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References

References

- S. Kujala, M. Kauppinen, L. Lehtola, and T. Kojo, “The Role of User Involvement in Requirements Quality and Project Success,” in Proc. of RE, 2005, pp. 75–84