The Game of One More Idea: Gamification of Managerial Group Decision-Making in Software Engineering

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Abstract: Gamification is widely used and explored for improving learning and increase motivation. However, it has not been further explored in the context of software engineering managerial decision making, as a supportive tool in engaging both the individual and the team when making managerial group decisions. By applying a framework for game- and study design, we develop a card-based game for managerial group decision making, specifically for software engineering management teams. Our study is an industrial exploratory case study at the Swedish Transport Administration, where the decision-making game is tested on a management team. The aim of the study was to evaluate the perceived effects on the team's engagement and overall decision-making process. Our experiments showed that the perceived engagement and confidence in making group decisions using the game was improved. Although difficult to conclude general remarks, the results give indications that the decision making process could benefit using the card game.

1 INTRODUCTION

Managerial decision-making is a crucial part of any organization, covering a wide range of decisions from daily operational tasks to strategic decisions that can make long-term impact. In the field of software engineering (SE), making these decisions becomes even more complex. Depending on the organizational structure, engineering managers not only have to lead their teams but also be part of important technology choices, security strategies, development methodologies; being technical as a manager is expected and also proven to be a success factor (Kalliamvakou et al., 2019). Moreover, soft skills such as team collaboration and communication is also highly important to consider (Galster et al., 2022). Combining these required soft and technical skills with the complex landscape of decisions to be made, SE managers would benefit by using supportive tools or decision frameworks that support their decision making.

Although not typically used in the context of providing decision-making support, *gamification* could potentially be used for putting more focus on a task (Pedreira et al., 2015). Gamification refers to using game-like elements in non-game situations to make tasks more engaging and effective (Deterding et al.,

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2011). It is extensively applied to induce behavioral changes across individual, cultural, and social contexts (AlMarshedi et al., 2017). The methodology is in particular used for increasing motivation and efficiency in learning, e.g., within the e-learning context (Khaldi et al., 2023), but also in improved knowledge creation (Elidjen et al., 2022). Further, in Khaldi et al., (2023) it was also concluded that gamification as analyzed from a general management perspective implies that it incorporates fun, engagement, learning, and data-driven decision-making. Hence, the methodology have the potential to increase the engagement and efficiency in the managerial context. However, contrasting results are also found where managerial gamification has indicated demotivation and less performance (Liu and Wang, 2020). Therefore, with unclear results in how this methodology can impact group decisions, we consider yet one more dimension: the software engineering manager context. Thus, given the decision making complexity for the SE manager, introducing gamification into managerial decision-making could therefore be explored if better and more efficient decision making is possible. By better we primarily refer to the notion of *reflexive* as coined by Alvesson et al., namely to think critically about one's actions and decisions, and the underlying assumptions that provide guidance (Alvesson et al., 2016). This is not equivalent to simply re-

flect on one's decision and the potential outcomes, but also think critically about the options and what leads to one's conclusions. We use this notion and apply it to managerial group decision making, as the ability to be more reflexive within a management team, hence implying a more dynamic group reflective process.

This paper provides preliminary experiment-based research using a developed prototype card game, supporting managerial decision making. The primary aim of the game is decision support to SE management teams, where managers collaborate in a wide range of decisions. By adding a gamification element into such management team, we perform experiments in how the chosen game could improve the ability to increase the individual *engagement* of a manager, and how the *perceived improvement* of managerial group decision making is affected. Our study consists of a case study of a managerial SE team in one of the larger Swedish public sector agencies.

The rest of the paper is outlined as follows: the remaining of this section includes related work and our formulated research questions. Section 2 describes out chosen research methodology, experiment design, the game development process and output, and a description of the target company of the case study. Section 3 summarizes the result from the experiment, section 4 the discussion and analysis of the results, and we conclude the paper in section 5.

1.1 Related Work

In general, the idea of utilizing gamification in a management context is not new; a comprehensive systematic review in the field categorizes several different areas within the managerial context and proposes a framework for analyzing them separately (Wanick and Bui, 2019). However, none of the categories identified were specifically within managerial decision making in the SE context. Moreover, a case study in managerial decision making was conducted (Cechella et al., 2021), but within the banking context. Gamification in the SE context is also heavily studied, several literature reviews have classified different use case areas and frameworks, e.g., (Barreto and França, 2021; Pedreira et al., 2015; de Paula Porto et al., 2021). However, the primary focus is on the software engineer-, developer- and architecture roles and not managerial decision making.

Using card based games for decision making has been tested in other contexts than SE, e.g., in military decision making (Medhurst et al., 2009). Experiments were conducted where cards revealing pieces of information was used and presented sequentially. Players was then using the cards to assess different

scenarios for deciding if escalation was needed or not. Another context investigated, however not using cards, is in water governance; it was found that the creation of game-based methods that facilitate participatory decision-making is also shaped by the broader principles of group decision making (Aubert et al., 2019). These findings along with (Aubert et al., 2022), (Zhou, 2014) and (Schriek et al., 2016) suggests that gamifying decision making does provide benefits, however not fully evaluated within the context of SE managerial decision making.

1.2 Research Questions

Since the current literature on gamification in the SE context does not include managerial decision-making explicitly, in particular engineering manager group decisions, we address the following research questions:

- RQ1: Can card-based gamification improve the perceived quality of SE group managerial decision making?

- RQ2: Can card-based gamification increase the individual engagement in SE group managerial decision making?

2 METHOD

The chosen method is an exploratory case study since we seek to find preliminary insights of what gamification in the managerial decision making within the SE context can bring forward; hence we are not evaluating a theory. This approach is suggested by Yin (Yin, 2009) and further elaborated in (Bell et al., 2022). The case study is over a selected group of managers at the target company, and thus isolated in their context and working environment. Data collection and analysis is conducted using a mixed-method approach (Bell et al., 2022) where quantitative data is collected using anonymous survey sheets, and qualitative data is collected via free text surveys and semi-structured interviews (Bell et al., 2022).

2.1 Gamification Design

As a foundation, we based the construction of our game using the framework proposed in (Aubert et al., 2019) and further tested and adapted in (Aubert et al., 2022). In essence it provides a procedure where the game construction is build upon the "what, why, who, when and where" questions, leading to a game-based approach, specifically the game's context. The "why"

question focuses on the aims and results of the game, while the "who" question mainly considers the individuals involved and their processes. The "where and when" questions delve into the situation's context, shaping the design encapsulated in the "how" question. This framework thus enables one to design the most effective game-based approach in order to reach the targeted outcomes of the gamification, but also be able to assess it adequately (Aubert et al., 2019). Hence, the questions provide the context which leads to defining the game and what type of study is needed for the assessment.

As noted in (Aubert et al., 2022) we also consider the challenge of individualism vs. collectivism, namely to balance the competitive factor such that decisions made are not solely driven by individual agendas, but instead towards team achievement. Using the gameficiation ontology proposed in (García et al., 2017) we outline our game-based approach using the framework from Aubert et al. as follows:

- **What.** Managerial group decision making within the SE context, specifically decisions relating to technology adoption/investment, re-organizational matters, tools and software development strategies etc. Since the organization consists of several SE units, the management team needs to collectively make such strategic decisions and then implement them throughout the organization's different hierarchies.

- **Why.** The main purpose of the *game* is to increase the individual engagement in the group decision making process, and to enable the group to be more reflexive (Alvesson et al., 2016) in a more structured way. Namely, enable the group to be more engaged and at the same time thinking more critically and aiming for data-driven decisions. The *goal* is to contribute with as many inputs and ideas as possible to drive the reflexivity forward.

- **Who.** The *players* are engineering managers, responsible for the software development teams and operations. The management team lead, the head of the department, is also part of the game, acting as the entity allowed to make any final decisions when there is no consensus in the group.

- **When.** The game should be played any time there is a group decision to be made, and typically during the normal management team meetings that occur weekly. Moreover, free form meetings with no agendas also occur weekly with the goal of catching new or un-planned events; these meetings can also be used if group decisions are needed on an ad-hoc basis. However, *temporal*

contraints are needed, e.g., time-boxing so that decision are not stalled.

- **Where.** The game is suited for co-located teams, however future research should implement and evaluate digitized versions of the game to understand effects in distributed teams.

The details of the development of the game rules and structure is described in subsequent sections.

2.2 Development of the Game

2.2.1 Planning Poker

The game was developed with inspiration from the classic planning poker card game used in agile sprint planning (Grenning, 2002). Although planning poker does not have a gamification parameter (no player can really win against the others), it provides other effects such as reducing optimism bias (Mahnič and Hovelja, 2012). Moreover, as summarized by Mahnic and Hovelja (2012) planning poker builds upon the Delphi method which is a structured communication technique that uses rounds of anonymous surveys to collect data from experts on a subject, aiming for consensus or insightful predictions on complex issues. However, in planning poker there is no elements of anonymization. Our proposed game uses the same foundational structure as in planning poker by allowing all players contribute with their perspective (allowed to play cards that indicate an idea, perspective or opinion). Another structure is that each round enforces a group discussion aiming to reach consensus or majority after a number of iterations of gameplay.

2.2.2 Card Game Design

The competitive element in our game is based on the idea of using cards, having in mind that the game should be possible to digitize if needed, e.g., for distributed teams; some research indicates that specifically trading card game design fulfills this transition if needed (Marchetti and Valente, 2015). Now, a competitive game aiming for collective decision making should avoid promoting a single solution in itself, but instead allowing participants to freely share their thoughts or providing them with an overview of various potential compromises (Aubert et al., 2022). Hence, our construction emphasises this concept by adding a rule of being able to express either ideas by playing idea cards, or express the need for more discussion by playing brainstorming cards. These two rules will allow the players to be able to share opinions in a structured way, and ensure more time if necessary. To balance the players' freedom, an overall
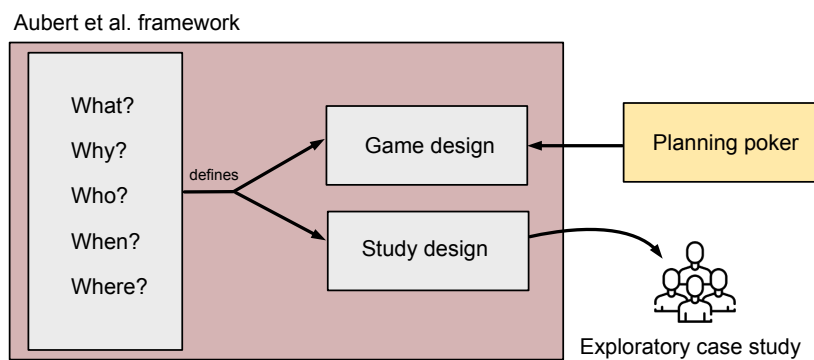
Figure 1: The overall methodology, where the framework by Aubert et al., (2022) is the foundation and planning poker inspired the game structure. The game was evaluated in an exploratory case study with a selected SE management team.

game master is needed, whom is able to have the final saying in situations where players get stuck or no majority/consensus is reached. Finally, the gamification element is of collecting points by achievement, where each player is rewarded a point (or token) for every new idea that is presented in the discussion of a problem/decision. This will enforce creativity and engagement.

The cards were designed in Affinity Designer and all graphics were generated using DALL-E (OpenAI, 2021). When generating the card pictures (figures and symbols), a gender diversity perspective was considered to spread to occurrence of female and male depictions evenly. A simplified overview of the chosen methodology is depicted in Fig. 1.

2.2.3 Rules of the Game

In the proposed game, each manager is equipped with a deck of cards at the beginning of each (weekly) management meeting. The deck includes the cards "Low Risk," "Medium Risk," "High Risk,", "I Agree," "I Disagree," a variety of "Let's Brainstorm" cards, "Coffee Break", "Parking Lot", "Final Decision," and "Idea" cards. When a decision is needed and the discussion starts, the gameplay starts. One player is chosen as the game master (GM) (who has the highest mandate to make decisions). The game is divided into two phases: *discussion* and *decision*, where for former is iterative and the latter is the step where the final decision is made. We outline the two phases as follows:

- **Discussion Phase:** the team time boxes the discussion into 10 minute blocks. During a block the team discusses the matter and each player may play an *idea card* if an idea for solution, a new perspective or a question that follows by a new collective insight is given. After the 10-minute block ends the team goes round the table and play one risk card each to indicate the individual

perception of risk involved in the current status of their decision making process. After all risk cards are played, another round the table is run where everyone has the opportunity to play a *coffee break* card indicating the need for a pause, a *final decision* card indicating the need for making a decision now without having more blocks, or a *brainstorming* card indicating the need for at least one more round of discussion. The GM either decides to continue the discussion and thus accepting any brainstorming cards played or switch the game into the decision phase. If there is diversity in the perceived risk, i.e., many players have very different opinions on what risk level the matter has (from the first round the table), the GM can decide to run another block regardless of the outcome of the second round the table. Before the block ends, each player gets a token or point for every idea card they played during the block. At any time during the discussion, any player can play the parking lot card indicating that the current discussion has deviated and should be "parked" for later. Similarly, the agree- and disagree cards can be played at any time to indicate a player's opinion towards an idea, risk opinion or other situation.

- **Decision Phase:** If the team reaches a state where a final decision is needed to be made, the decision phase starts. Everyone count the number of tokens or points collected from the previous phase. At this stage there should be at least one proposed decision. The GM makes the final decision and if that turns out to be a previously played idea from any of the players, that player receives one more token. The game ends by that decision and the player with the most number of tokens wins. Preferably, the tokens should be saved and collected incrementally every time the game is played. Thus, the team can have monthly or an-

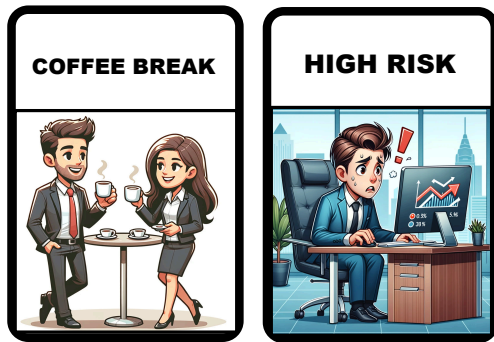nually milestones rewarding creative and engaging individuals.

Figure 2: Example card design, a coffee break card and high risk card. All graphics are prompted in DALL-E.

To summarize: players play idea cards to present new suggestions and other cards to express their opinions on the discussions. The game progresses with players contributing ideas and reactions, culminating when the final decision card is played, otherwise diversity in perceived risk or the collective need for further brainstorming, drives the game into another iteration. The player who has used the most number of idea cards by this point wins, emphasizing active engagement but also rewarding creativity in the decision-making process.

2.3 Experiment Design

The experiment is constructed by a series of *gameplays*, where each play was not determined beforehand but instead used on any current decision to be made in the management group. The head of the team was GM in all instances. For each gameplay a template of data was filled by the GM with the purpose to provide data for the experiment, e.g., gameplay time, number of iterations and so forth. All gameplays were scheduled to occur at the standard team meetings in Q1 2024.

After each game all participants will be asked to fill an anonymous survey (pen and paper), indicating the perceived effect of the game in the decision making. Three questions were formulated where the answer scale was i Likert scale from 1 to 5 defined as follows: 1 = worse compared to not using the game, 2 = slightly worse compared to not using the game, 3 = indifferent, 4 = slightly better compared to not using the game, 5 = better compared to not using the game. The survey questions were:

- *Q1: How was the decision making process (discussion) compared to not using the game?*

- *Q2: How confident were you in the final decision?*

- *Q3: How engaging were you during the decision making process (discussion)?*

Each participant will also be asked to fill a free text entry of feedback of the game. After the gameplay phase of the experiment, a series of short semi-structured interviews was planned with two of the participants. The interview scheme was based on the following interview questions:

- *IQ1: What effects did you experience in the group decision making when using the game?*

- *IQ2: Did you have opportunities to challenge other people's perspective and be challenged yourself during the gameplay?*

- *IQ3: What were the main benefits and drawbacks of using the game?*

- *IQ4: Any suggestions for improvements of the game design, rules, or applicability?*

The main aim of the experiment is two-folded: to capture the experience of using the game as in perceived support (or no support) when making a group decision, and to capture the level of increased, decreased or non-influenced engagement in the managerial group decision (on an individual level). By using Q3 with IQ1 and IQ2 we would get indications on the reflexive dimension, i.e., if the player is pushed towards thinking over the options with engagement, and possibly showing increase of creativity. The score cards will indicate these perceptions, however with the risk of bias and non-statistically significance due to the small sample size. Since this case study experiment is more of finding indications in a selected case study, this experiment could be up-scaled in future studies with both control groups and larger sample size (multiple management teams). Therefore, we limit this particular experiment run in the context of the target company.

2.4 Target Group Description

We performed the experiment on a software engineering management team at the Swedish Transport Administration's ICT division. The team was selected due to convenience sampling and the team size was $n = 7$ individuals. All engineering managers were responsible for several software development teams, and one manager was also responsible for two operation (DevOps) teams focused on 24/7 operations and incident management of the organization's applications. The age spread was between 38 and 61 years old, and all team members had previous manager roles. None of the participants had tried gamification methods previously and was not aware of the technique. Typical types, and not exclusively, of group

decisions the team handled were strategic topics such as how to manage the growing amount of contractors, defining team and organizational structures, investment options such as training or conferences for the employees and defining key performance indicators.

3 RESULTS

The experiment was run as a gameplay session on-site at the target company, with 4 gameplays. The mean values of the survey scoring from the participants are shown in Tab. 1. The management team was running the game on-site at the company, and at the time the team's HR partner was also present but did not participate in the game. A short introduction of the rules (5 minutes) was given by the GM before starting the meeting. The gameplays were then run every time there was a topic of discussion that needed a decision to be made. The first round was made in two blocks and finalized after 18 minutes. One decision was made quickly (under 10 min.) and one decision was postponed to the next meeting due to time constraints (after 2 blocks the time was running out). 4 of the players played idea cards, 2 players played risk cards during the discussion and 2 players played agree/disagree cards during the discussion. One player did not play any cards at all in any gameplay. No one asked for clarifications of the rules or purpose. After each session the survey score cards were filled in and collected by the GM. The free text entries was not filled in by any of the players.

Table 1: The resulting mean values $\bar{x}_i$ for each survey question i, for the gameplays in the experiment. Time refers to mean gameplay time, and mean number of 10 minute blocks that was used.

$\bar{x}_1$	$\bar{x}_2$	$\bar{x}_3$	Mean time	Mean blocks
4.0	4.0	4.4	15 min.	2

Two interviews were made, each took about 10 minutes and was on-site: one with player A and one with player B. Player A was interviewed the same day after the experiment, and player B was interviewed 2 weeks later. Although a limitation of the validity of the study with only two interviews, it would indicate some directions on how the game was perceived. For each question-response pair, we denoted keywords (coding) if the response related to any of the reflexive dimensions such as *reflection, creative, thinking, challenge* etc. Not all keywords were mentioned. We summarize the answers in Tab. 2 as representative quotes from A and B respectively, where keywords are in bold.

Table 2: Summary of semi-structured interviews with player A and B, keywords in bold.

Question	Summary
IQ1 (A)	Helped in being more **creative**. Made it fun.
IQ1 (B)	Made me **think** more.
IQ2 (A)	Using the cards was tricky at first but made me **think [reflect]** more about options.
IQ2 (B)	Hard to asses, maybe. People seemed **creative**.
IQ3 (A)	It made the meeting more fun. "Sexifying" the decision-making part. Unclear to see if the scoring part will motivate me. To get more benefits, the game should be run continuously so everyone get used to it.
IQ3 (B)	It was easier to visualize our decision process. For people that usually does not talk much, maybe this approach could help. Inspire if you are not too **creative**.
IQ4 (A)	Maybe have a digital version that can be shared on a screen.
IQ4 (B)	Hard to tell if there could be any improvements, I need to play more.

4 DISCUSSION

The results suggest that the game was improving the individual engagement in the decision making process (high mean values of Q1-Q3) and that the interviewees expressed increase in creativity and fun. These expressed notions could indicate a higher level of motivation as expected effect from the gamification method. The reflexive dimension is difficult to capture, but the mean value of Q3 (level of engagement in the decision making) was 4.4 and the answers from IQ1-IQ3 suggests that the players was indeed thinking more during the game and found it more fun to engage in the decision making, thus reflecting and weighing options could partly be factors that are affected. No feedback was given for the rules or the game design, therefore we conclude that these factors was not significant for this particular experiment. However, on a large scale study we would expect to find minor adjustments on the cards and/or rules.

The mean time of all gameplays (15 min.) can be considered short, although depending on what decision is to be made. Only two blocks in general was

used for the decisions to be made, with the exception of one decision that was postponed and the game had to be cancelled due to time constraints. From this preliminary data we can suspect that the game could influence the temporal aspect of the team's decision making. Without the possibility to benchmark the decision making speed for the examined group of study, we would still argue that the time boxing component of the game contributes to the speed of progress (Muller, 2009).

One player did not play any card at all during the whole experiment, and the current experiment design was not suited for capturing that type of factors. In the context of digital gamification, the level of participation can increase (Barata et al., 2013) by applying gamification methods, but it is uncertain if this would apply to our case. Thus, the experiment design could be further developed into capturing the participation level, e.g., asking questions on confidence and motivation to be active in the game. Moreover, it was less focus on trying to win the game according to the interviews, i.e., no mentioning of score or competitive perspectives. Instead, just playing the game itself seemed to initiate engagement and creativity. Therefore, it would be of interest to investigate further if the competitive component is necessary or if the cards as such would be enough to trigger the participants in engaging more into the decision-making process.

We propose that for future work an up-scale of the experiment should be made, i.e., run the game in multiple management teams and preferably have one control group making decisions without the game during the experiment. Such up-scale study could indicate more general results, however if it is still within the frame of a case study we cannot draw any firm generalized conclusions. Another suggestion is to adapt the game further with new perspectives used in group decision making, e.g., adjustment for teams that are in different maturity stages (one set of rules for a newly compiled team, and another set of rules for a more mature but low-performing team, and so on). Finally, a thorough study of the game's effects but digitized so that distributed teams can use it, would be interesting since nowadays, especially in post-pandemic times, the likelihood that the management team is co-located is not as high as before.

4.1 Threats to Validity

The internal validity can be affected by the fact that the chosen team in the experiment was via convenience sampling, hence there is a risk that the team is not representative for a typical SE management team. Moreover, we did not have a control group to compare the results, however, since we measured the *perceived* effects of the game, it would be hard to calculate differences against a control group. This would be relevant for further studies in behavioral SE.

The external validity can be challenged in part when it comes to generalization. The experiments were run within in a very specific environment (the target company) and specific group (the management team). However, the experiment design is simple and easy to replicate, thus any further studies could strengthen the results if applied in other environments and teams. Following the argument by Ghaisas et al. (Ghaisas et al., 2013) we could expect some *generalization by similarity*. This means that the characteristics of the case study use case (size or type of organization, culture, projects) SE management teams with similar attributes might respond similarly as in our study. Hence, while our study does not offer a complete generalization, it provide insights that could be relevant in similar settings.

5 CONCLUSIONS

These preliminary results indicate that the game indeed improved the selected group's (perceived) decision making according to the survey and interview responses. Therefore, we have provided an answer to RQ1, but with the reservation that further studies (e.g., longitudinal case studies) are needed for understanding underlying factors to the results and improve the statistical significance. The individual engagement was also increased by using the game in the decision making, the results from Q3 alone strongly indicate this (mean value of 4.4 of 5). Therefore, RQ2 is answered, however we have not provided evidence that the SE context has any influence. We can therefore not conclude if the increased engagement has any relation to the SE management context or management contexts in general. Overall, the game of one more idea seems to indicate benefits to managerial decision making.

The game is available for free on GitHub: https://github.com/hannessalin/research-code/tree/main/decision-card-game with cards and game rules for printing.

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