Gamification Applied to Project Management and Agile Methodologies for Fast Development Teams

Gamification & Kanban Methodology

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"Necessity is the mother of invention."

Plato

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Resumo

O aumento exponencial de projetos na área de desenvolvimento de software e afins tem levado equipas a aderir a metodologias ágeis. Estas metodologias visam garantir a qualidade e rapidez com que o projeto é desenvolvido, e ajudam na organização das equipas por forma a não desperdiçar recursos. Contudo, por vezes é identificada falta de motivação por parte de desenvolvedores e gestores em aderir a estas metodologias, seja por motivos sociais, barreiras psicológicas, ou até mesmo falta de motivação em geral.

Por forma a reduzir os efeitos da falta de motivação na adoção às metodologias ágeis, a implementação de mecânicas de gamificação, promete aumentar a participação e motivação dos utilizadores. Estas mecânicas simulam um ambiente divertido, similar ao encontrado em videojogos, desta forma, proporcionando uma nova experiência Ágile aos utilizadores, que ajuda a motivar e ultrapassar as suas dificuldades de aderência.

A solução gamificada criada, tem como base a metodologia Kanban, que simula como seria aplicada em contexto real, uma verdadeira plataforma Kanban gamificada. O objetivo desta solução é encontrar quais os elementos de motivação dos utilizadores, por forma a facilitar a adoção a estas metodologias. Por fim, por forma a confirmar a abordagem aplicada, foi feita uma avaliação através de um questionário.

No futuro, a solução deverá ser construída e aplicada num contexto real, por forma a obter resultados de forma mais detalhada, e assim, adaptar e desenvolver continuamente a solução conforme os mesmos.

Palavras chave: Gamificação, Kanban, Adoção, Metodologias Ágeis, Motivação, desenvolvimento de software

Abstract

The exponential increase of projects in the area of software development along with others has led teams to adhere to agile methodologies. These methodologies aim to guarantee the quality and speed with which the project is developed, and help organize teams to not waste valuable resources. However, every so often it is identified a lack of motivation on the part of developers and managers to adhere to these methodologies, either for social reasons, psychological barriers, or even a lack of motivation in general.

To decrease the effects of the adoption problems, solutions such as gamification promise to increase user engagement and motivation. The applied mechanics simulate a fun environment similar to what is found in video games to change the way users look at agile solutions, and overcome their difficulties in adopting them.

The created gamified solution was based on the Kanban methodology and simulates how it could be applied in a real professional environment. The objective of this solution is to find the main elements of motivation for users, to facilitate their adoption of these methodologies. Finally, to confirm the applied approach, an evaluation was made through a survey.

In the future, the solution should be built and applied in a real work environment, to obtain results in a more detailed way, and thus continuously develop and adapt the solution accordingly.

Keywords: Gamification, Kanban, Adoption, Agile Methodologies, Motivation, Software Development

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1 – Introduction

It is in this first chapter that we approach points such as the context of this project, the motivation that led to the choice of its theme, the research questions and how their answers can benefit others, the objectives of this project, and finally, the structure of the document.

1.1 Context

Project development is a lengthy and complicated process that involves several components to achieve the desired final product. Nowadays this process has been refined and adapted with agile methodologies [1], one of the best-known methodologies is Kanban [2], which like others, helps optimize the development process, and reach the final goal faster, and with the best possible quality. However, despite these processes becoming more and more refined, there is a notorious lack of adaptation to these processes on the part of those who practice them for various reasons, such as psychological barriers, lack of social skills, or overall motivation [3].

To overcome these adoption problems, the implementation of solutions such as gamification [4] has been successful. Video game mechanics known by the general public, such as points, badges, leaderboards, and progression systems, promise to change the way users interact with agile solutions while providing them with a challenging and fun environment, thus overcoming their adoption problems. These mechanics have been very popular because they take advantage of the extrinsic motivation of the users to create the necessary motivation to complete the tasks.

1.2 – Motivation

Due to the pandemic, several IT companies were forced to change their work model to the work-from-home model. This way, employees had to change their daily lives drastically, which in turn may have created problems in their work productivity and motivation. Therefore, with the entry into the job market as a designer in a rapid project development team during the pandemic, and after extensive research on agile methodologies and gamification, it was with great interest that this topic was chosen for the development of the present dissertation.

1.3 - Research questions

In the previous context, it is provided a general sense of agile methodologies and on the lack of motivation of its adherence, on gamification and on how it may provide a source of motivation to overcome personal users obstacles, and finally, on the personal motivation presented in this introductory chapter. Considering this previous study, the following two questions were asked:

- How can one be motivated to adopt agile methodologies through gamification?
- What are the main motivation elements?

Answering these questions will allow future projects to have a better understanding on how to overcome the difficulties mentioned above, and add value to gamification and the project management in general.

1.4 – Goals

The main objective of this document is to understand which motivational elements in gamification are most successful and have the most effect on people, and how these can help to overcome barriers. Firstly, it is necessary to understand the subjects such as project management, agile methodologies, and gamification, so that in the following phases it is possible to build an operable prototype. Following this first step, the second one is to build the gamified solution with the Kanban methodology, based on the studies of the previous phase. Finally, based on the questionnaire created and distributed, analyze the collected data and conclude whether this solution allows answering the research questions.

It is important to emphasize that the main objective is to understand what are the main elements of motivation in a gamified Kanban solution, and not whether the created prototype is viable in a real work context. This is because, before implementing a working prototype in a real context, it is necessary to understand whether the solution is solid and can become an added value or just another obstacle. Even if it does not work in the area of project development, the solution may be adapted to other professional contexts. Additionally, the visual support prototype only serves as a reference of how the solution would look in a real context, it is not a full working platform.

1.5 - Document structure

The structure of this document was inspired by the seven research conduct guidelines by Hevner et al. [5], however, the guidelines and their order were slightly changed and added to better complete the structure of the dissertation. This document is composed of seven chapters, this introductory chapter being the first, where we address several relevant topics for choosing the theme of this dissertation. The complete chapter list:

- **Introduction**: The first chapter provides an overview of the document;
- **Theoretical Background**: This is where the concepts of project management, agile methodologies, and gamification are covered;
- **Related Work:** In this chapter, several real cases of gamification implementation are discussed, as well as their results;
- **Applied Research Methodology:** Here, the methodology used and the research method are discussed;
- **Proposal & Prototype:** Where the objectives and framework of the gamification solution are addressed, and the design of the visual prototype is presented and discussed, as well as the implemented gamification mechanics;
- **Survey & Results:** This chapter presents the created survey, as well as the collected results;
- **Conclusion:** The results obtained are discussed as to what the next step of this project could be.

2 - Theoretical Background

2.1 - Project management

Everything has a beginning and an end, and in project management, controlling and adjusting every detail of a project considering its first drafts to its conclusion matters. With the use of communication, tools, and processes, project managers can expect better and faster results. According to the Harvard Business Review [6], project management has multiple phases: planning, build-up, implementation, and closeout.

- **Planning**: The planning phase is all about identifying the foundations of the project, what is the idea, who will fund it, how and who will develop it, and what will it resolve.
- **Build-Up**: In this phase, the team is being assembled, a timeline of events created, future problems identified, and the budget developed.
- **Implementation**: This is when the project is in active development, in this phase, it is imperative the communication between the development team and project manager, who needs to be informed and have the know-how on how to adapt and overcome whatever problem may occur.
- **Closeout**: Once every task has been completed and the project objectives have been met, it is time to evaluate and identify what worked and what did not, and how to be better prepared for the next project.

Figure 1 shows a representation of this process.

Figure 1- Project management phases

2.2 - Agile methodologies

Developing high-quality projects is the main objective for project managers. Non-planned and non-communicative teams when in active development for a complex project, may give a low-quality result at a very high cost. Preethiga Narasimman [7], adds that traditional project management is firm and linear and does not allow many opportunities for adaptation, while agile management promotes flexibility. With this knowledge, software development life cycle models were created. According to Alexandra Altvater [1], these models are a process that produces the best possible outcome, in the fastest time possible, and at the lowest cost. As described in Figure 2, cycles are composed of multiple stages that improve the quality of the project by finding and removing the existing deficiencies.
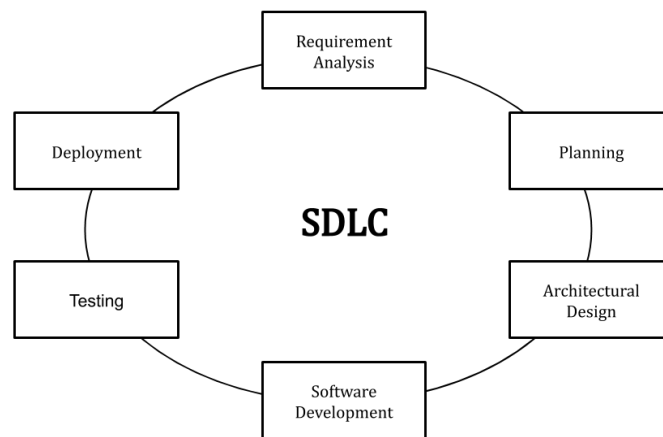
Figure 2- The 6 stages of Software Development Life Cycle (taken from - https://stackify.com/what-is-sdlc/)

These new system stages are described as follows:

- Requirement Analysis, in this stage, inputs from multiple sources such as stakeholders, customers, industry experts, and development teams, are collected. This allows for faster detection of current issues.
- Planning, where the team focuses on the development path the project will take, analyses future risks, and how to overcome them.
- Architectural design, following the plan created in the previous stage, this plane is then reviewed by the stakeholders to confirm if it meets their expectations. This stage is crucial for the project, if the stakeholder feedback isn't used correctly it could lead to more costs.

- Software development, where the actual building begins, in this stage it is key to follow the designated plan.
- Testing, errors, and deficiencies are normal to occur during the building, therefore it is crucial to have a testing routine that finds those flaws.
- Deployment, the end of the life cycle, the building, and major testing are over, although, it is preferable, that before the product is released, it should be tested by the stakeholders to ensure that the final product is what was expected.

There are numerous SDLC models like waterfall, spiral model, and the big bang model, however, Moeen Khan [8] defends that the Agile model is the prime model. Its flexibility permits a constant flow of solutions for every obstacle or new requirement during the project development. Although its adaptability aspect is the main attraction, Khan also refers to other aspects that catch the eye, such as:

- Better quality results;
- Fast project development;
- Fast demonstration demos;
- Low initial resources requirements;
- High interaction with clients and users;

Due to all these benefits, the agile model is currently the most preferred SDLC model in the tech industry.

2.2.1 – Lean thinking & Kanban

A raw concept of the Lean methodology was introduced by Toyota in the 1940s, its core being about reducing costs. Mark Crawford [9] mentions that lean focuses on user satisfaction and reducing the company's unnecessary costs with the lean principles, which are:

- **Value identification,** through multiple inputs from the client and development team, end value can be estimated, for instance, what are the product requirements and how much will it cost to accomplish them;
- **Value stream,** by analyzing every step towards the final result, a map of value can be created, where it can be easily identified and removed, steps that may injure the flow of the development;

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- **Development flow,** without any obstacles, the development process is smooth and can deliver faster results;
- **Pull,** with faster deliveries, customers may request more orders in the same timetable as before.
- **Perfection,** despite the process being more efficient, there will always be more changes that can help improve the development flow. This is why the lean thinking process should be redone several times.

The Kanban model picks up lean thinking and puts it into practice, which will give a better overview of the project development. According to David J. Anderson and Andy Carmichael [2], Kanban brings attention to knowledge work, it ensures that the development flow runs smoothly with customer requests being attended to without overwhelming the development team. Kanban promotes visibility to ensure that the amount of work a team has is balanced with current customer needs, and the team's ability to work and deliver. Kanban is based on respect for workers who contribute to the company, and also focuses on sustainability, service orientation, and survivability.

2.2.1.1 Kanban roles

Kanban was originally designed to not create new roles inside a corporation, this is due to the "start with what you do now" method, which means that nothing changes, no added responsabilities, tasks, or roles to anyone. However, to facilitate the development team, in time and practice, two roles were added to the Kanban model:

- **Product manager**, receives the inputs from customers and redistributes work orders at the Replenishment Meeting;
- **Delivery manager**, keeps the development flow smooth, additionally is responsible for the Kanban meeting and Delivery Plan.

2.2.1.2 Kanban board

Visual signals are displayed in what is called, a Kanban board, which is composed of multiple columns, each representing steps in the project development design. The signals indicate new developments for the project and provide better control of the volume of work in progress at

a given time. These visual signals provide a balance in the system, by not assigning new work orders to an already overwhelmed team, or, by having an available team with no work orders. The pull system is the assigning work process, once a team completes a project and is available for the next one, a visual signal is displayed on the Kanban board, following this, the new slot is occupied with a new work order from the product backlog.

The Kanban board is designed according to the project needs, the most basic form of the board can be seen in Figure 3.
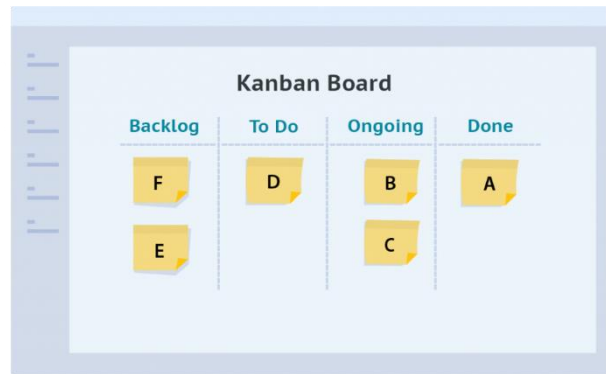
Figure 3 - Kanban board [28]

2.2.2 – Challenges & Adoption

Despite its overall benefits and increased adoption in mixed-type organizations, in many cases, the adoption process may find some resistance from the development teams or management. Nuottila et al [3], mention several reasons that provoke resistance to adoption, such as:

- **Psychological barriers**: Social stress may arise when developers feel that their lack of knowledge in determining subjects may come to the attention of others;
- **Social skills and teamwork:** Agile methodologies require an increase in communication, which could be complicated for some developers;
- **Lack of motivation:** Developers who are content with current systems, will have less motivation to change their work habits.

To overcome some of these resistances, Aniket Mahanti [10], states that to successfully implement agile, strategies must be applied, some of which are:

- **Management buy-in,** create awareness about the benefits and procedures of agile to upper and middle management;
- **Employee support,** by giving proper support about agile processes and frameworks to management and development teams, the adoption is easier;
- **Pilot agile projects,** these projects serve as an example of how to merge current projects with agile processes and present their benefits;
- **Sustainability,** by succeeding adoption, it is necessary to maintain motivation to not let management and development teams regress to old habits.

These strategies enable the easy adoption of agile methodologies in the current context of a company. However, some practices focus on motivation, which also allows development teams and managers to use new processes like agile, thus achieving the objective.

2.3 – Gamification

Video games have come a long way since Pong was first introduced, their mechanics improved to create motivation, and are in constant development. With their success, these mechanics were implemented in other scenarios, in an attempt to achieve similar results as when applied in video games. This is called gamification, defined as "the use of game design elements in non-game contexts" [11]. According to Kai Huotari and Juho Hamari [12], gamification enhances a service experience through various gaming experiences, which in turn, creates value for the user.

To adopt gamification, certain game elements must be introduced to the non-game context. Kevin Werbach and Dan Hunter [13] identify three elements that are crucial to gamification:

- **Dynamics,** focuses on the individual's desires, emotions, and constraints;
- **Mechanics,** generate engagement from the individual through challenges, competition, or rewards;
- **Components,** particular adoptions from mechanics and dynamics like badges, points, or leaderboards.

These elements, provide a complete game experience in a non-game context. The authors, reinforce that even with the three elements, it is necessary to be certain that they are well introduced to the context.

2.3.1 – Motivation

Jonh.W. Atkinson [14], mentions that motivation in the common-sense theory is described as a behavioral appetite towards contentment while keeping away from sources who have the opposite effect. People are impulsed on their own to complete a task to receive something back in return, either physical or psychological. Edward Deci and Richard Ryan [15], refer that there are two types of motivation to people, intrinsic and extrinsic:

- **Intrinsic motivation**, an individual is motivated to finish a task in his interest on their own.
- **Extrinsic motivation,** an individual is motivated to finish a task to receive a reward.

These two types of motivation are part of the Self-determination theory [15], and they must be maintained and challenged, otherwise, over time they may diminish. The authors conclude that when the context in which an individual is incorporated provides stimulus to the psychological need to grow, the individual motivation will naturally arise.

Video games through the use of their mechanics compel individuals to do and accomplish tasks inside the game. According to Seppo [16], in their whitepaper, they mention how these mechanics use the individual's psychological need to grow, and make them pursue rewards. In the whitepaper, intrinsic motivation is referred to be more suitable for students or individuals who enjoy the context, being more focused on the self-desire to grow and do the task for its pleasure. While according to Guy Boulet [17], extrinsic motivation with gamification mechanics provides better engagement for individuals who lack intrinsic motivation in contexts less desirable for them.

2.3.2 – PBL (Points, Badges, and Leaderboards)

Nowadays many examples of gamification adaptation use the PBL system to motivate individuals to complete tasks. It is commonly used due to being very easily adapted to many projects. As stated by Kevin Werbach and Dan Hunter [13], the PBL system is sustained by extrinsic motivation and is composed of:

- **Points:** by earning points, individuals will be compelled to keep staking them or trade them for rewards. These points cannot be earned easily or their purpose to be collected and keeping one's engagement will fade;
- **Badges:** are the visual status of a current position or an achievement by the individual, these may be earned with points or through completed tasks;
- **Leaderboards:** provide a visual map of the individual's placement among his peers, the authors state that leaderboards may be harmful to the adaptation when not well adapted to the context. Individuals may be demotivated to keep going forward when others may be already far ahead.

Although this system is effective, relying only on this gamification method can be problematic if not well adapted.

2.3.3 – Player types & interests

Every player is compelled to pursue something, however, not all players seek the same thing, some a trophy, a title, or any other type of reward. In his publication, Richard Bartle [18] identifies four things that people appreciate while playing, which are:

- **Achievements,** where players are determined to finish a task. Customarily, these tasks are hard to complete, which in turn, makes them more enticing;
- **Exploration,** games with large environments invite players to explore and get rewards;
- **Socialising,** player-to-player interaction;
- **Imposition,** by having interaction between players through communication tools or game mechanics, players will eventually aid or torment each other.

Through these designations, the author label the players as:

- **Achievers:** Completing objectives;
- **Explorers:** Seeking and gathering information;
- **Socializers:** Commune with other players;
- **Killers:** Contentment through other players' misfortune.

In Figure 4, the graph represents the sources of players' interest and how they define their labels, this graph is denominated by the "Interest Graph".

```
                        ACTING
         Killers          |              Achievers
                          |
                          |
                          |
                          |
                          |
PLAYERS  -----------------+------------------  WORLD
                          |
                          |
                          |
                          |
                          |
         Socialisers      |              Explorers
                      INTERACTING
```
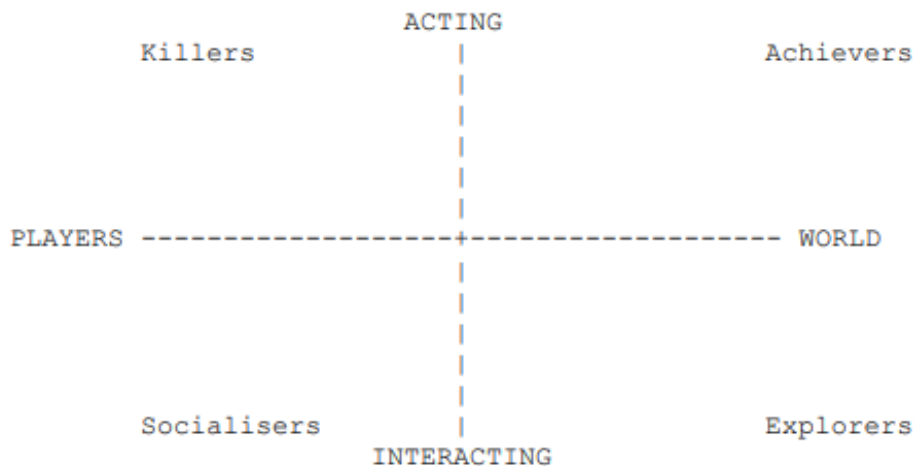
Figure 4 - Player types and source of players interest [14]

The end of the axes indicates the players' interests, and through a simple quiz, it is possible to identify what drives players in games and what is their place in this graph.

The author also refers that these four-player styles must coexist in parity with each other. This means that the numbers of each player type should remain somewhat constant, to maintain a balance, which is determined by the administrators who control the simulation.

Bartle provides an example with the graph presented in figure 4, if considered a plane, it shows how tipping the weight of one of the areas would affect the others. This weight represents the administrators' change in the simulation design and its effects on the different types of players and their interests, furthermore, if too much weight is provided to one of the extremes of the graph, it could ruin the simulation purpose. For instance:

- **Players:** Providing too many mechanics for player communication and not for the actual experiment, will reshape the simulation into a communication tool.
- **World:** Making the experiment tilt more into the world by implementing mechanics that won't offer much communication between players, may result in a lack of motivation from players. However, this result may create motivation for players who do not desire player-to-player communication.
- **Interacting:** Players need the feeling of freedom and that their choices have weight, and that their environment changes with their choices. Restricting them from that feeling by tilting too much to interacting, players will find themselves on an already predetermined path that will not offer much action, and consequently, demotivate the player. The author also refers that, this approach may prove to be successful for

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new players who need an introduction to the simulation, or, for players who are more driven by this kind of narrow path experience.

- **Acting:** Too much action may be more exhausting and tedious than first anticipated. By tilting more into the acting area, players may feel that constantly doing tasks and having no breaks to learn new things is overwhelming. The author emphasizes that there must always be depth to the experiment.

These extreme cases serve to show the balance between the players' interests is key, and even if some players are content with one extreme case, the majority most likely aren't.
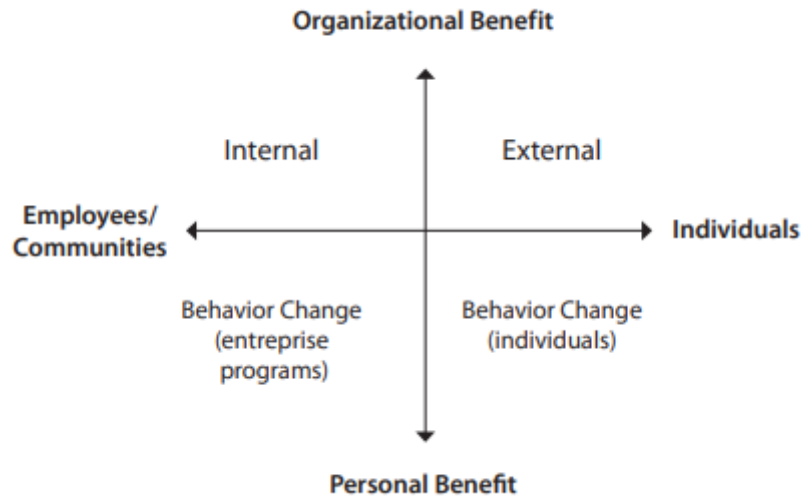
2.3.4 – Gamification in business

Kevin Werbach and Dan Hunter [13], mention that gamification does not only benefit users, but can also help organizations improve their processes and escalate productivity. Furthermore, the authors mention that inside an organizational environment, there are three prominent non-game contexts:

- **Internal gamification**, inside the organization, which is acting as a community for all employees, promotes team building and motivation to do more, while bringing more communication between colleagues and improved results to the organization.
- **External gamification,** is addressed to customers, with the help of all the current marketing tools to extract information from the public, the introduction of multiple marketing strategies with gamification produces better customer loyalty and entices new customers.
- **Behavior gamification,** this context seeks to change one's behavior through the use of gamification. It can be in the form of habits or ways of thinking.

A better view of the relationships between these contexts is presented in Figure 5.

Figure 5- Gamification contexts business relationships [13]

To easily design a gamification solution, it is necessary to fully understand what mechanics will work, and, if motivation can be achieved. Bryan Burke [4] mentions that to design a gamification solution, it is necessary to employ the following seven steps:

1. **Define the business outcome and success metrics:** What are your objectives for using gamification?
2. **Define the target audience:** One approach does not fit everyone, to who are you designing the solution?
3. **Define player goals:** What are your player's needs and motivations?
4. **Determine the player engagement model:** What mechanics will be implemented in the solution.
5. **Define the play space and plan the journey:** Where and how the solution will be implemented.
6. **Define the game economy:** What are the rewards? Prizes? Recognition?
7. **Playtest and iterate:** Collect feedback and improve the solution.

These seven steps will create the foundations for a gamified solution, although, this is a continuous process that must evolve by receiving feedback from the players and adding new features.

3 - Related Work

Due to the successful implementation of gamification in multiple and different scenarios, it is possible to analyze several cases and understand what benefits and limitations can be expected.

Kevin Werbach and Dan Hunter [13] mention the case of Ross Smith at Microsoft, where Smith implement the Language Quality Game, where he recruited Microsoft employees around the globe, to, in their spare time, review Windows 7 dialog boxes in their native tongue. The employees were rewarded with points whenever they found an error, and be placed on a region leaderboard. In the end, Smith registered that, employees found this experiment very addictive and enjoyable, turning this gamification case very successful.

In another example, the author Brian Burke [4], mentions the less fortunate Google News Badges case, where Google implemented a PBL system where readers would receive badges according to the number amount of news a reader would eventually read. Having too many grades and types of badges, got readers rapidly disinterested, and after fifteen months Google removed the system. Burke also mentions that what matters is how hard the journey was and the feeling of reaching the end, not the PBL system. This case exposes that even a simple PBL system, when incorrectly adapted, can pull down an otherwise good experiment.

3.1 – Gamification in Education

Lack of motivation is a recurring problem, and this problem can be also found in people in learning programs such as schools or corporations. Dilip Soman and Wendy Hsin-Yuan Huang [19] use a five-step process to gamify an educational concept, some of these are general steps, for instance, focusing on the target audience, learning objectives, resource management, and the introduction of gamification elements. Even though the gamification process is targeted at educational purposes, it is possible to gain relevant insight for gamifying other projects.

In the education context, with clear objectives established, the authors identify common pain points in students, for instance, focus, pride, and motivation. These pain points help determine which gamification elements will fit better in the learning program, thus, creating a more personalized and better experience for the players.

One case study broached by the authors was in the National University of Singapore, where students would tend to procrastinate all semester and only pick up on their work a short time before the deadlines, or just could not comprehend subjects taught in a short time. With the pain points identified, to overcome these issues, an education program was adjusted with gamification elements. For motivation-related problems, experience points and leaderboards were implemented, and for students who could not focus and learn their subjects, the curriculum of the course was altered. The assignments were divided into larger numbers and renamed as "missions", which in turn gave it a sense of storyline, and students who submitted the answers to these assignments would get instant feedback. Same as professors, who could evaluate and make adjustments to the program where needed.

The students who participated in this program found this new system more helpful, and, gave them more motivation to keep leveling up through the assignments. These new elements motivated the students to excel, thus reducing the pain points and their effects.

Similarly, Rodrigo Smiderle et al [20] have conducted an experiment with two groups of students in a university, where one group used points, badges, and a ranking system, while the other was non-gamified. This experiment was aimed at understanding wether gamification has different types of affects on students regarding their personality. For this study, a gamified version of the program Feeper and a non-gamified were used, where students would complete programming tests, and the program would correct them. Aditionally, the students took a IGFP-5 personality test, and were divided without prearrangement in the two groups. In the end, this experiment concluded that the students that used the gamified version had better quality answers in their tests than the non-gamified group, and regarding the personality traits, this experiment showed that introverts in both gamified and non-gamified groups had better scores than the extroverts.

3.2 – Gamification in Agile methodologies

As already mentioned in the theoretical background, the adoption of agile methodologies is not always easy. Due to bad communication between management and development teams, lack of motivation, or social stress. Through gamification, it is possible to alleviate some effects of these difficulties, and when successfully implemented, even prosper.

Murat Yilmaz and Rory V.O'Connor [21] mention a case study where a focus group was used to gather information in three different periods, about current development processes and

how to improve them, through simple surveys. With the information from the first survey, several issues were pinned down, such as a lack of communication between the development teams and product owners, delays in feedback loops, and an overall lack of general knowledge of agile processes. The next step was to change the agile process to better fit the general needs, although, after the second phase of surveys, to meet the development team's needs for intrinsic and extrinsic motivation, gamification was implemented, and the business objectives were re-equipped to:

- Design of targeted behaviors (encouraging teamwork, sharing information, and accomplishing more objectives);
- Identification of player characteristics (player types);
- Designing activity loops;
- Designing elements of fun;
- Deploying necessary instruments.

In the last phase of surveys, regarding the gamification implementation to motivate developers, the authors conclude that there was an increase in performance in development processes.

3.3 – Discussion

Through the case studies presented, it is possible to extract some of the processes used and the benefits that gamification provides when well implemented. In the Microsoft case study [13], a PBL system was very well implemented, making the target audience feel like playing a game and having fun, while in fact, they were working. However, as in the case of Google News Badges [4], when gamification elements are implemented without prior experience or research, and without expectation of results, the result will cause more disturbances than benefits.

In the cases of Dilip Soman, Wendy Huang [19], and Murat Yilmaz, Rory V.O'Connor [21], despite being directed to different contexts, at the beginning of both gamification implementation processes, information was collected through interviews or surveys, from the target audience to identify pain points, and with these, set goals. Table 1 provides a better overview.

Table 1 - Factor overview

Factors	Interpretation
Fun environment	Successful simulations provide players with the unique feeling of playing a game. Thus, what was once a strictly professional and, in some cases, monotonous environment, reshapes into a motivating and possibly even fun environment.
PBL system	This system has proven to be the easiest to implement and to provide positive results, therefore, being the most common mechanic utilized. However, in some cases may not be the best to implement. If this mechanic is used excessively, or, if players are not interested, the result may differ from what could be a great success.
Information gathering	It is important to gather information during multiple stages of the development of the simulation, and even after its completion.
Constant development	A good simulation must keep its self-development over time to maintain its success and player engagement

4 – Applied Research Methodology

This project consisted of the design of a gamified Kanban solution, and in addition, a visual support interface. This proposed solution allows developers to receive and deliver projects while acquiring points that can later be exchanged for prizes, and progression to earn badges. Furthermore, project managers are also able to benefit from this platform with an overview of all projects and their status, and a leaderboard on the developer's productivity.

Data collection was made through a survey that was divided into different groups of questions. This is to better understand the knowledge of the respondents on the different subjects such as Kanban, gamification, and the proposed solution. Through this gathering of information, it was possible to help answer the following research questions:

- How can one be motivated to adopt agile methodologies through gamification?
- What are the main motivation elements?

The research method consists of a mixed approach, qualitative due to the studies and solutions developed by other authors, to identify which are the most efficient and popular motivating mechanics. Quantitative due to the numerical data that will be obtained from the survey's results. As for the type of questionnaire, it is explanatory, to help assess one's source of motivation, and was created specifically for this project.

5 - Proposal

This chapter dives into the objectives, aspects, and choices of the created prototype and how it can surpass agile adoption issues through motivation, and even enhance Kanban's advantages to its users.

5.1 – Gamification Framework

Although it seems easy to implement gamification mechanics, in reality, a grounded study is necessary to understand which mechanics work best to achieve the objectives of the solution. In previous sections, we identified some real cases where the lack of this study, concluded with a final product that did not meet the determined objectives and ended up becoming an invalid solution. To avoid this outcome, we have used Brian's Burke logical seven steps to build a gamified prototype, mentioned in subsection 2.3.4.

5.1.1 – Business outcome & success metrics

For our solution, the expected business outcome is to escalate one's productivity with agile practices adoption. To achieve this outcome, it is necessary to understand to what extent the solution will be considered a success when it is implemented. Burke [4] mentions that the business outcomes and success metrics cannot be overly unrealistic, they should be achievable and easy to interpret, so it does not cause too much strain if the marks do not hit the required targets. Thus, formed on the related work and research problems, our success metrics are:

- Verify which of the gamification mechanics applied in the solution is favourite;
- Compreend if the current mechanics are enough, or, more should be added, or, removed;

These are the success metrics for the survey on the created solution. Through simple and direct questions, respondants will be able to vote their answer in order to determine the success of the solution.

5.1.2 – Target audience

The solution intends to mitigate the difficulties of adhering to agile methodologies mentioned in subsection 2.2.2. Bryan Burke [4] outlines that it is necessary to know our target audience to better adapt the gamified solution to their needs, in this way, it promotes funneling, thus creating boundaries around the target audience and facilitating design decisions.

The target audience for this solution is project managers/team managers and development team members. Although the solution is aimed at fast development teams due to the Kanban methodology, it can also be applied to medium or long-term development teams such as software development teams.

5.1.3 – Player goals

It is necessary to understand what drives our players to complete certain tasks, so we can create an experience that enhances that drive. As previously mentioned in subsection 2.3.1, intrinsic and extrinsic motivation lead individuals to complete tasks and receive something in return, whether in the form of a prize or just for personal achievement, in this way, we take advantage of these types of motivation to create the player's goals. Furthermore, now with the player and business outcome goals outlined, in Figure 6, it is possible to better understand where both overlap. Bryan Burke [4] also mentions that it is on these common goals that gamification works best, as this is where both parties achieve their goals.

Shared goals
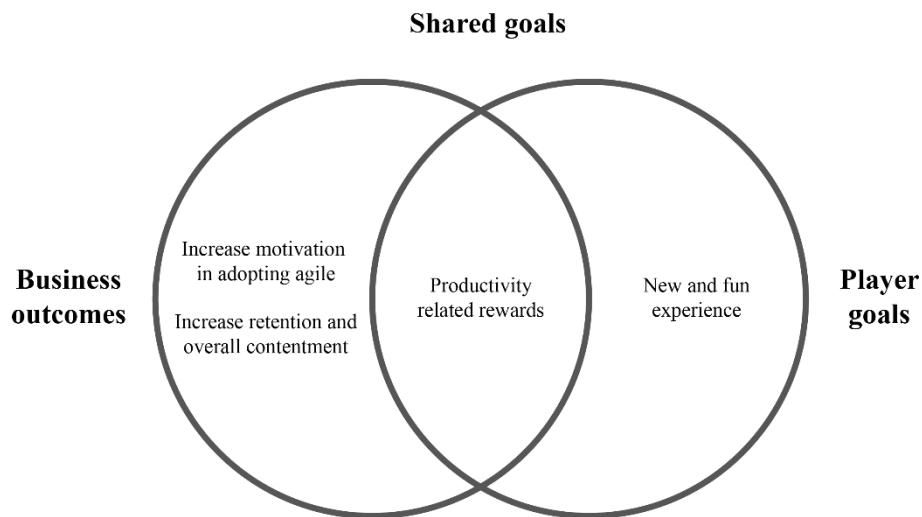
Figure 6 - Gamification Scope

5.1.4 – Player engagement model

This section will elucidate the established structure decisions of the gamified solution and how users interact with it. To help with the explanation, the author Bryan Burke [4] uses the player engagement model, so it is possible to obtain a better reading regarding the solution's position and which parameters are more focused on the solution. Our proposal's player engagement model can be seen in Figure 7.
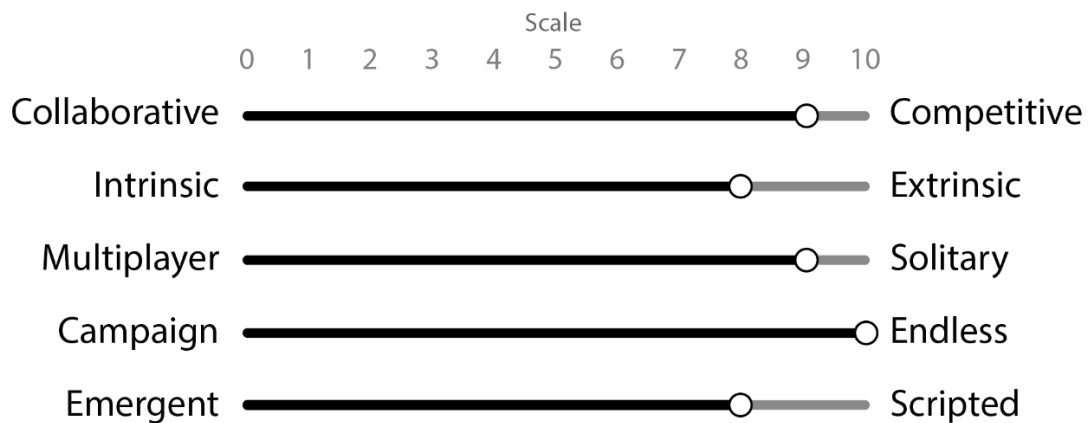

Figure 7 - Player engagement model, adapted from [4]

Through our model, it is possible to have an overall view of how users interact with the solution. To better understand our engagement model and its parameters, the following, details the choices made:

- **Collaborative/Competitive** – Users do not normally collaborate. However, some projects may permit a rare chance of collaboration between users.
- **Intrinsic/ Extrinsic** – The solution allows for an environment where both intrinsic and extrinsic motivations can inhabit. This is possible due to the different types of gamification mechanics applied such as prizes and badges. However, the main motivation type for this solution is extrinsic.
- **Multiplayer/Solitary** – The main focus is on users who can alone accomplish their tasks, however, rarely there may be projects that require two users to work together.
- **Campaign/Endless** – Kanban methodology is designed for continuous work, therefore it does not end as long as projects keep appearing.

- **Emergent/Scripted** – The solution will be mainly scripted for the reason that the result is known, managers will add projects and attribute them to development team members, however, special urgent projects for a limited time only emerge, these events may be due to a special occasion or urgent request not previously planned.

5.1.5 – Play Space & Journey

This step is crucial in the development of the solution, as this is where the play space and the player journey are created. The play space is where our users enter the game and interact with the solution. Our space design is simple and intuitive to interact with, this design choice was made according to the research of Ali Derejeh and Dalbir Singh [22] where they mention that graphic objects like icons, fewer features at the same time, and, easy to use interface, are the most viable options for a more broad target audience. The player's journey is the route and experience users take while using the solution, and those who manage to complete tasks are rewarded, therefore, engagement and motivation are continuous.

5.1.6 – Game Economy

To keep user engagement levels high, Brian Burke [4] mentions that a good gamified solution needs a good game economy, these can be represented in the form of amusement, rewards, self-esteem, and social capital. In our solution, we can find these types of game economy in mechanics such as the PBL system, where users after completing tasks, receive points or badges. The managers provide the prizes and their prices, and the development team members exchanged their points for various prizes of their choosing, however, earned badges are unique for each user and not tradable. Figure 8 provides a better perspective of our solutions game economy.
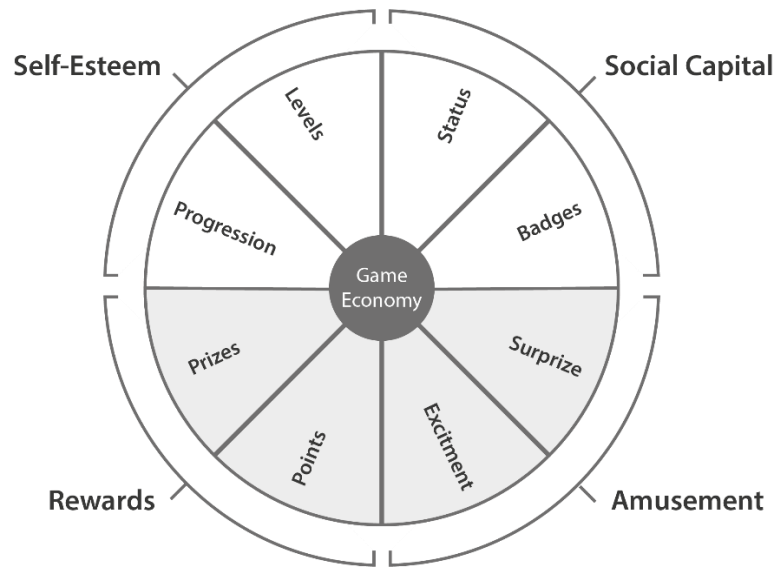
Figure 8- Solution's Game economy, adapted from [4]

5.1.7 – Playtest & Improvements

This last section is reserved for testing the gamified solution and obtaining and analyzing data on how to improve it. For our solution, the tests are carried out through a survey in the google forms platform, where it is possible to receive direct feedback about the implemented mechanics. The gathered information is important to further develop the solution, and additionally if the user is motivated by implemented mechanics. The complete survey may be found in Appendix A.

5.2 – Prototype

In this section, the choices made in the implementation of gamification mechanics and the prototype's design are discussed.

5.2.1 – Using Kanban

There are already several solutions with agile methodologies in the project development market, however, for rapid development teams where projects arise successively and are completed in a short space of time, agile methodologies such as scrum are not ideal. Therefore other agile methodologies like Kanban, where the process is continuous, are a better fit for these fast teams. By using Kanban, managers can get a better overview of current projects and their status. Thus, they may assign projects to the various developers of the team that have fewer projects on the board. This allows better use of available resources and agility in development.

5.2.2 – Prototype Features

As previously mentioned, to repress agile adhesion issues, this prototype focuses on gamification mechanics implemented on the agile methodology Kanban. In this prototype, several mechanics work around the extrinsic motivation of users, with few focused on intrinsic motivation. Together, they create a more engaging and advantageous environment for the user. This permits users to keep their motivation high, therefore, prolonging the prototype's usage.

From a very large pool of gamification mechanics, and for this specific type of prototype, only a small group of mechanics were chosen, for a good coexistence with each other without tiring the user. This small group is composed of the following mechanics:

- PBL (Points, Badges, and Leaderboards);
- Awards;
- Progression bars.

These mechanics provide the perfect opportunity for having a user's previous bad experience renewed, by disregarding Kanban issues while enjoying the best it has to offer. The

following subchapters go into detail on these mechanics and how they work together within the prototype.

5.2.2.1 – PBL

The PBL system (points, badges, and leaderboards) is the main mechanic of the prototype which focuses on both types of motivation. The following list provides a good description of these mechanics:

- **Points** - Developers who accomplish tasks are rewarded with points, the number of points depends on the project. Each project is associated with a determined number of points and assigned to a developer by his project manager. Having a manager that controls the number of points for each project is necessary due to the diversity of complexity that each project may have. This way, it is possible to prevent situations where developers who are assigned high-complexity projects do not lose the motivation to finish them due to the low award of points.
- **Badges** – Achieving a certain goal will award developers with badges, for instance, after a certain number of completed projects, these badges identify the developers' skills and accomplishments.
- **Leaderboards** - To get a better overview of the productivity of each developer, leaderboards were implemented, however, based on research by Seblha Balci et al. [23], leaderboards can have negative effects on users' motivation, this way, only managers will have access to each team's leaderboards, thus not having effects on the developers.

5.2.2.2 – Awards

Points can be exchanged with awards, they can be in multiple forms, such as gastronomic experiences, vacation destinations, merchandise, or other any other types of prizes. Each type of award has a certain price, that can be paid with points, therefore, to obtain them, players must collect a certain number of points to reach the award's price. To collect them, players simply have to complete their assigned tasks, and whenever the opportunity appears, special events where players can choose whether or not to participate, provide extra points.

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5.2.2.3 – Progression bars

For a user to stay motivated while using the solution, another game-like mechanic was implemented. The progression bar system allows the user to have a better perception of their progress until reaching the next goal and enjoying their rewards, whether these are points or badges. The implemented progression system is directed toward the development team members and is aimed to improving their engagement.

5.2.3 – Prototype Sections

The built prototype is composed of several sections, and its interface is divided into the development team members and managers sections. The further subsections go into more detail about each section. From now on development team members will be referred to as dev members for better understanding. Figure 9 provides a better overview of how the prototype sections are divided and which ones overlap between both dev members and managers. These groups are divided into two colors throughout the interface, orange for managers, and blue for dev members.
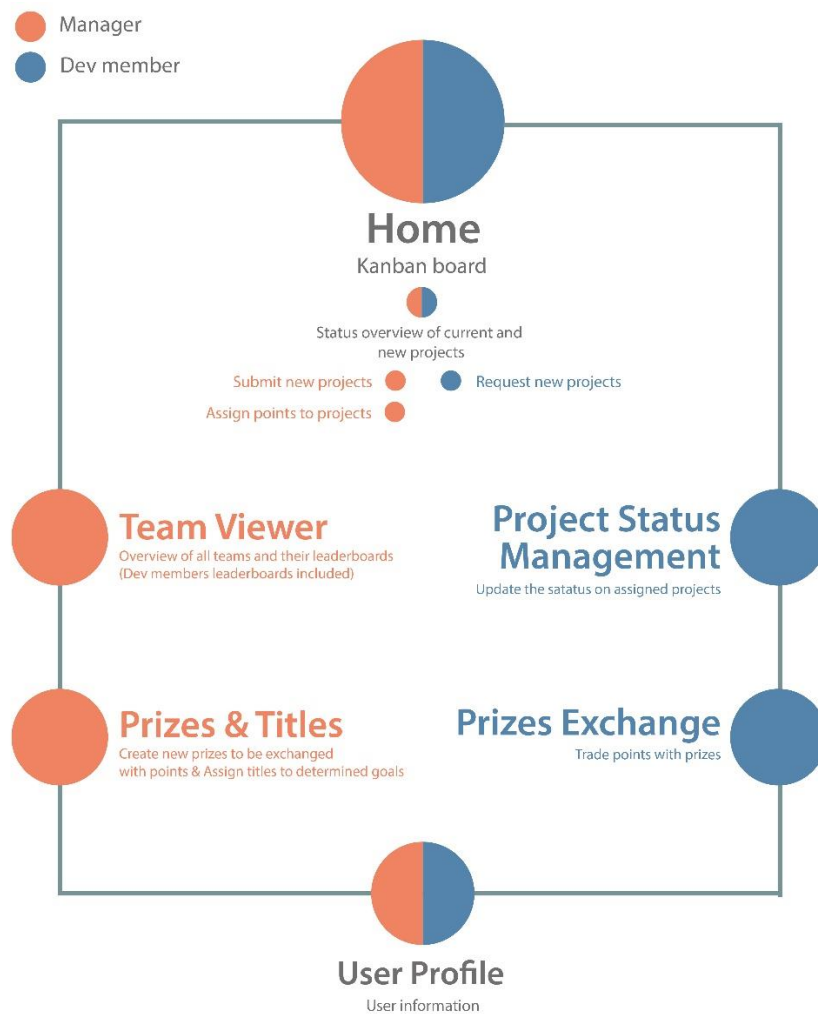
Figure 9- Interface sections

5.2.3.1 – Home

It is in this sub-chapter that we address the first interface that users interact with in the solution. This is where both dev members and managers can get an overview of the status and information, regarding all their teams' projects in the Kanban board during a specific time period. The implemented board is simple, with only four columns, those being **Project Backlog**, **To do**, **Ongoing**, and **Complete**. While for dev members this section is more of an overview, for managers this is where they can add new projects, pick the date for their delivery, attribute their value in points, and assign them to the dev members. Figures 10, and 11 present the home section for dev members and managers.
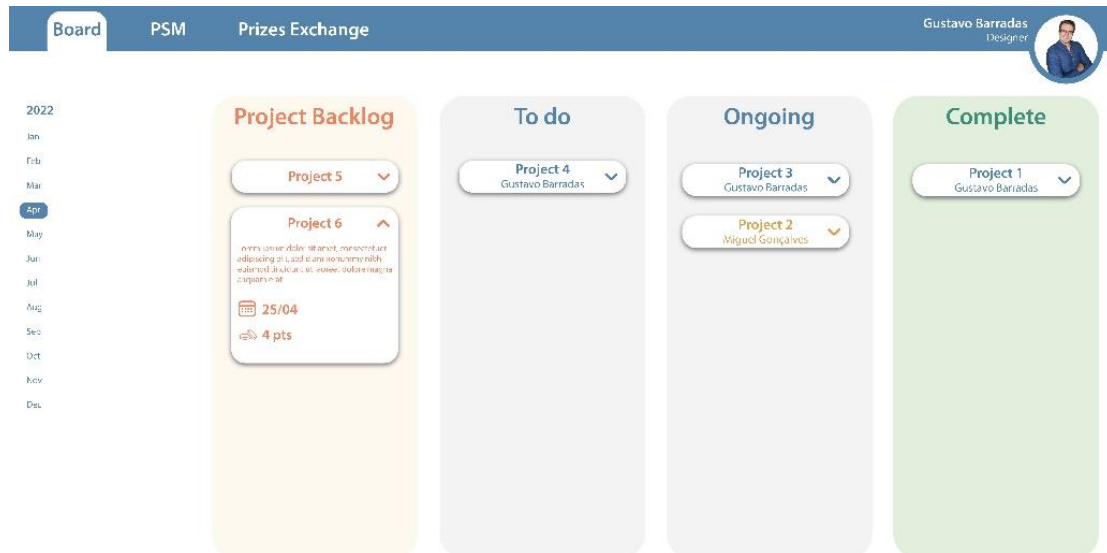
Figure 10 - Dev member Home view
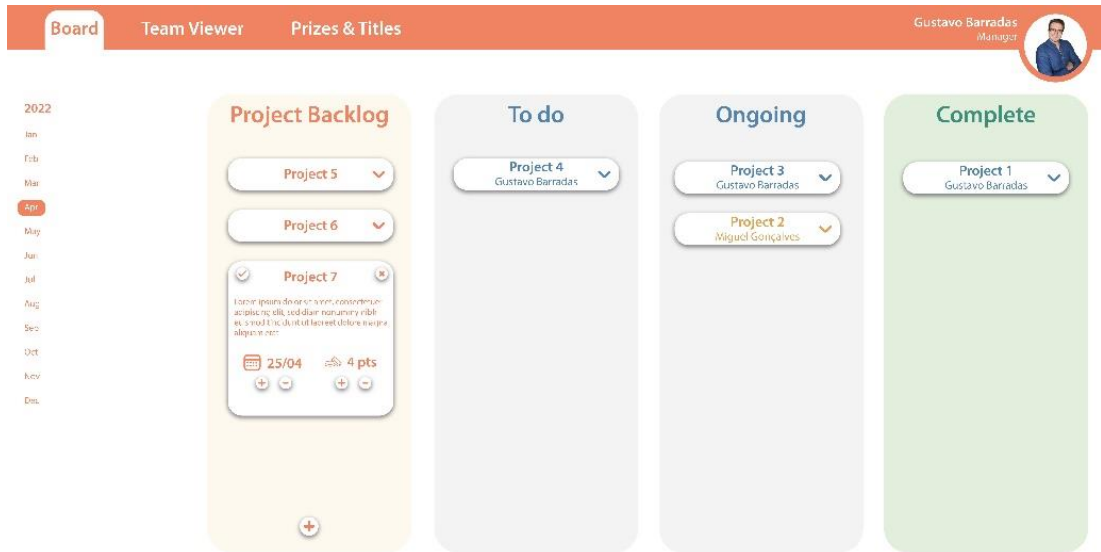
Figure 11 -Manager Home view

5.2.3.2 – Team Viewer

In this section, we cover the interface where managers can get an overview of the productivity of their teams and individually of each dev member. This is where the leaderboard gamification mechanic was implemented and it is only visible to managers. This decision, as previously mentioned in research by Seblha Balci et al. [23] defends that leaderboards may bring negative side effects. The leaderboard presents the order in which dev member has been the most and least productive from their complete, ongoing, and on-hold projects in the chosen timeline. Additionally, managers can add new dev members to a team, or remove them. The interface design is presented in Figures 12, and 13.
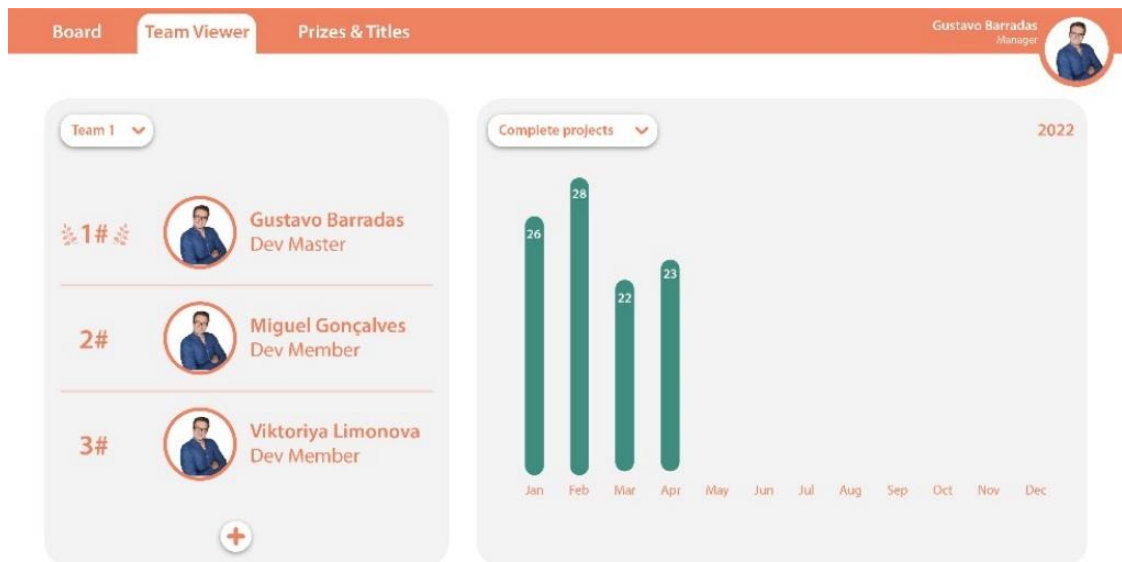
Figure 12 - Team Viewer image 1
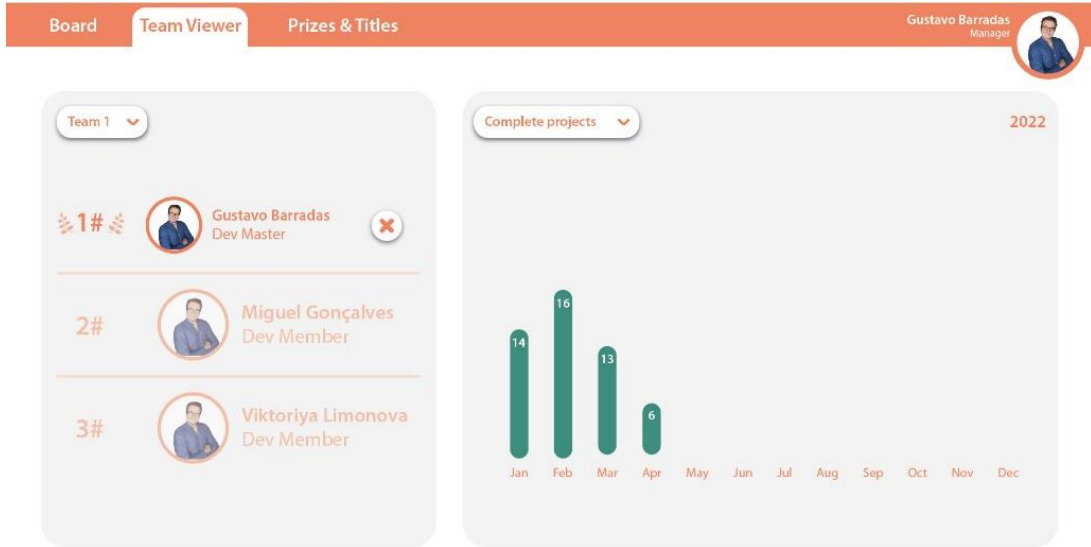
Figure 13 - Team Viewer image 2

5.2.3.3 – Project Status Management

For dev members to be able to track their progress and change the status of their current projects, the "Project Status Management" interface was created. This section goes into detail on the implemented gamification mechanics, and the information exposed to the user. For dev members to keep up to date with their progress and current goals, the progress bar gamification mechanic was implemented, this way, users can quickly get the information they want regarding their progress. This bar is updated whenever a dev member reaches his goal and activates his rewards.

Furthermore, in this interface, dev members can update the status of each project assigned to them. The status names are in accordance with the names that are given in the Kanban board, To do, Ongoing, and Complete columns. Figure 14 provides a view of this interface in the prototype.
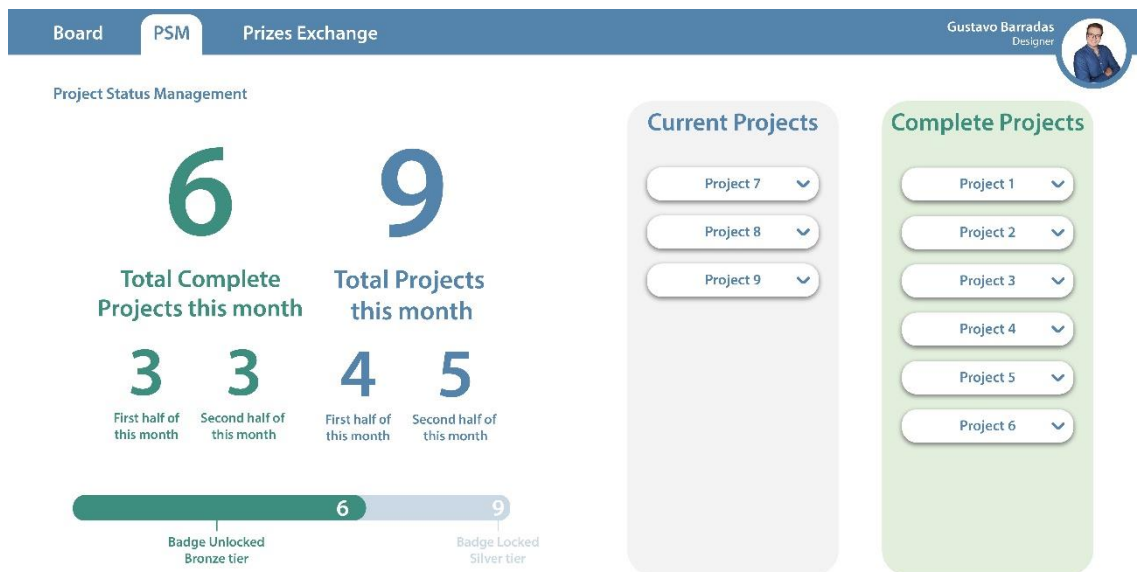
Figure 14 - Project Status Management interface

5.2.3.4 – Prizes & Titles

As previously mentioned, this prototype appeals to both intrinsic and extrinsic motivations, however, the focus is more on the latter. In this way, an interface is needed that allows managers to transform the points received from dev members for their completed projects into tangible rewards. The prizes can be varied and of several categories, as an example, in Figure 15 it is possible to observe that there are prizes of the most diverse categories to please all types of public. These categories can be holiday trips, gastronomic experiences, goodies, and other fun experiences. Like many companies which also support employee rewards, these may come from partnerships with other companies, merchandise from the same company or others, or even monetary awards.

Additionally, managers can also create new titles for dev members to obtain in their progress bar.
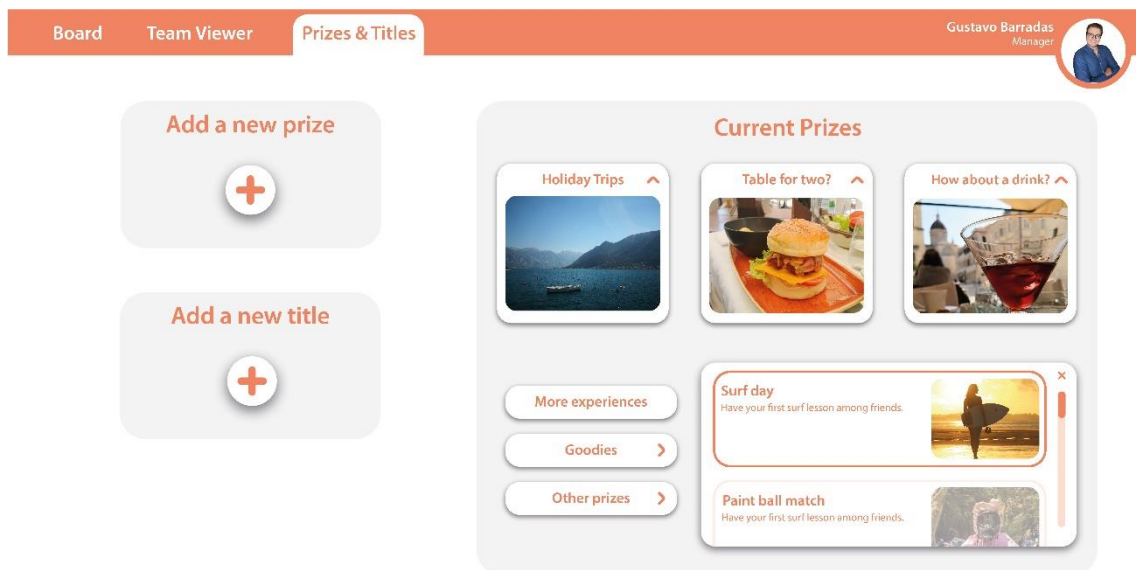
Figure 15 - Prizes & Titles interface

5.2.3.5 – Prizes Exchange

In the previous subchapter, the interface where managers create new awards and titles for their dev members was addressed. In this subchapter, we cover the prizes interface for dev members, shown in Figure 16, where they can exchange their accumulated points for various prizes. These prizes can range from small merchandise items to vast experiences, such as gastronomic, fun, or just adventurous. These prizes are the responsibility of the managers, and they are expected to be very pleasing for the dev members. This is to ensure that the commitment levels are higher than before the solution was introduced.

Regarding the interface's design, it is very similar to the manager's interface, with the only considerable alterations besides the color blue being the dev member's current points are displayed on the left.
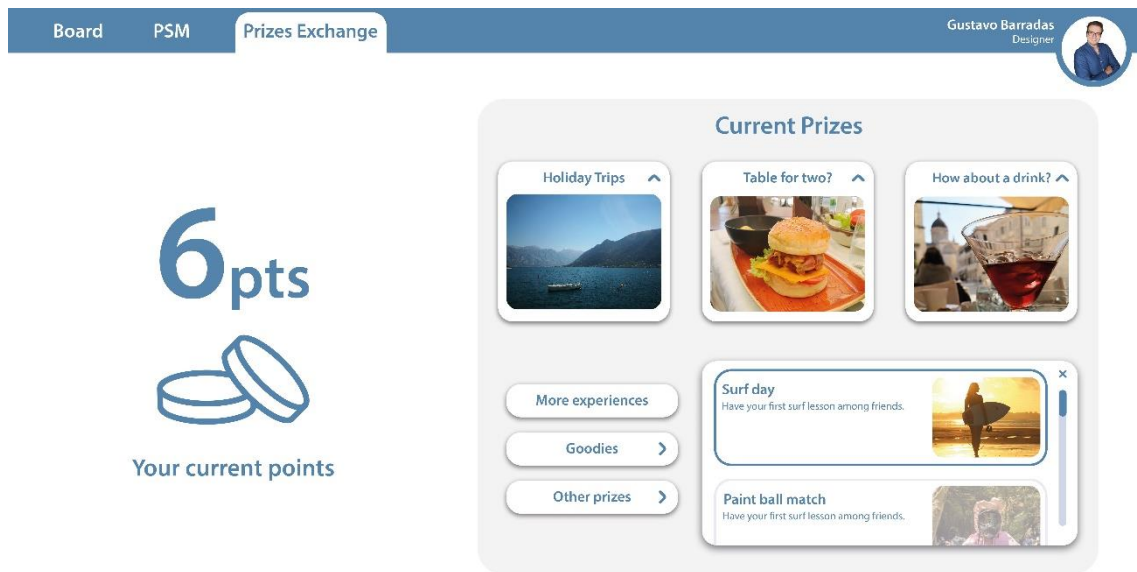
Figure 16 - Prizes Exchange

5.2.3.6 – User Profile

In this last sub-chapter, we cover the last interface for managers and dev members, this is where detailed information regarding projects is exposed, as well as other useful details. This interface, despite having the same objective for both types of users, presents more options to the manager than to the dev member. The manager, as we can see in Figure 17, can observe in detail the complete projects of each team at a given moment in the timeline. Also, the manager can create new teams and later, in the Team Viewer interface, add the members to the new team.

For the dev member, as can be seen in Figure 18, this interface presents less information compared to the manager interface where here it only shows information related to himself. Additionally, it also presents the current tier/badge of the dev member, and also the tier in previous months.
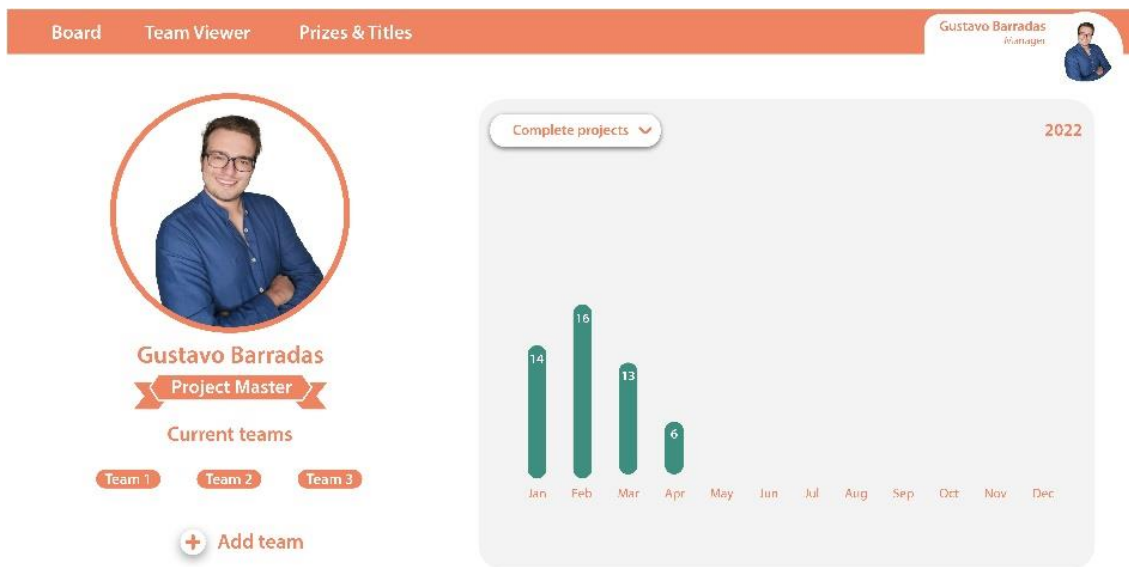
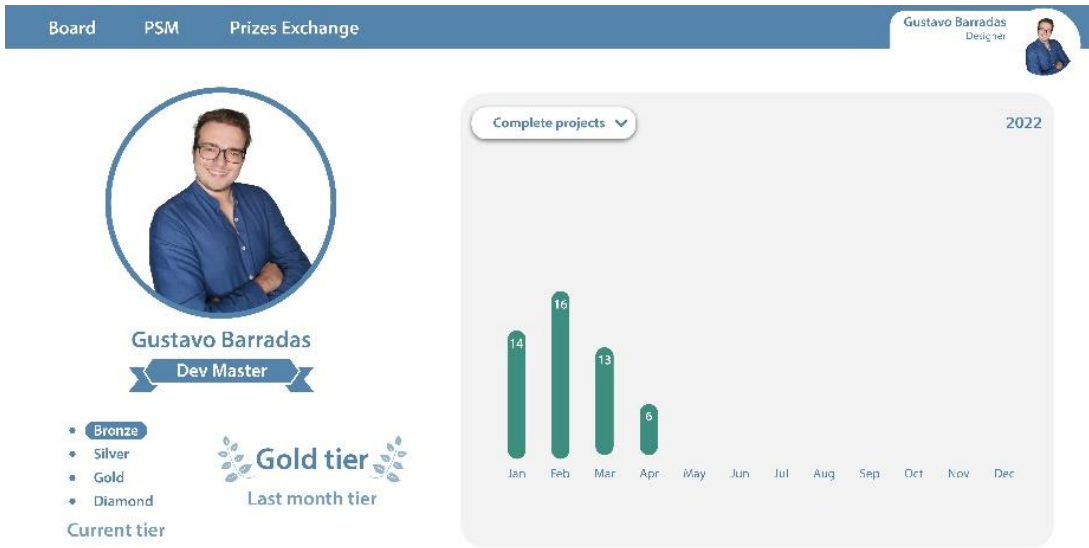*Figure 17 - Managers User Profile*

Figure 18 - Dev member User Profile

6 – Survey & Results

To understand if the created solution and the implemented mechanics meet the objectives set for this research, this chapter addresses the created survey that hosts several questions about the respondents' knowledge of agile Kanban methodology, gamification, and its mechanics, and finally, about our prototype.

6.1 – Survey

As mentioned, a survey was created to record the opinions of respondents. This survey has a total of thirty-seven questions divided into five sets of questions, the first being just demographic questions, followed by the other sets that go into more detail about Kanban, gamification, and the prototype. Figure 19 provides a better view of these sets.
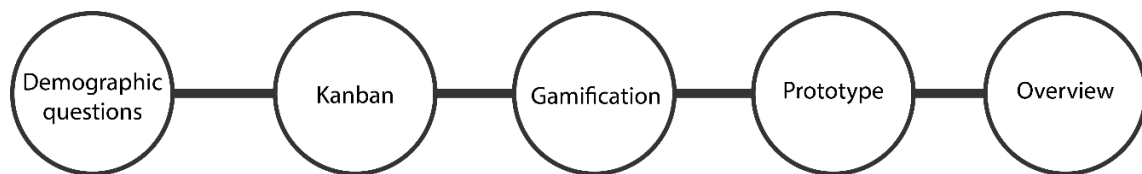
Figure 19 - Survey sets

6.2 – Results

The survey was shared with several managers and members of development teams, however, it was also shared with other respondents of different professional areas on the premise that the results show if the solution is appealing to everyone, and that it can surpass adherence issues in other areas that of agile methodologies. The total number of respondents to the survey was sixty. The following sub-chapters, despite giving an overview of all the results, will only summarize the results obtained with a few tables and figures. The complete survey data will be available in the final annexes.

6.2.1 – Demographic questions

This first set of demographic questions is focused on the respondent only, with a total of four questions, one is optional, depending on the answer to the previous question. From the results collected in these first questions, it is possible to analyze and observe the following results:

- That we obtained almost parity between the gender of our respondents;
- The majority were aged between 26 and 39;
- 33.3% of the respondents work as a member of a development team, 10% as project managers, and the rest is made up of various areas such as students, teachers, police officers, artists, and marketers.

Additionally, respondents who are not project managers or dev members had the opportunity to submit their professional areas. The following Table 2 demonstrates the focal questions and their results in a much more detailed way.

Table 2 - Survey demographic questions and answers

			Occupation		
			Development team member	Other	Project Manager
Gender	Female	How old are you			
		18 - 25 years old	2	9	0
		26 - 39 years old	0	5	2
		40 and above	1	7	1
	Male	How old are you			
		18 - 25 years old	5	4	0
		26 - 39 years old	12	7	3
		40 and above	0	2	0

6.2.2 – Kanban

This second set of questions is focused on respondents' knowledge and professional experience with the agile Kanban methodology, and it is composed of eight questions. Through the responses collected, it is possible to determine important results, such as:

- 61.7% of respondents were not familiar with the Kanban methodology;
- 23.3% of respondents use the Kanban methodology in their workplace, while 18.3% use another methodology;
- 28.3% of respondents voted positively on the methodology and 18.3% voted that they found this methodology very useful.

Table 3 provides a better view of this first part of the focal questions and the collected results ("vote 2 – Sort of not useful" was not selected by participants).

Table 3 - Questions and answers number 1, 2, and 4 of the survey

			4. From 0 to 5 how useful do you rate this methodology			
			0 - Don't know this methodology	3 - Neutral	4 - Sort of useful	5 - Very much useful
1. Are you familiar with Kanban methodology	No	2. Have you used or use this methodology in your workplace	No			
			No	27	5	0	0
			Not Kanban, but another	4	0	0	0
			Yes.	0	0	1	0
	Yes	2. Have you used or use this methodology in your workplace	No	0	0	1	2
			Not Kanban, but another	0	1	3	3
			Yes.	0	0	7	6

The last questions of this set are focused on adherence to this methodology in their workplace and if it helped them in their daily tasks. Thus, it was possible to conclude the following results:

- Of the total number of respondents, 25% use Kanban and mention that its adherence process was easy, while 13.3% mentioned that it was difficult;
- 13.3% of respondents indicate that Kanban has sort of helped them in some way, and 10% that it has helped them very much.
- Finally, it is worth noticing that 35% of the respondents voted that they would recommend the use of Kanban.

Table 4 provides a better view of the last questions of the group and the collected results.

Table 4 - Questions and answers number 5, 6, and 7 of the survey

			5. Was it easy to adopt this methodology in your workplace		
			Didn't use this one or any other	No	Yes
6. From 0 to 5 how do you rate the adoption of this methodology	0 - Didn't adopt this methodology	7. From 0 to 5, rate how much this methodology has helped you	0 - Didn't use this methodology	35	1	0
	2 - Sort of difficult	7. From 0 to 5, rate how much this methodology has helped you	2 - Didn't help much	0	2	0
			3 - Neutral	0	1	0
	3 - Neutral	7. From 0 to 5, rate how much this methodology has helped you	3 - Neutral	2	3	0
			4 - Sort of helped	0	0	2
	4 - Sort of easy	7. From 0 to 5, rate how much this methodology has helped you	3 - Neutral	0	0	1
			4 - Sort of helped	0	0	5
			5 - Helped very much	0	1	3
	5 - Very easy	7. From 0 to 5, rate how much this methodology has helped you	3 - Neutral	0	0	1
			4 - Sort of helped	0	0	1
			5 - Helped very much	0	0	2

6.2.3 – Gamification

This set consists of only six questions and explores the knowledge and experience of respondents with gamification. The topic of gamification is generally known, and year after year the number of companies that somehow adapt gamification concepts to internal systems increases. The obtained results help us understand if there is already a mass adherence, or if it is just a known topic. The results obtained were:

- Out of all respondents, 68.3% were familiar with gamification, however, 53.3% have never interacted with any gamification elements in a work environment.
- The most popular gamification element among respondents is the points system, with 46 votes out of 60 respondents, and the less known is the timer system, with only 21 votes.
- In workplace interactivity votes, the points system was once more, the most popular vote with 28 votes out of 60 respondents, and the least popular vote was also the timer system.

Through these results, it is possible to observe that although gamification is a somewhat known topic, there has not yet been a mass adherence. Table 5, Figures 20, and 21 provide a better overview of the collected results.

Table 5 - Questions and answers number 9, 10, and 11 of the survey

| | | | | 11. Rate this interaction from 0 to 5 | | | | | |
				0 - Didn't interact with it	1 - Didn't like it at all	2 - Sort of didn't like it	3 - Neutral	4 - Sort of liked it	5 - Liked it very much
9. Are you familiar with Gamification	No	10. Have you ever interacted with gamification elements in a work context	No	14	0	1	3	0	0
			Yes	0	0	0	0	0	1
	Yes	10. Have you ever interacted with gamification elements in a work context	No	11	0	0	1	1	1
			Yes	0	1	1	7	6	12

12. What gamification elements do you know?
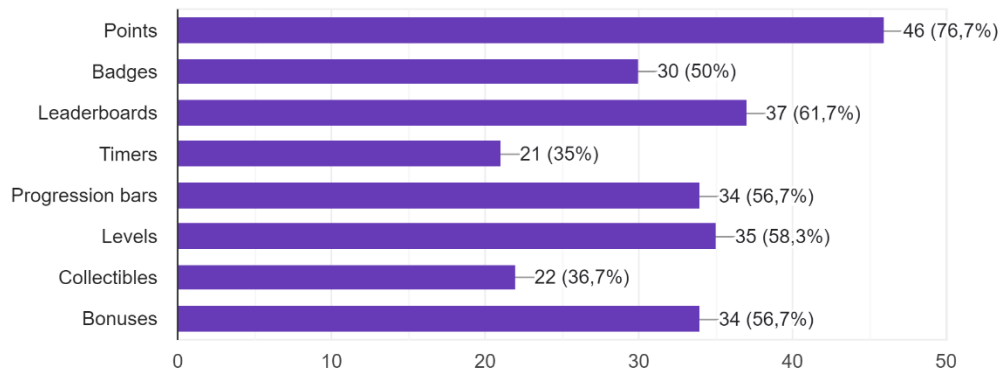
60 respostas

Figure 20 - Survey question number 12 and results

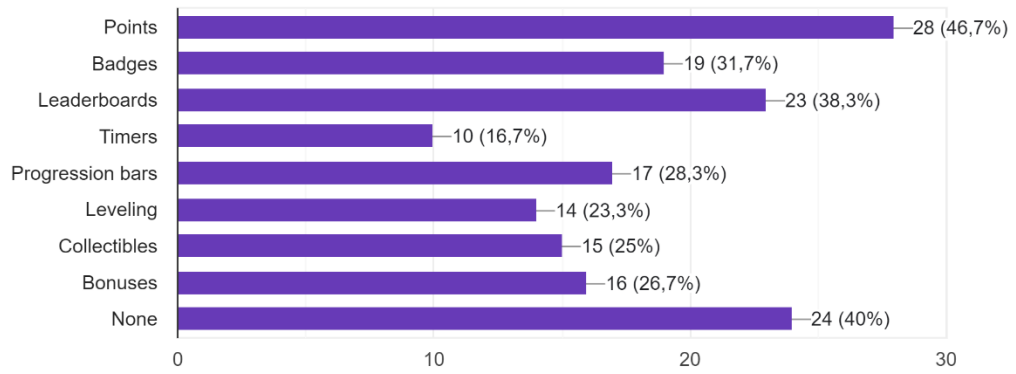## 13. With which gamification elements have you interacted with?

60 respostas

Figure 21 - Survey question number 13 and results

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6.2.4 – Prototype

This set, consisting of 12 questions, is dedicated to the prototype built with the help of visual support, and through these questions, it is possible to obtain direct feedback from the implemented mechanics. Taking into account that this set of questions is the largest, the following results are presented succinctly and divided into several sub-groups, which are:

- Points system;
- Progress and badges;
- Leaderboards;
- Player types;
- Overall Gamification Mechanics.

Firstly, through the results collected from the **Points system** group, it is possible to identify that:

- 65% of respondents voted positively on the implemented points system.
- 50% of respondents voted that points should be automatically assigned to each project, while the remaining 50% voted that it should be the manager;
- 75% of the collected results reported positive feedback about the points exchange mechanic;
- Regarding the points for prizes exchange, 15% of the collected results chose to have other rewards besides experiences, and or goodies;

Moving on to the collected results from the **Progress and badges** group:

- For progress viewing, only 1.7% of the respondents answered with a less-than-average score from 1 to 5, with 3 being average.
- The badge mechanic results also received only 5% less than average score, and 68.3% better than average.
- Regarding the number of badges available to dev members, 60% of the respondents agree that the current number is enough while 16.7% prefer fewer tiers.

Moreover, the **Leaderboard** group despite having only two questions is important due to the great ease with which leaderboards can negatively impact a player's experience. The collected results are:

- 21.7% of the respondents answered with a less-than-average score for the implemented leaderboard mechanic, while 50% answered with a better-than-average score.
- Concerning if the leaderboards should be public to the dev members, 41.7% of the respondents chose the negative option.

As for the **Player types** group, it is composed of a single question that concerns how managers identify the dev members' interests, and or, strong skills for certain projects. The gathered results from the respondents are:

- 10% of the results were less than average, while 71.7% were better than average scores.

Finally, the last group is **Overall gamification mechanics**, this group focuses on other gamification mechanics that could be implemented in the prototype, and if the currently implemented ones should be removed:

- The bonuses mechanic with 45% of the total votes, was the option with the highest number of votes, while the second most voted option, was, just maintaining the currently implemented mechanics with 43.3% of the votes;
- Despite 48.3% of the respondents voting on the option to not remove any of the already implemented mechanics, leaderboards and Badges had a high vote count each to be removed, with 25% and 21.7% respectively.

Through the results obtained from this set, we can have a better understanding of the application of the chosen gamification mechanics, and thus, change as necessary to provide the most positive experience.

6.2.5 – Overview

The overview is the last set of questions in the questionnaire, which consists of six direct and simple questions that help answer the most important questions in this research. The results obtained were:

- Regarding the usefulness of the prototype, 68,3% of the respondents voted positively better than average scores to the question, while only 5% voted lower than average;
- If it would be a good fit for the current work position of the respondent, 36.7% of the votes were average, and 33.3% were better than average.
- For the recommendation of the presented solution, 50% of the respondents voted that they might recommend it, and 35% voted affirmatively that they would indeed recommend it.
- In terms of adapting this solution to contexts other than project management and Kanban, 66.7% of respondents voted that it would depend on the context, while 28.3% answered "Yes".
- Regarding who benefits most from this solution, 56.7% of respondents choose the option that this solution benefits both managers and dev members equally, while 26.7% pointed out that only managers benefit.
- Regarding the last question, which addresses which techniques would most motivate respondents if they engaged the created solution, the most voted mechanic was the "Points & Prizes exchange" with 47 votes out of 60, followed by "Progression Bars" with 17 votes and "Leaderboards" with 15 votes.

These results provide clear feedback about the constructed prototype, the following Figures 28, 23, and Table 6 provide a better overview of the main questions of this set.

28. Did you find this Gamified Kanban Solution useful?

60 respostas
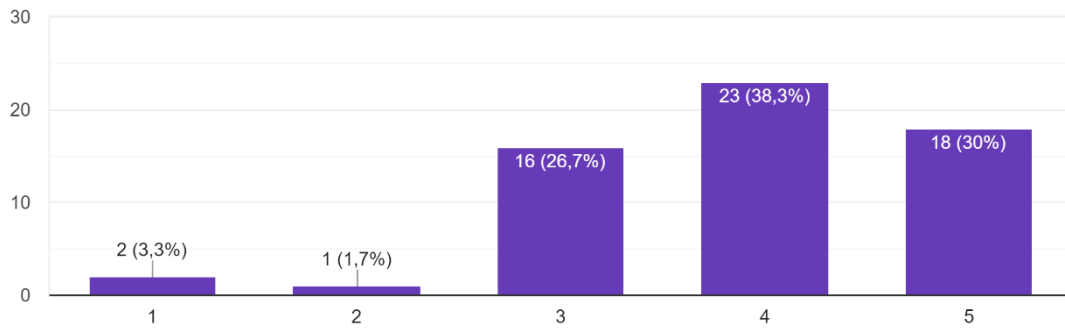
Figure 22 - Survey question number 28 and results

Table 6 - Questions and answers number 30, and 32 of the survey

		30. Would you recommend this solution to your colleagues		
		Maybe	No	Yes
32. Who do you think this solution benefits more	Dev Members	5	4	1
	Equally both	18	2	14
	Managers	7	3	6

33. What were the Mechanics that would motivate you the most to use in this solution?
60 respostas
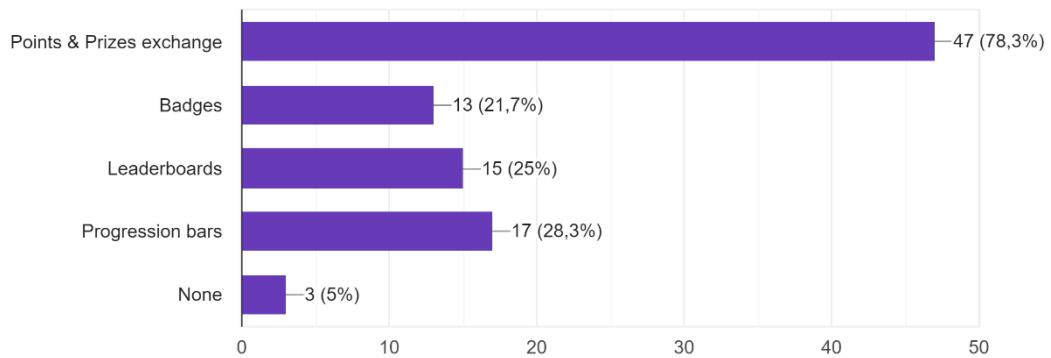
Figure 23 - Survey question number 33 and results

With this final set the questionnaire ends, in the next chapter, we conclude how the data collected from this questionnaire can be used for the continuous development of not only this prototype but also the development and success of gamification applied to agile methodologies, more specifically to the Kanban methodology.

7 – Conclusion

Gamification is not a new concept as we have observed, and even less in the context of agile methodologies, however, this study sought to incorporate gamification mechanics with Kanban, a methodology that despite being known, has not been much tested with gamification. The created prototype serves to entice and increase the enthusiasm and commitment of development teams that are currently in an environment of fast and continuous work. Thus, extensive research was carried out on these topics that allowed the elaboration of a questionnaire and reached this last chapter, where we can comment on the results obtained and reach several conclusions.

7.1 - Discussion of the obtained results

The questionnaire proved to be effective in getting results, not only from the prototype created but also on the individual topics we addressed, Gamification and Kanban. This allows for more grounded conclusions to be drawn.

Through the responses obtained in the first 3 groups, it was possible to verify that the topics of gamification and Kanban are already known in the community, however, despite being well known, there is still little adherence in professional environments, and much less, gamification incorporated with Kanban. We could also observe that the respondents who know and interacted with gamification, strongly recommend its use. This demonstrates that gamification does create a good experience in a work environment.

During the research period for the prototype's construction, we determined that the PBL system [13] would be the core gamification mechanic of the project due to its easy adaptation to Agile, and also for being one of the best-known gamification systems. According to our collected results, the points, badges, and leaderboards were part of the group of the most known gamification mechanics. Additionally, the points mechanic was the most positively voted in our prototype, followed by Progression bars, Leaderboards, and Badges. This is yet another proof that the PBL system is the best-known and to some extent the favorite.

With this confirmation of results, it is possible to conclude that the PBL system is the one that most motivates users, by focusing on their extrinsic motivation. Thus, we can try to answer the main questions that led to the creation of this project, "**How can one be motivated to adopt**

agile methodologies through gamification?", and **"What are the main motivation elements?"**, the answer to both questions is with the PBL system. By exploiting extrinsic motivation, it is possible to facilitate users' adoption of these methodologies, furthermore, the PBL points system being the most chosen option in multiple questions in the survey, we can conclude that this is indeed the main motivation element.

7.2 - Communication

To share the knowledge and research acquired in this project, a conference paper was written together with the advisor of this thesis, Professor Sandra Gama, and colleague Viktoriya Limonova. This paper was submitted and published at the International Conference on Human-Computer Interaction 2022 [24].

7.3 - Limitations

The implementation of gamification in agile methodologies, despite not being a new topic, real cases found during the research phase of this project were almost exclusively of Scrum methodologies. In this way, there were certain limitations on how to adapt mechanics other than the best known, and also on the process as a whole. Additionally, it is pertinent to mention that the built prototype and visual support are merely informative, they serve to demonstrate what a real case of implementing gamification in Kanban methodology would look like, thus limiting the depth of the results obtained.

7.4 - Future work

The first step would be to build a functional prototype, to test the user experience and also the interface. The next phase would be the implementation of the prototype into small groups integrated within a company, to obtain real-use results. Subsequently, it is to maintain a constant development update process of the prototype, either with new gamification mechanics, new prizes, and badges or with changes to the Kanban model. Following this, adding the player types and their interest to the solution would provide a new way to adapt to specific users, therefor creating a more captivating and personalized experience.

Additionally, through the survey, we obtained several responses regarding a possible integration of prototypes of this type in other professional contexts, it would be interesting to understand where else there are difficulties in motivating adherence to new systems, and to look for a fun way to introduce gamification.

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Appendixes

Appendix A

Google form survey – Questions & Answers

Gamification as a motivating source in Kanban Methodology

This study is part of the master's thesis and it's purpose to identify a source of motivation for the lack of adherence to agile methodologies. In an attempt to overcome this obstacle, a gamified solution as source of motivation was implemented to the Agile Kanban methodology. This survey is divided in to several sections, it's anonymous, and it takes approximately 5 to 7 minutes to conclude.

Thank you for your participation!

Gender
60 respostas

- ● Male
- ● Female
- ● Other
- ● Prefer not to say

45%

55%
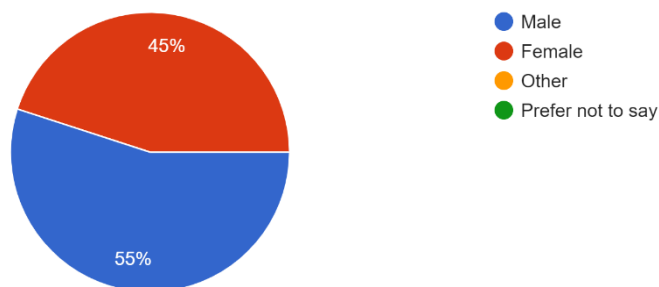
How old are you?
60 respostas

- 18 - 25 years old
- 26 - 39 years old
- 40 and above

48,3%
18,3%
33,3%

Occupation
60 respostas

- Project Manager
- Development team member
- Other

56,7%
10%
33,3%
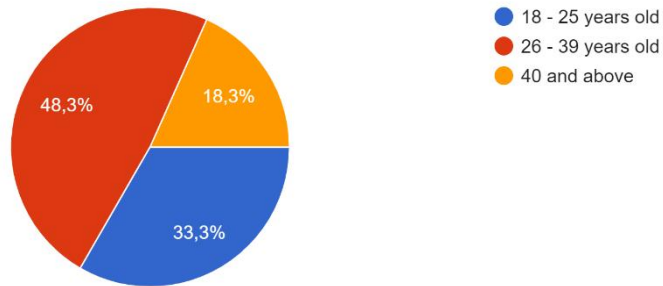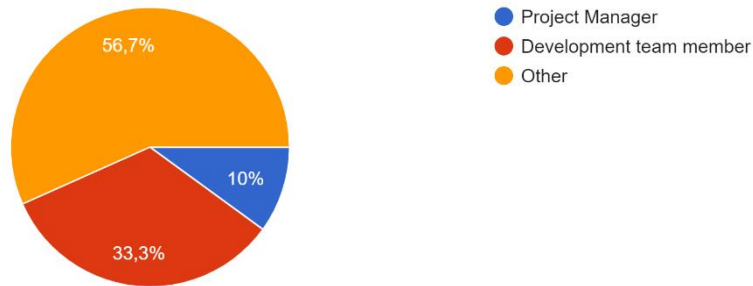
If you checked the "other" option, please submit below.
31 respostas
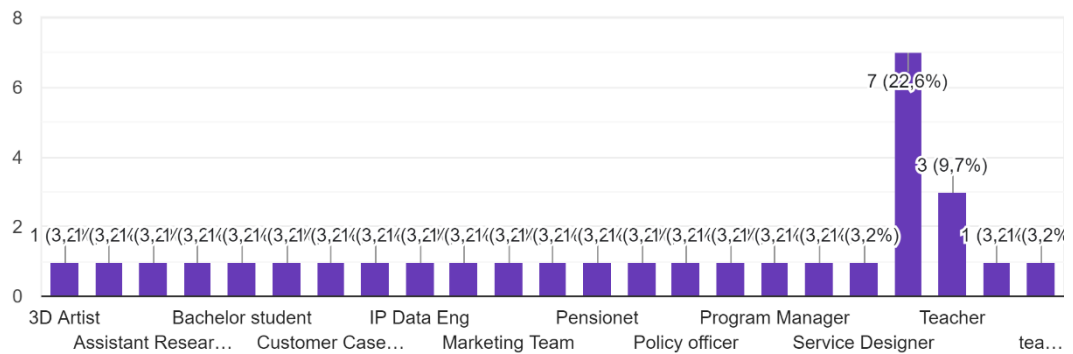
7 (22,6%)
3 (9,7%)
1 (3,2%)

3D Artist
Assistant Resear…
Bachelor student
Customer Case…
IP Data Eng
Marketing Team
Pensionet
Policy officer
Program Manager
Service Designer
Teacher
tea…

1. Are you familiar with Kanban methodology?
60 respostas

- Yes
- No

61,7%

38,3%

2. Have you used or use this methodology in your workplace?
60 respostas

- Yes.
- Not Kanban, but another
- No

58,3%

23,3%

18,3%
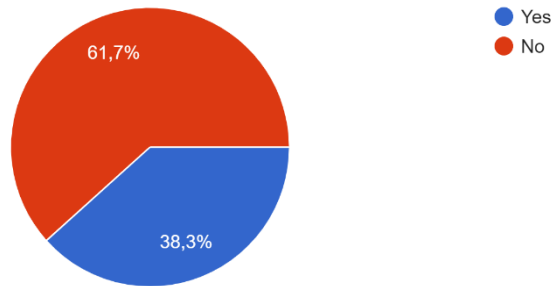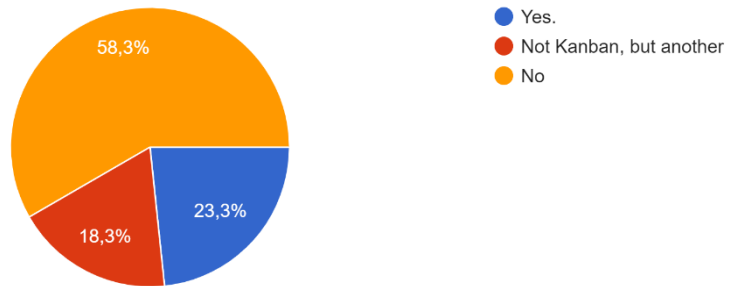
3. From 0 to 5 how much do you like Kanban methodology?
60 respostas
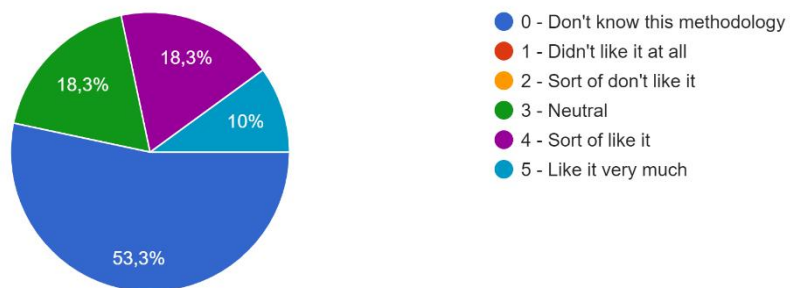
- 0 - Don't know this methodology
- 1 - Didn't like it at all
- 2 - Sort of don't like it
- 3 - Neutral
- 4 - Sort of like it
- 5 - Like it very much

18,3%

10%

18,3%

53,3%

4. From 0 to 5 how useful do you rate this methodology?

60 respostas
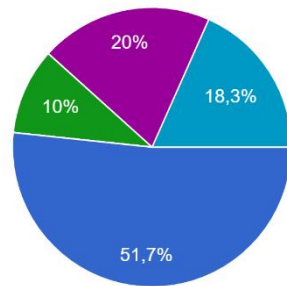
- 0 - Don't know this methodology
- 1 - Not useful at all
- 2 - Sort of not useful
- 3 - Neutral
- 4 - Sort of useful
- 5 - Very much useful

5. Was it easy to adopt this methodology in your workplace?

60 respostas
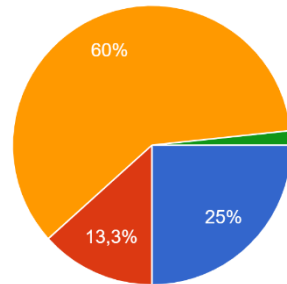
- Yes
- No
- Didn't use this one or any other
- Didn't use it this one or any other

6. From 0 to 5 how do you rate the adoption of this methodology?
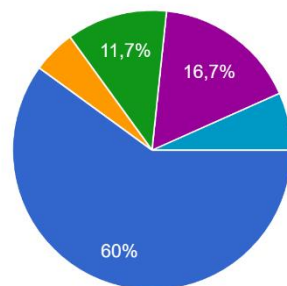
60 respostas

- 0 - Didn't adopt this methodology
- 1 - Very difficult to adopt
- 2 - Sort of difficult
- 3 - Neutral
- 4 - Sort of easy
- 5 - Very easy

65

7. From 0 to 5, rate how much this methodology has helped you?

60 respostas

- 0 - Didn't used this methodology
- 1 - Not at all
- 2 - Didn't help much
- 3 - Neutral
- 4 - Sort of helped
- 5 - Helped very much

13,3% 13,3% 10% 60%
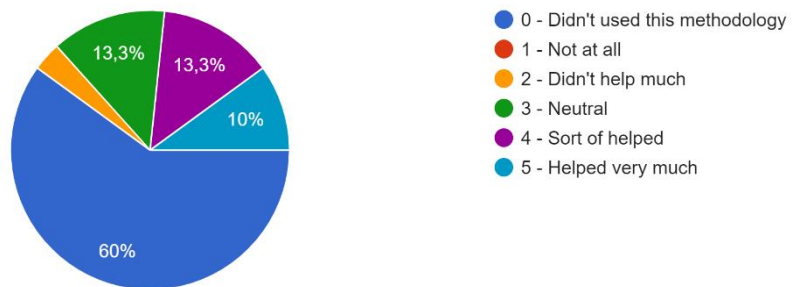
8. Would you recommend the use of Kanban methodology?

60 respostas

- Yes
- No
- Don't know

61,7% 35%
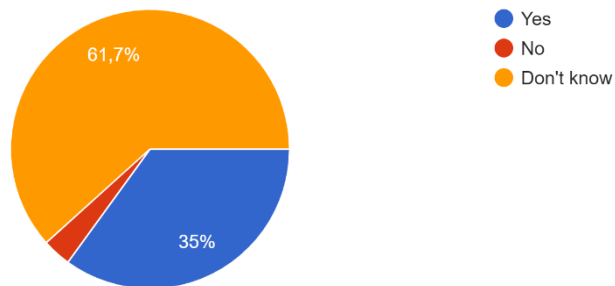
9. Are you familiar with Gamification?

60 respostas

- Yes
- No

31,7% 68,3%
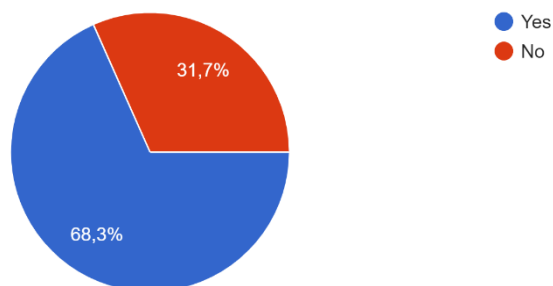
10. Have you ever interacted with gamification elements in a work context?

60 respostas

Yes
No

53,3%

46,7%
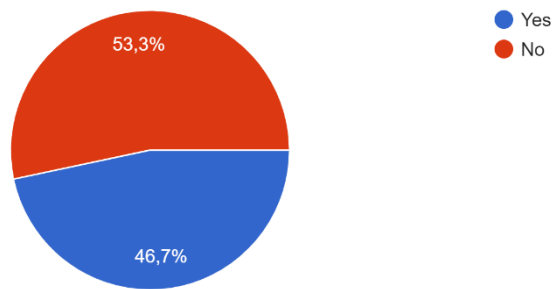
11. Rate this interaction from 0 to 5

60 respostas
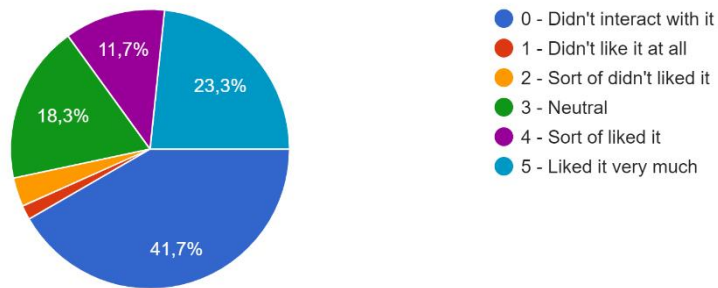
- 0 - Didn't interact with it
- 1 - Didn't like it at all
- 2 - Sort of didn't liked it
- 3 - Neutral
- 4 - Sort of liked it
- 5 - Liked it very much

11,7%

23,3%

18,3%

41,7%

12. What gamification elements do you know?

60 respostas

Element	Value
Points	46 (76,7%)
Badges	30 (50%)
Leaderboards	37 (61,7%)
Timers	21 (35%)
Progression bars	34 (56,7%)
Levels	35 (58,3%)
Collectibles	22 (36,7%)
Bonuses	34 (56,7%)
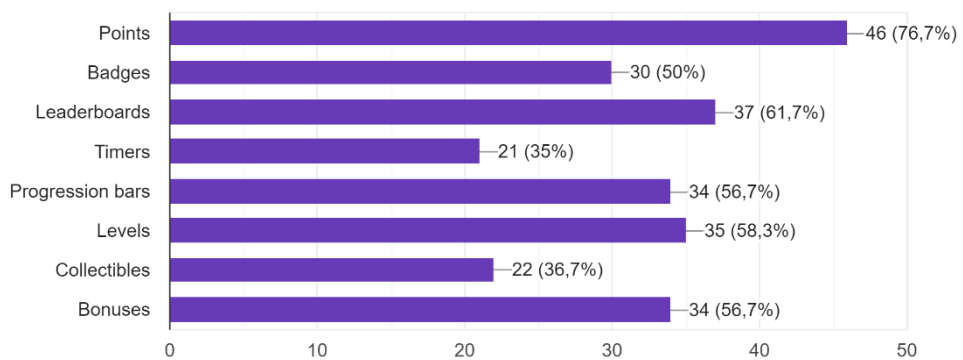
13. With which gamification elements have you interacted with?
60 respostas
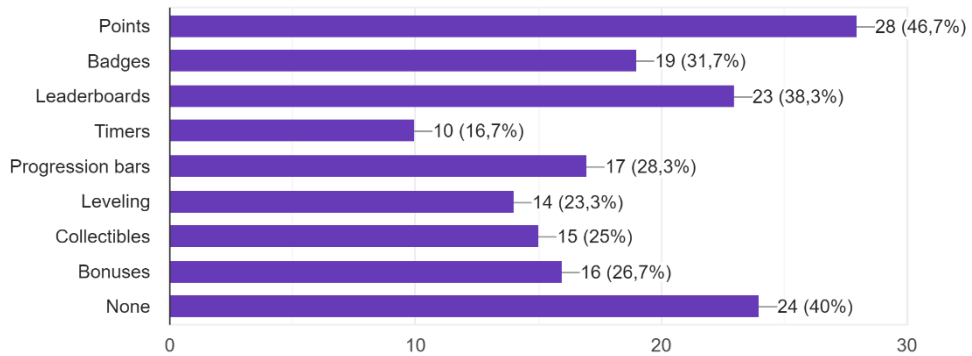
14. Would you recommend your experience?
60 respostas

- 0 - Didn't have one
- 1 - Not at all
- 2 - Sort of not
- 3 - Neutral
- 4 - Sort of yes
- 5 - Very much
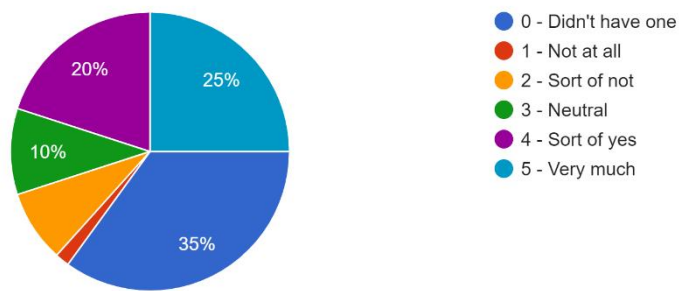
15."Point System", Board Tab - Managers assign points to each project, and dev members may collect them after the project's completion. How do you feel about the Points assignment Mechanic?
60 respostas
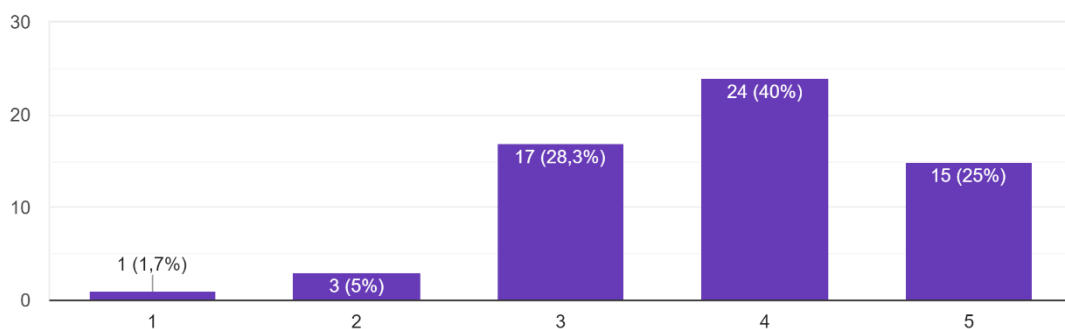
16."Point System", Board Tab - Would you rather the points be assigned automatically to each project, or manually by a manager?

60 respostas

- Manager
- Automatically

50%

50%
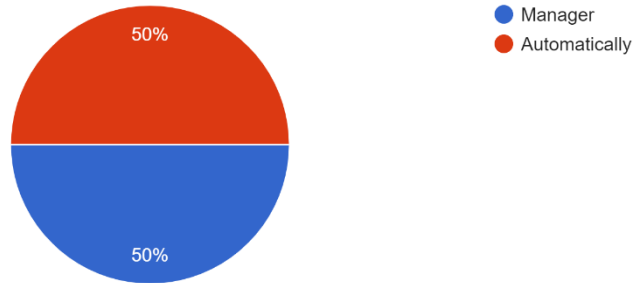
17."Point System", Prizes Exchange - Dev members can view and exchange their points for different types of prizes. How do you feel about the Points Exchange Mechanic?

60 respostas
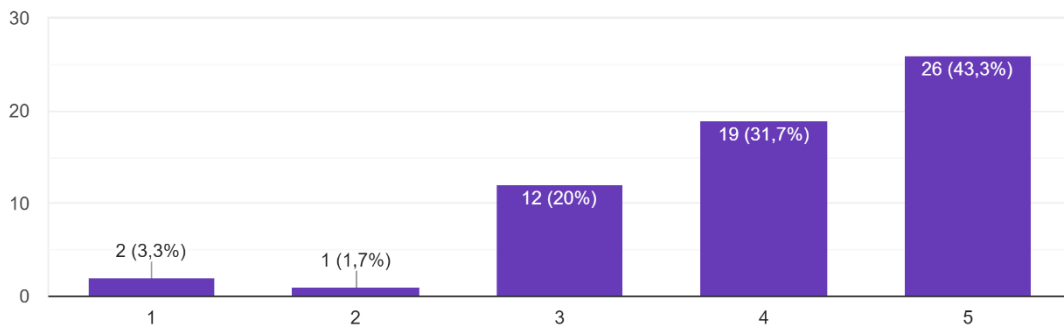
18."Point System", Prizes Exchange - For what prizes would you exchange your points?

60 respostas
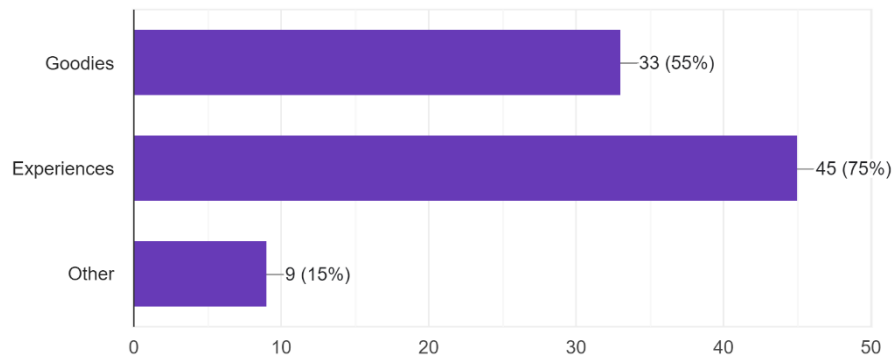
19."Point System", Prizes Exchange - If you chose the option "Other", please elaborate below.

6 respostas

Answered Above
Work conditions improvements; Discounts
Money
Time off work, and or extra vacation days
Battle pass!
More vacation time

20."Progress and Badges", Project Status Management - Here, Dev Members can view their progress towards new badges, and update their pr...us. How do you feel about the Progress Mechanic?

60 respostas
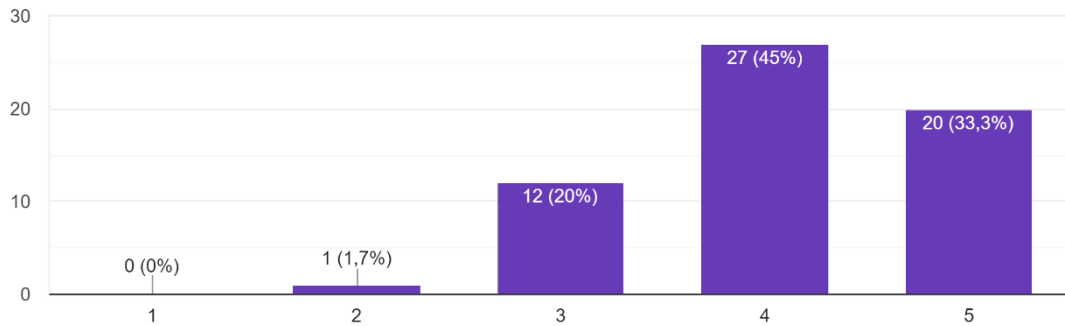
21."Progress and Badges", User Profile - Here, Dev Members can view their current and previous month badge tier. How do you feel about the Badge Mechanic?

60 respostas

70
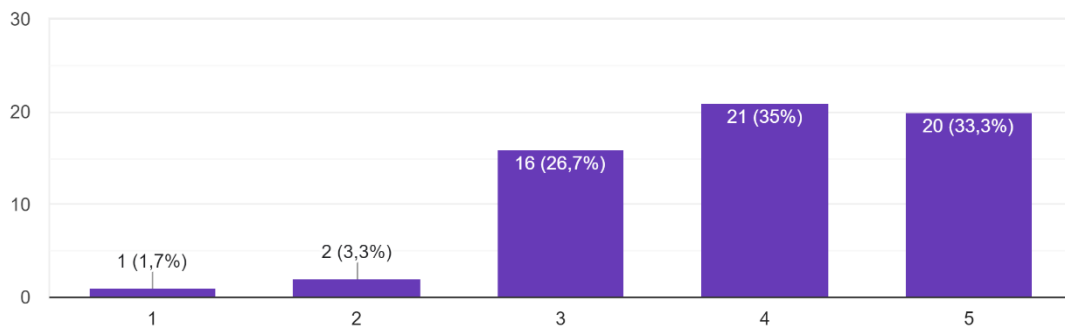
22."Progress and Badges", User Profile - Would you rather have more or less Badge tiers?

60 respostas

- ● The current number is enough
- ● More tiers
- ● Less tiers
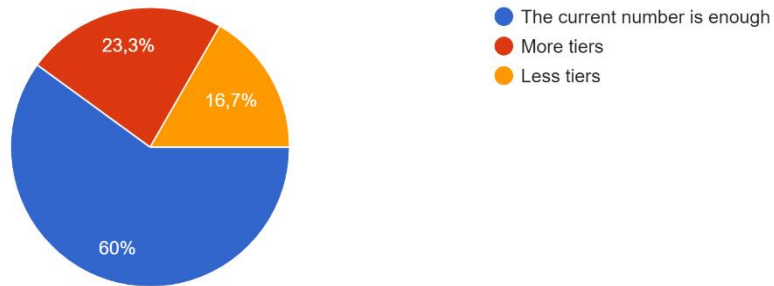
23."Leaderboards", Team Viewer - Dev members are ranked based on their productivity, these Leader boards can only be viewed by managers.
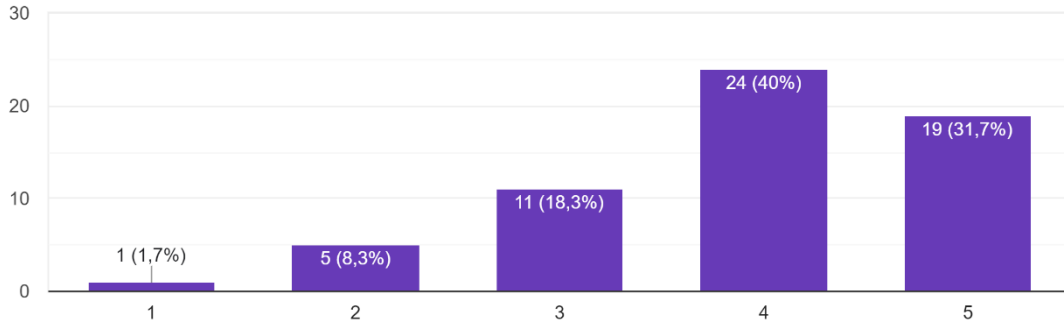
60 respostas
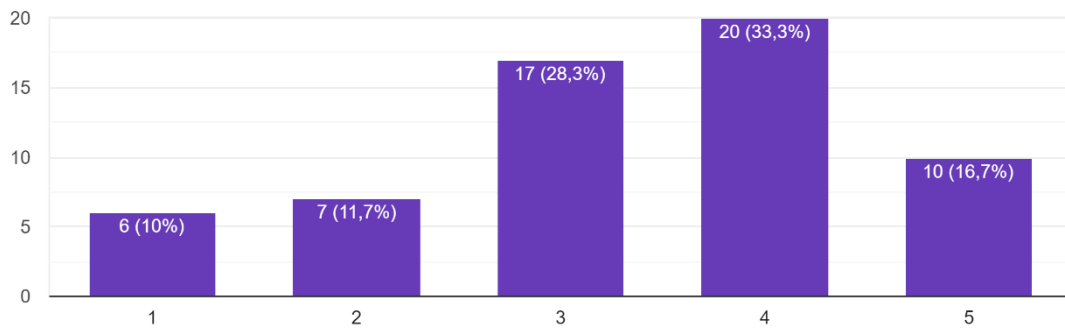
24."Leaderboards", Team Viewer - Do you think these leader boards should be public to Dev Members as well?
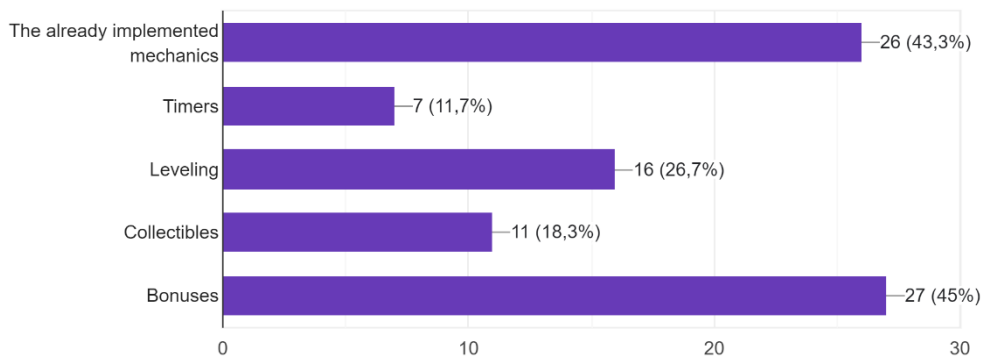
60 respostas

- ● Yes
- ● No
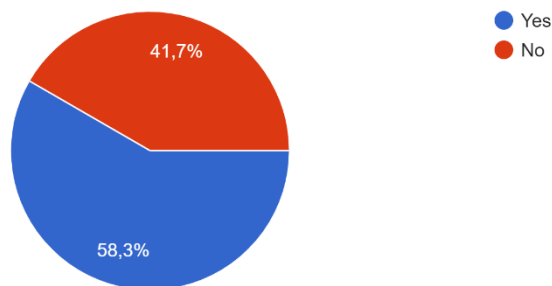
25."Player Types", Team Viewer - Managers are to able visualize details of past projects, in order to identify the different types of players that corres...ture projects. How do you feel about this mechanic?
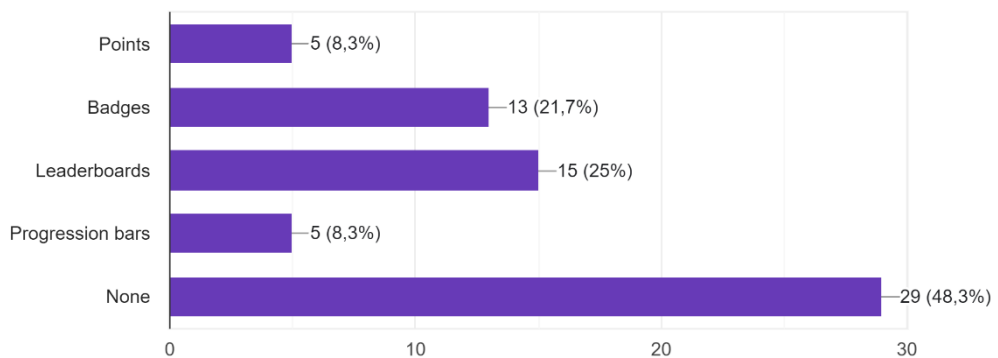60 respostas

26."Overall Gamification Mechanics" - What more Gamification Mechanics should be applied?
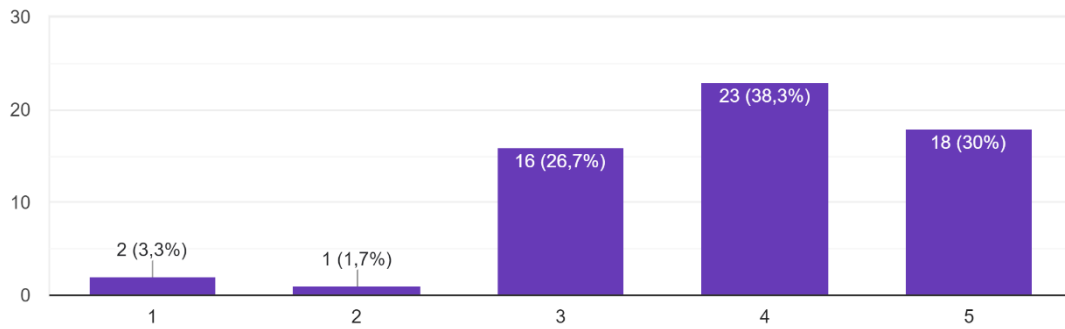60 respostas

27."Overall Gamification Mechanics" - Of the current Mechanics applied, which ones you believe that should be removed?
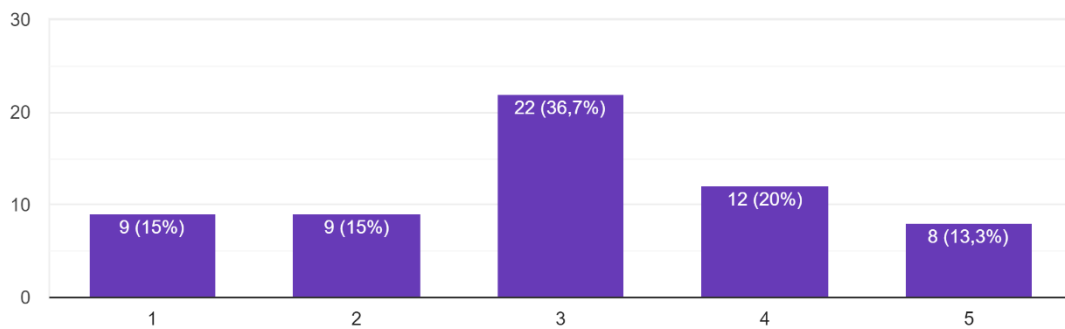60 respostas

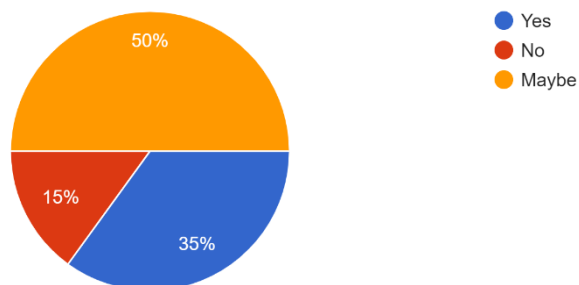## 28. Did you find this Gamified Kanban Solution useful?
60 respostas

29. Would it be a good fit for your current work position?
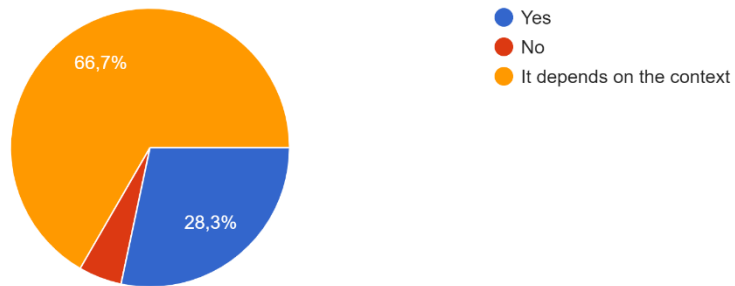60 respostas

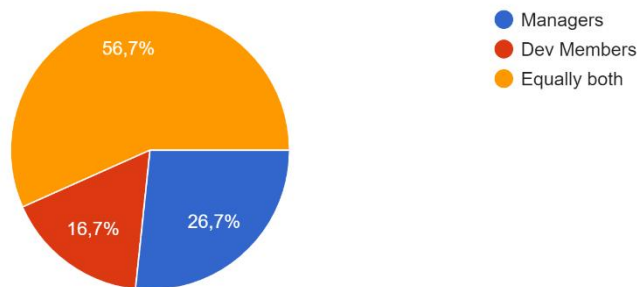## 30. Would you recommend this solution to your colleagues?
60 respostas

31. Do you think this solution could be applied to contexts other than project management and Kanban methodologies?

60 respostas

- Yes
- No
- It depends on the context

66,7%

28,3%

32. Who do you think this solution benefits more?

60 respostas

- Managers
- Dev Members
- Equally both

56,7%

16,7%

26,7%

33. What were the Mechanics that would motivate you the most to use in this solution?

60 respostas

Points & Prizes exchange	47 (78,3%)
Badges	13 (21,7%)
Leaderboards	15 (25%)
Progression bars	17 (28,3%)
None	3 (5%)