MASTER FINAL PROJECT: **BUSINESS AND INFORMATION TECHNOLOGY**

KNOWLEDGE MANAGEMENT SYSTEM DESIGN FOR AN AGILE DIGITAL AGENCY

THE CASE OF EL NIÑO B.V.

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PROJECT
Knowledge Management System Design For An Agile Digital Agency: The Case Of El Niño B.V.

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This thesis is the result of a great journey, that started with my decision to follow a masters abroad. Achieving a scholarship to study abroad kickstarted this long challenge, which a global pandemic made even more difficult. Though, with the support of good friends that I met along the way, I was able to get to this last challenge that is my final project. In simpler words, this journey was not easy, but was also a lot of fun!

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ABBREVIATIONS AND SYMBOLS

DT: Design Thinking
DTC: Data Thinking Canvas
KM: Knowledge management
PM: Project Manager
PO: Product Owner
SME: Small and Medium-sized Enterprise
TL: Tech Lead
WoS: Web of Science

ABSTRACT

Knowledge loss is an effect seen in companies with high rates of employee turnover (Robillard, 2021). On top of that, Agile methodology can lower the amount of documentation at companies (Faniran et al., 2017). Both of the characteristics mentioned, make El Niño, an Agile digital agency with high turnover rates based in the Netherlands, an interesting case study from the knowledge management perspective. The high turnover rate is known by the company, due to mainly hiring students and recent graduates, therefore the managers do not actively try to lower the rate, though it is important to lower its negative effects. The research uses the Design Science Methodology (Peffers et al., 2007) to reach its goals. To understand the problem a *Literature review*, an *Archival Analysis* and *Interviews* were conducted, resulting in the *Findings*. These findings informed the design of the artefacts, resolving the sub-research questions. The main challenge was combining the broad topics of the artefacts, into a unified iterative workflow. The resulting workflow facilitates knowledge management in different phases of the project development cycle, including data-driven ideation and project evaluation (both from internal and external perspectives). This study does not cover the entire Demonstration phase of the Design Science Research methodology; therefore, the created workflow still has to be evaluated in the real-world environment.

Keywords: Agile; Data Thinking; Design; Knowledge Management; Project Evaluation; Turnover.

RESEARCH OUTLINE

To learn about the company in the case study, chapter *1* discusses the initial research development, by explaining the case study and the company in which the case study is presented, which introduces the context of the research. Chapter *2* presents the exploratory research, which includes a *Literature review*, an *Archival Analysis* and formal *Interviews*; these are important to understand the theory and practice behind the problems faced by El Niño, as well as consider the state-of-the-art works related to it, those resulted in the research *Findings*. The research questions are presented in the *Solution Objectives and Scope of the Project*, which guided the design of the tools. Chapter *3* presents the design and development of the artefacts, which were divided into the main research topics: *Knowledge management Artefacts, Ideation Artefacts*, and *Project evaluation Artefacts*. Chapter *4* presents the combination of the artefacts into one *Workflow*, which contains the main value of this research. While, in the following chapters (5 and *6*), the Discussion and *Conclusion* are presented, where there is a discussion of the results and suggestion of future work. Followed by *References* and *Appendix*.

1. INTRODUCTION

The value of this study arises from the challenges confronted by El Niño. As a digital agency that uses Scrum, an Agile methodology, the company naturally focus less on documentation (Faniran et al., 2017). Moreover, the company has a high turnover (in 2021 the annual turnover rate at El Niño was around 58%), due to the large number of students or recent graduates that are hired to the company. Both characteristics collaborate to a knowledge loss, a factor that has negative impact at the company (Robillard, 2021). Therefore, this research aims to reduce the knowledge loss by suggesting a knowledge management system that works through different phases of the digital product development in an Agile company.

The present case study will be based on the contingency theory, which explains that there is no best way to organize a corporation, as different companies require different organizational styles according to their strategy and competitive environment (Trkman, 2010).

El Niño B.V. is a technology company, specifically a digital consultancy agency focused on web development, which conducts projects for diverse customers around the Netherlands and Europe. Their teams are separated into multidisciplinary teams that work with Scrum, an agile framework, and each squad is responsible for different customers and their projects, which focus on digital development.

Lightweight frameworks, such as Scrum, were created driven by a fast-growing complexity from technology companies (Ebert & Paasivaara, 2017). After the creation of the agile methodology, different companies started to introduce and adopt it to their projects as it improves company's productivity and ability to successfully fulfil their project goals and customer needs (Tam et al., 2020a). Agile frameworks have proven effective in bringing agility and advancing the software development field (Marnada et al., 2022). Although, implementing a framework in a company can be challenging, especially for SMEs, that frequently have limited resources. Companies, such as El Niño, can benefit from frameworks because they help structure work and make it clear to the organization which are the processes in place, as well as what is expected at each phase. This research focuses in designing a workflow that reckon with the agile framework, based on knowledge management principles.

Lim et al. (2019) stated a lack of studies related to frameworks that support organizations in managing data-based value co-creation. During the literature review for this research, it also became clear that there is no significant amount of work directed to the topic, which is remarkable, since data has great importance in today's economy, as stated by The Economist (2017) "data is the new oil".

Evidence-based solutions bring even more value to the company and its products/services, highlighting the importance of the use of data (Kronsbein & Mueller, 2019). Though, to be able to use the data, first is important to learn its value, so the right sources can be used. Data is abundant, especially inside digital companies, though companies in general still lack in using

internal data before looking for external sources (Kaufmann, 2019). El Niño, for example, has access to the database of many of its customers, although the data is not yet fully explored. This shows that the company is missing an opportunity, as it is of its interest to rise its competitive advantage.

In order to motivate the use of available data, previous research on ideation methodology has developed a useful tool, called Data Think Canvas (Kronsbein & Mueller, 2019), which supports ideation through the conjunction of data and the Design Thinking methodology. Though, the tool does not completely satisfy El Niño's needs, as Scrum is an iterative process, therefore the tool was adapted considering the digital consultancy's development process. Moreover, data is used in the entire knowledge management system, to reach more innovative solutions based on facts.

For this research, the definition of "open innovation" introduced by Chesbrough (2003) will be used, as open innovation uses both internal and external sources to drive innovation. Moreover, the notion of systemic innovation presented by Manley (2001) is relevant to this study to understand the complexity of the problem, as well as to understand how innovation can be stimulated in the company.

This research focuses on solving some of El Niño's challenges, which can be found in other organizations, increasing the value of this research. This research was developed using a broad scope, in which the goal was to understand how to create a knowledge management system, in an Agile company, involving different artefacts throughout the product development processes. Although it is an unusual way of doing research, its broadness is a positive characteristic for the company in the study case, as the topics cover the entire product development cycle, allowing the design of an iterative workflow. As it will be presented, the outputs of the last phase in the product development cycle can also be used as input for the beginning of the next cycle.

To get to the results of this research, we considered structural and cultural characteristics of El Niño BV. Initially day-to-day activities and internal documents were taken into consideration when identifying the problem. After analyzing the company's documents and informally speaking with some of the company's employees, it was identified that there are three main challenges that the company faces:

1. Knowledge is often lost due to the high turnover of employees.
2. The team should collaboratively use data to propose new projects.
3. The team does not have a structured way of getting feedback from customers or employees.

All the characteristics previously mentioned will be explored from the knowledge management, data-driven ideation, and project evaluation perspectives. The Literature Review Questions, presented in the *Appendix B*, direct the literature research for the state-of-the-art work related to this study and condensed in the *Literature review.*

After conducting the *Literature review*, an *Archival Analysis* and *Interviews* were conducted, leading to the *Findings*. All of the mentioned exploratory research methods are valuable, as they allow a more detailed understanding of the business environment, as well as the previous scientific research, in which the solution will be proposed. Then, the following Research questions are proposed:

- *What are the key components of a Knowledge Management system for El Niño B.V., an Agile medium-sized digital agency with a high turn-over rate, to avoid knowledge loss throughout the digital product development cycle?*
    - *Sub-RQ 1: Which Knowledge Management practices can support the creation of a Knowledge Management system for* El Niño?
    - *Sub-RQ 2: How to operationalize the use of a collaborative data-driven ideation tool for El Niño, considering KM practices* and customer goals?
    - *Sub-RQ 3: How to iteratively collect and present internal feedback data to allow knowledge sharing?*
    - *Sub-RQ 4: How to collect external feedback to support the alignment between digital product development and customer expectations?*

Those questions guided the research, as well as the design of the artifacts related to each topic and will be answered at the end of this study. Knowledge management will serve as the basis for the created system, presented in chapter *4*. All artefacts have been created to encourage and support knowledge management throughout the project lifecycle and especially the *Ideation Artefacts* and *Project evaluation Artefacts* phases.

The originality and value for the fields of Business Management and Information Technology are derived from the systematic research that was done for the design of knowledge management system to support product development, in an Agile digital agency. As a result, a complete workflow design is presented, by the proposition of a series of IT artefacts, in the areas of Knowledge Management, Data-Driven Ideation and Project Evaluation.

1.1. PROBLEM IDENTIFICATION

Most El Niño projects are carried out over long periods of time. El Niño's goal with most customers is to have long partnerships, by either continue offering maintenance to the project once the main features are finished, or by keep implementing new features and expanding the current projects. Therefore, projects usually do not have "an end". Two perspectives should be considered in this case: Knowledge Management (KM), as the information regarding the projects must be kept inside the company even with employee turnover; and customer satisfaction, as it requires a lot of creativity and innovation from the digital agency. So they can keep offering new solutions to customer's problems.

According to Wong (2005) Culture and technology play a main role from the Knowledge Management (KM) perspective, but it also involves management, resources, and (industry)

environment. Another important factor, mentioned by the company owner, is innovation. In technology-related companies, innovation is crucial to the company's growth and durability, especially for Small and Medium Enterprises (SMEs) (Fowler & Highsmith, 2001; Fred et al., 2020). All these perspectives are going to be approached through this research, in order to bring improvements to the organization in the case study.

From its beginning, the company grew organically, therefore processes were implemented and changed according to what management saw fit during the decision-making process. Though, some main characteristics were maintained: Most of their hires are students or people at the beginning of their careers; the company prefer projects that allow its employees to learn and be innovative; and feedback is considered essential, as everyone is welcome to share their opinion on different matters inside the company. On the other hand, the characteristic can increase turnover.

At last, feedback and product evaluation contribute to product improvements between iterations in agile product development (Lopez et al., 2021), also contributing to customer satisfaction. Although El Niño uses agile practices, they currently lack the feedback loop for their products and processes during the iterations. Besides, although having data from projects and past iterations, it is still not fully being utilized for the company's benefit, for not having it easily available.

1.2. COMPANY BACKGROUND

In this section, different characteristics of the company will be presented, as they contextualize the case study, presenting the boundaries and cultural background of the company. It was previously introduced that the target of this research is the company called El Niño, which is a digital agency that works on customized web solutions. The agency is a medium-sized enterprise (according to KVK, The Netherlands Chamber of Commerce) located in the Netherlands, that offers different digital services, such as Magento webshop development and maintenance, web applications development, app development, digital marketing, and, the recently added services, customised hardware and data services.

The company was created by Michael Angelo Groeneveld, who started the company during his master's studies, 15 years ago. This means that the company grew organically and continues to grow in small increments that are being done throughout the years. The company started as a small enterprise where everyone worked on different projects as one team, as it grew the company separated into different multidisciplinary teams.

El Niño nowadays has two offices: one in Enschede and another in The Hague. Although the geographic separation, both offices share systems and resources, and company decisions are done considering both locations. The geographic separation characteristic is important for this research, as it reflects on the structure of the organization.

As will be further explained in this study, the teams are divided into squads. There are 2 squads in Enschede (Codebusters and Snooze) and 2 squads in The Hague (Blackbox and The Church of Magentology). The results of this research should be able to support both offices.

Along with the company's main goal of generating revenue, it operates with the mission of "creating a safe environment for people to grow". Moreover, for their vision, they avail three main attributes, which are pro-activeness, sharing, and growth. Therefore, its processes should be aligned with its culture to increase the chances that the implemented processes will reach their goals (Yang & Hsu, 2010).

1.2.1. Stakeholders

The stakeholders of the study are the people or institutions involved, which will be the most impacted or have some type of interest in it (Oxford dictionary, n.d.). Taking this definition into account, it is plausible to consider El Niño's employees and its owner, as the main stakeholders. Besides, El Niño's customers are also key stakeholders, as they are the ones receiving a direct (positive) impact from its outcomes, intending to achieve higher customer satisfaction.

The company currently employs more than 40 employees, in diverse areas in the company (per graph in *Figure 1*). Things change fast in the company and employees come and go in a fast pace. In April 2022, only 41,18% of the employees had worked at El Niño for more than 12 months.

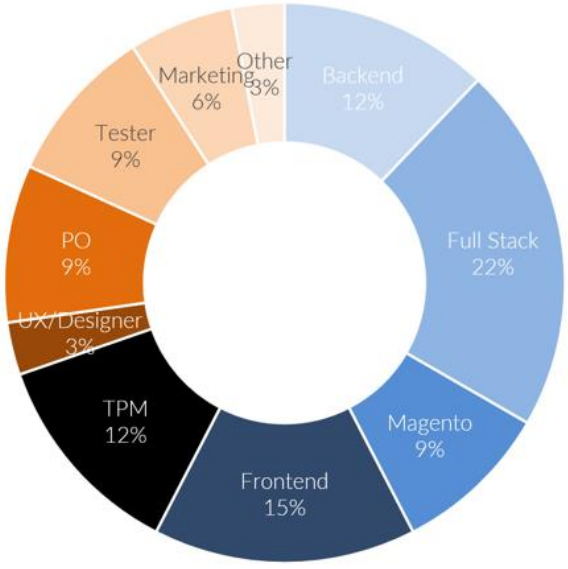

Figure 1: Areas of employment at El Niño
Source: Company internal survey (April 2022).

Moreover, El Niño is a company with people from diverse backgrounds, more than 40 nationalities have worked at the company in the past. Besides, to be able to deliver different solutions to its customer, it leans on the skills and knowledge of various teams with divergent perspectives.

The conjunction of the mentioned characteristics highlights the need for the implementation of a clear and well-designed business process workflow. Khan et al. (2021) have already shown the

relationship between organizational learning culture, workforce diversity, and knowledge management with innovation and organizational performance, though it is still unknown how it should reflect on its processes.

1.2.2. Internal processes

As previously introduced and will be further explained in chapter *2.1.1.2.*, the company is separated into four squads and follows a customised version of the "Spotify model", which is a team structure that focuses on autonomy, communication, accountability, and quality (Kniberg & Ivarsson, 2012). Each squad work on different projects and has the Scrum framework (from the Agile framework) as a base. Though, their team structure was slightly modified from the Scrum guide to adapt to company requirements, their "squads" consists of a Product Owner, a Tech Lead and the Developers, besides, the company shares a multidisciplinary team that include UX designers, marketeers, and data engineers. They begin a new sprint at every 14 days and, at each sprint, the Product Owners (POs) plan which projects (and features) will be developed within that period. At the same time, the Tech Leads (TL) make sure that the team is technically ready, ensuring developers' technical questions are being answered. Both PO and TL work as Project Managers (PMs), organizing the team, to make sure that all projects are going according to plan, though there is not Scrum masters in the teams.

Each squad has its own strategy on how to distribute tasks within each sprint. For example, the Church of Magentology squad, lets each team member choose their own tasks, while Snooze's TL prefers to assign the tasks to each developer.

Besides, for this research is important to consider that different working processes were created spontaneously. Those processes give support to employees to perform their day-to-day tasks, which improves productivity (Sine et al., 2006). On the other hand, it is important to closely consider each of the current practices, as many of them appeared without a systemic approach or a clear role structure, which could result in inefficacy (Perrow, 1961).

Another relevant characteristic of El Niño is its flat hierarchy (presented in *Figure 28*, in the *Appendix A*). Although, some vertical hierarchical characteristics can be found in the company's structure, employees are still mostly managed horizontally. This gives a lot of freedom and encourages employees to be innovative, rather than to maintain the status quo (Teece, 1996). On the other hand, employees with a more dominant characteristic end up having a stronger "voice" inside the squads, which can prevent others to also share their opinions.

The organizational chart (*Figure 28*) shows the different roles at El Niño. Though, projects are usually connected to a squad that requires different resources outside the squad, available in the company. All the organizational characteristics mentioned should be taken into consideration when elaborating the tools and *Workflow* that will be the output of this study.

2. EXPLORATORY RESEARCH

With the context previously presented, a few topics emerge as key topics of the study; Knowledge (of the employees) is the most valuable asset held by the company, as, in principle, it is the main asset that allow the employees to deliver solutions to the customer problems. Therefore, Knowledge Management will be a pivotal topic for the creation of all the artifacts and process workflow.

Stimulating open innovation is another goal of the study, based on the company mission and company director's strategy to make the business a more innovative company. To reach this goal, data is presented as a useful factor, considering the data availability inside the company and the investments made by the management in hiring a Data team.

The company revenue mostly comes from the development of technical products, that are developed in different projects by the squads. Considering the significance of the customers and the employees, involved in those projects, for the company growth, their opinions compose another main topic of this study which will be referred as "project evaluation". Customers feedback will be examined from the product perspective, while employee feedback will be examined from the internal process perspective.

In this chapter, the *Literature review, Archival Analysis,* and *Interviews* conducted in for this study will be presented. Each section, led us to some substantial findings, which were summarised into key *Findings* that will be further presented and used in the *Artefacts design & development* chapter, to guide the creation of the artefacts.

2.1. LITERATURE REVIEW

A literature review will be conducted to gather scientific background of the main topics of this study. Besides, previous research findings and suggestions for future research will be considered, increasing the scientific relevance of this study.

The criteria used for this literature review are shown in *Appendix B*. The goal is to achieve an understanding of the current scientific state-of-the-art of the research that has been done, related to the previously specified topics, to build the literature review presented below.

2.1.1. Knowledge Management in Information System

Knowledge is one of the most important factors to produce competitive advantage and innovation for companies (Inkow, 2021; Ng et al., 2011; Nonaka, 1994). There are different perspectives to approach knowledge. Knowledge sharing (KS), for example, is part of Knowledge Management (KM), it contributes to collaboration increasing a company's efficiency (Sensuse et al., 2021). Though, it is also important to consider knowledge creation and knowledge implementation as part of the knowledge process (Intezari et al., 2017).

Organizational knowledge was a topic studied by Nonaka (1994), as he argues that innovation comes from the creation and definition of problems that are solved by the development of new knowledge. Nonaka is a well-established author in the area of knowledge creation. He argues that different types of knowledge (tacit and explicit knowledge) are created in different ways: socialization, externalization, internalization, and combination (Nonaka, 1994). Therefore, he created the model shown in Figure 2.

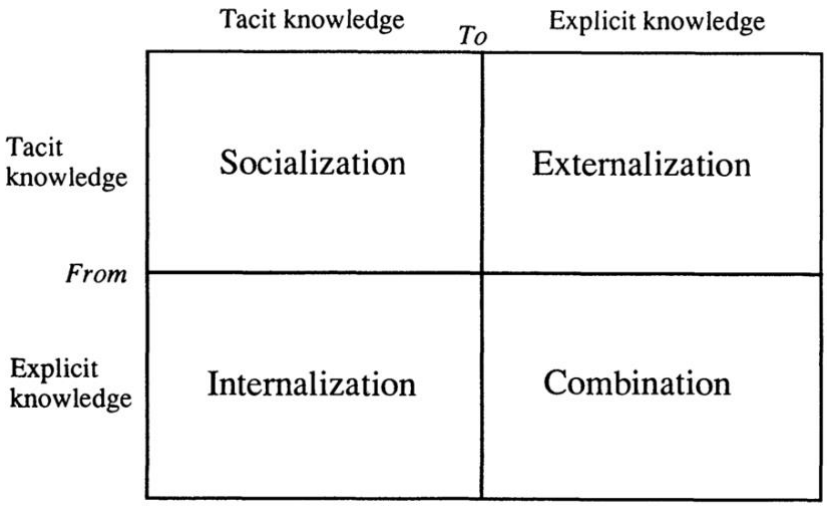

Figure 2: Modes of the Knowledge Creation
Source: Nonaka (1994)

As proposed by Nonaka (1994) “the process of organizational knowledge creation is initiated by the enlargement of an individual's knowledge within an organization”. The four types of knowledge creation exist within the digital agency context, though, it happens with different levels of intensity from other companies. When knowledge stops being created, the company loses an important part of its competitive advantage (Inkow, 2021; Nonaka, 1994; Sensuse et al., 2021). Thus, different strategies should be created to avoid it from happening.

The knowledge that employees create and acquire should be managed, thus it is maintained in the company, increasing its chance of success (Inkow, 2021). Besides, in software development, knowledge management can avoid mistakes to be repeated, increasing the integration of competencies between employees, and reducing dependence on (a few) individuals that possess critical knowledge for the company (Sensuse et al., 2021).

Different authors have associated different phases with the KM process; therefore, we will use the same definition given by Goldoni & Oliveira (2010). They define 5 phases of the KM process, which are:

> *1. Creation – the addition of new knowledge and adjustments to existing knowledge.*
> *2. Storage – the codification of knowledge for its storage in knowledge databases.*
> *3. Dissemination – sharing or distribution of knowledge within the organization.*
> *4. Utilization – application of knowledge.*
> *5. Measurement – evaluation of the KM process phases and the results attained.* (p. 302)

These phases are used to coordinate and generate long-term value (de Castro et al., 2019; Gloet & Terziovski, 2004). Besides, they are essential for digital agencies, such as the one being inspected in this case study, considering the services and products created are mostly based on their employees' knowledge. Each one of the phases plays an important part in creating good knowledge management (Gerrits, 1993). According to Gerrits (1993), business processes are, in most cases, cross-functional which highlights the need for KM, considering information processing is often needed.

2.1.1.1. Knowledge management within the Agile framework

In companies that develop digital products, it is common to see the use of Agile frameworks, such as Scrum, the most commonly used Agile framework in companies (Matthies, 2019b); therefore, Agile is another topic that should be investigated within KM. Agile has been used in the industry since the concept has been introduced by the work of Nagel et al. (1991). Though, it got especially influential in the areas of enterprise information systems (Mooney & Ganley, 2007) and software development (Cohen et al., 2004). Different definitions of Agile were gathered by Imache et al. (2012), though most of them highlight the importance of learning and adapting to the environment. That characteristic relates to both *Ideation with support of data* and *Project evaluation* topics, which will be further discussed.

Moreover, Levy & Hazzan (2009) argue that agile methods have implications for cooperative software development. They also suggest different KM practices that can be an effective manner of using KM within an organization such as whole team meetings (preferably in person), extra roles assigned to software developers to help the team leader manage the team, collaborative workspace, stand-up meetings, measures, customer collaboration and pair programming. Those practices collaborate to create an organizational culture, which is an important factor for innovation inside a company (Manley, 2001).

2.1.1.2. Team topology: the Spotify model

The work of Ahmed & Colomo-Palacios (2021) studied different team topologies in Software teams and they found that teams' goals have a significant impact on individual goals leading to a high success rate. The Scrum framework is based on Agile methodology and is an example of a framework that breaks a complex problem into small pieces, which are solved within a specific timeframe. The framework arose from companies' necessity of having iterative and incremental methods, where changes are welcomed, an idea that became well-known and heavily used after the creation of the Agile Software Development Manifesto by Fowler & Highsmith (2001).

One of the well-known models for IT companies (Salameh & Bass, 2019) is known as the Spotify model, which is a mode of organization structure created and implemented by Spotify and was shared by Kniberg & Ivarsson in 2012, while they were employed there. In the whitepaper that was released online, Kniberg and Ivarsson (2012) mentioned that their scaling model was introduced gradually, giving employees time to adapt and get feedback regarding it. This is relevant, as KM impacts the team differently for the reasons below.

As was mentioned in the *Internal processes* section, the model introduced a new way of structuring the company, where small teams are called squads. Each squad is multidisciplinary and responsible for different projects, this means that most communications and decisions for the projects they are working, are only being done within the squad (Kniberg & Ivarsson, 2012). This allows companies to be more agile and have a faster response regarding the customers' requirements (Salameh & Bass, 2019). This can be facilitated, for example, by the use of tools, such as Gitlab[1], which gives the ability to create "Issues"[2] for each project requirement improving KM. Though, more still must be executed to improve employees' understanding and participation, in order to make KM more efficient. As presented by Offsey (1997), people must be aware of the reason and benefits that KM efforts bring.

2.1.1.3. The Knowledge Management process

To achieve good financial performance social practices are important (Andreeva & Kianto, 2012). Some of the relevant social characteristics should, then, be taken into consideration. Argote et al. (2003) argue about the importance of creating opportunities and providing people with motives to participate in the KM process. Besides, practices of KM can impact one's ability to create, retain, and transfer knowledge (Argote et al., 2003).

As previously mentioned, some of the characteristics, such as employees' age and high demand in the IT sector, present in the company of the case study result in a high turnover (Atouba, 2018; Turnea et al., 2020). To tackle this, it is important to guarantee that the knowledge held by those employees will not leave the company in case they decide to follow a different career opportunity. This knowledge management challenge can be solved with the creation of a KM system; thus, it will be further explored in the study case.

According to Cerchione and Esposito (2017), there are a few KM practices and tools used by SMEs to support knowledge creation. Writing internal wikis is a knowledge-sharing practice that will be further explored in the *Archival Analysis*. The wikis from the projects usually gather relevant information regarding the project, therefore the company should put effort to show that those practices enable the harnessing of collective intelligence (Razmerita & Kirchner, 2011) and contribute to innovation (Bolisani & Scarso, 1999).

Wikis often help employees in externalizing tacit knowledge, which is valuable for digital organizations, the study by (in't Hout et al., 2010) highlighted the effectiveness of the use of wikis for storing and sharing relevant information.

[1] GitLab is an opensource platform, developed by an open-core company, with premium options. The platform is focused on offering a solution for DevOps, which the teams use to develop software. The company and platform are well-known, with more than 30 million registered users, and used by more than 100 thousand other companies world-wide (GitLab, n.d.-a).

[2] Each issue is a bug or feature that the software company will work on. Using issues facilitate the discussion between the developers over each one of those small implementations. Besides, each issue can have comments, labels and milestone, notifications, references, and to-do notifications, which simplifies the work of developers (GitLab, n.d.-b).

Meher & Mishra (2019) have identified 10 variables related to KM from different literature, those are organizational performance, organizational structure, innovation capabilities, organizational culture, employee commitment, employee empowerment, knowledge sharing, knowledge integration, organizational learning, and client review.

Sergio Ruiz-Castilla et al. (2016) presented some recommendations regarding KM in the software industry:

> *"1. Include knowledge management processes in your company.*
> *2. Allocate resources and trained personnel with roles for knowledge management.*
> *3. Define a method and techniques for the conversion of tacit to explicit knowledge.*
> *4. Have knowledge management tools to capture, store and share knowledge.*
> *5. Measure the impact of knowledge management once implemented."*

At last, impact measurement is another recommendation by Sergio Ruiz-Castilla et al. (2016). Those recommendations can create a culture of KM inside the company and are in line with al Saifi's (2015) thoughts regarding this subject, as he argues that company culture plays a vital role in KM.

2.1.2. Ideation with support of data

Ideation is a process in which people generate different ideas to create inputs for a project, and reach different viewpoints (Hauser et al., 2006). Ideation is an essential part of a digital company that works with bringing project ideas to life (Geissdoerfer et al., 2016). Besides, the goal of the ideation process is to "effectively influence the thinker during idea generation" (Chen et al., 2019). The main factors associated with creativity are expertise, intrinsic motivation, cognitive ability, and flexibility to create (Amabile, 1997; de Carvalho Botega & Silva, 2020), which will be further explored in this research.

Authors, such as Chen et al. (2019), Kaufmann (2019), and Lim et al. (2018), have suggested different data-driven approaches to ideation. Chen et al. (2019) suggest using artificial intelligence in the process, to produce semantic and visual stimuli for idea generation. Though, there is no need for such a complex solution to produce the stimulus, as "*getting practical with data is often more valuable than revising statistical concepts*" (Kronsbein & Mueller, 2019). Besides, mental associations can be triggered by the use of other techniques (Bertoncelli et al., 2016).

Design thinking (DT) has an ideation stage, where it is encouraged that people "think outside the box", which stimulates innovation (Denning, 2013; Geissdoerfer et al., 2016; Hauser et al., 2006). Though, DT goes further than the ideation stage. It happens through a "human-centred approach to problem-solving" (Radnejad et al., 2021) by emphasizing collaboration and testing ideas (Denning, 2013; Radnejad et al., 2021).

The DT methodology can effectively have a positive influence on product innovation (Radnejad et al., 2021). Moreover, DT has proven to be effective when creating disruptive innovation

(Radnejad et al., 2021), which is crucial for digital companies, as they cannot afford to lose time or capability with projects that will not have a relevant impact on the business and its customers.

The responsible team for implementing DT is usually the design team, though different teams should be participants in the process, so they can bring their own perspectives (Denning, 2013). DT consists of 6 main phases: “understand”, “observe”, “define”, “ideate”, “prototype” and “test” (Geissdoerfer et al., 2016; Thoring & Müller, 2011). Although design thinking can be seen as an iterative process (Radnejad et al., 2021), the literature did not evidence that output data from previous iterations are commonly used in new iterations.

Adding data to the ideation phase of DT can not only complement ideas, but also use learnings from previous iterations to enrich the new ideas. The Data Innovation Board (DIB) (*Figure 3*) suggested by Kronsbein & Mueller (2019) offers a good solution to bring data and DT together, by offering a data-driven ideation framework for the development of data products and services for teams that have different levels of data literacy. DIB was created based on the Business Model Canvas (BMC), a well-known tool created by Osterwalder & Pigneur (2010). The BMC is commonly used to create or analyse business models, as it offers a visual overview of different areas of a business.

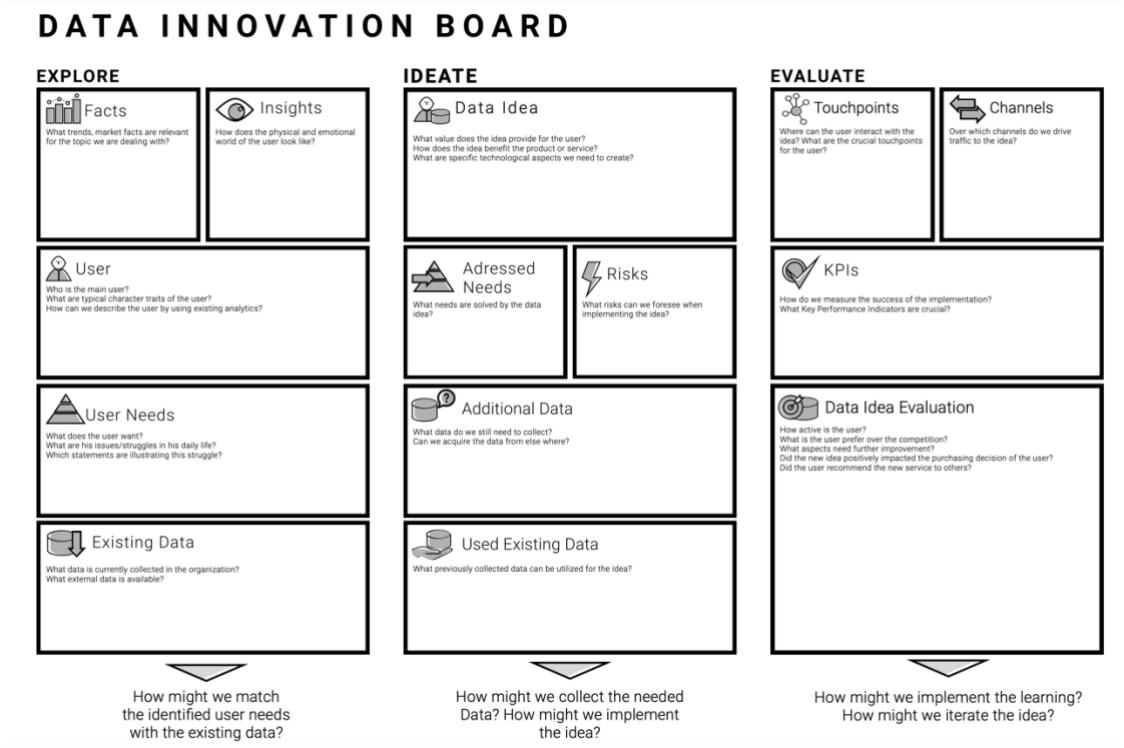

Figure 3: Data Innovation Board

Source: Kronsbein & Mueller (2019)

To be more effective for companies that work with different projects, such as digital agencies, the DIB can be further customized, especially with the addition of the iteration aspect. Furthermore, it should be understood the impact of the use of such a tool in a broader view, by not simply looking at the ideation stage, but combining it with previous and further stages of a project.

Although the Digital Innovation Board is not perfect to achieve El Niño's goals, as it would need to be adapted to B2B solutions, it does offer great benefits together with DT. For that reason, this research will focus part of its efforts on creating a data-driven ideation tool, to be used in the ideation phase of new projects at El Niño.

2.1.3. Project evaluation

Evaluation for projects, inside enterprises, can be done in a plethora of ways, several studies were found on different perspectives that authors researched within this topic. Celar et al. (2014) studied personal capability assessment, while Ahmad et al. (2013) and Looks et al. (2021) discussed usability evaluation for agile and measuring agility. Moreover, Tam et al. (2020) introduced the factors influencing the success of ongoing agile projects.

Tam et al. (2020b) work presented the relevance of internal process evaluation (internal perspective) and product evaluation (customer perspective) for the growth of successful companies. Therefore, those will be considered the goals of this part of the literature research.

2.1.3.1. Process evaluation of ongoing projects

Considering the agile mindset, internal feedback is important for the team and individual continuous improvement, having a positive impact in the company (Looks et al., 2021). Besides, for product development is important to get feedback from customers and end-users early in the development process (Ahmad et al., 2013), lowering the chances of project failure.

Feedback is a way of assessing and evaluating situations, people, or artefacts, which is essential in Agile to guide decisions (Matthies, 2019a). In Scrum, an Agile process framework, there are already meetings and discussion points, such as the retrospectives, where feedback is given by the team in a discussion format (Matthies, 2019b). Besides, data is an important factor for decision-making in Agile, as data can improve decision-making process, leading to project success (Matthies, 2019b).

Another relevant topic that should be included in the feedback process is the integration of people with different skills and responsibilities within the project. To effectively satisfy the customer needs, a squad need more than the skillset provided by their software developers, such as testers, designers, product owners, etc (Srivastava et al., 2017). Though, integration might be challenging as the study by Caballero et al. (2016) has indicated. To overcome these challenges, feedback could be used, as a way to integrate team skills and satisfy customer needs.

2.1.3.2. Customer Satisfaction and Digital Product Evaluation

Digital product evaluation is another focus point in this research, as it is a valuable and decisive topic for the project's success. The digital end-product must be up to the customers' standards, as customer satisfaction is a key factor for a business's success (Tontini, 2000).

Poh et al (2001), have done a comparative analysis on different R&D project evaluation methods, those methods are important for companies as they want to answer questions, such as "What is

the return on investment?" or "Was it a project worth implementing?". With the answers to those questions, the business can decide on the continuation of its company strategy, for example.

On the other hand, for a digital consultancy that is offering to develop those projects as a service, the different project evaluation methods that were compared by Poh et al (2001) are not useful. There are different reasoning to explain why those methods cannot be used: First, the supplier (digital consultancy) might not have all the data needed to complete the evaluation; Second, they do not have a say in the strategy of their customer, as they are simply offering a service; Third, the evaluation must happen throughout the development of the project, to achieve the best end-result, and none of the methods mentioned allows that. In that case, other success measures, that match the consultancy characteristics, must be found.

As stated by Jain et al. (2018), quality can be perceived in different ways, though customer perception is the one that counts the most, especially for digital consultancies. The quality definition by Weinberg (1992) will be adopted for this research, as he states that quality creates value for people. In this case, it is important to understand what is the value (if any) that the digital products are creating for the end customers and how that will affect the supplier-customer relationship established.

Quality requirements are usually believed to be implicit and difficult to measure (Lindsjorn et al., 2016; Mohagheghi & Aparicio, 2017; Weinberg, 1992). Therefore, the study by Mohagheghi & Aparicio (2017) advocates for the specification of quality requirements from the beginning of each project. Though, they also say that it is harder to track quality requirements, as they are less tangible than testing on a feature that can either work or not.

The research conducted by Subih et al. (2019) presents software quality factors for quality of design, quality of performance, and quality of adoption, which are factors that can be assessed by the team producing the software. Those will be further explored and combined in this research.

Recycling ideas and requirement lists within different projects can be a good way of achieving success in working with quality requirements (Mohagheghi & Aparicio, 2017), as it can also reduce the time dedicated to this task. Moreover, Mohagheghi & Aparicio (2017) have found 22 "quality attributes", which are written on a higher level and can be broken down into smaller and measurable requirements, which can be separated into basic lists or solution-specific lists. The benefit of using those lists is that it can help project managers and teams in creating a first effort estimation as well as making them more tangible with estimates based on previous projects.

A similar idea is presented in the study by Theobald & Diebold (2017). They argue that Definition of Done is among the 10 most beneficial Agile Practices, therefore having a positive impact on product quality. Besides, they argue that iteration reviews and having cross-functional teams also help with product quality.

As stated before, customer satisfaction is a decisive objective for companies, but most importantly for digital consultancy agencies. Some of El Niño's project end-goals involve delivering a digital

product that will lead their customers to increase sales, optimize internal processes, and more. To achieve that, it is important to evaluate the solutions being delivered.

2.2. ARCHIVAL ANALYSIS

To corroborate the *Literature review*, an archival analysis was performed on the company documents and online means of communication. As previously mentioned, the company wikis are stored in the company's GitLab, simultaneously GitLab is used to manage and deploy the company's web development work. Besides, El Niño has Slack, a messaging tool, as the main mean of internal communication. Below, the use of those tools by El Niño will be described and further analysed.

2.2.1. Slack (Company messaging app)

The Slack application is used internally to discuss internal matters and communicate with people on different levels (such as one-to-one, by project, by squad, by office location, and to the whole company), as can be seen in *Figure 4*.

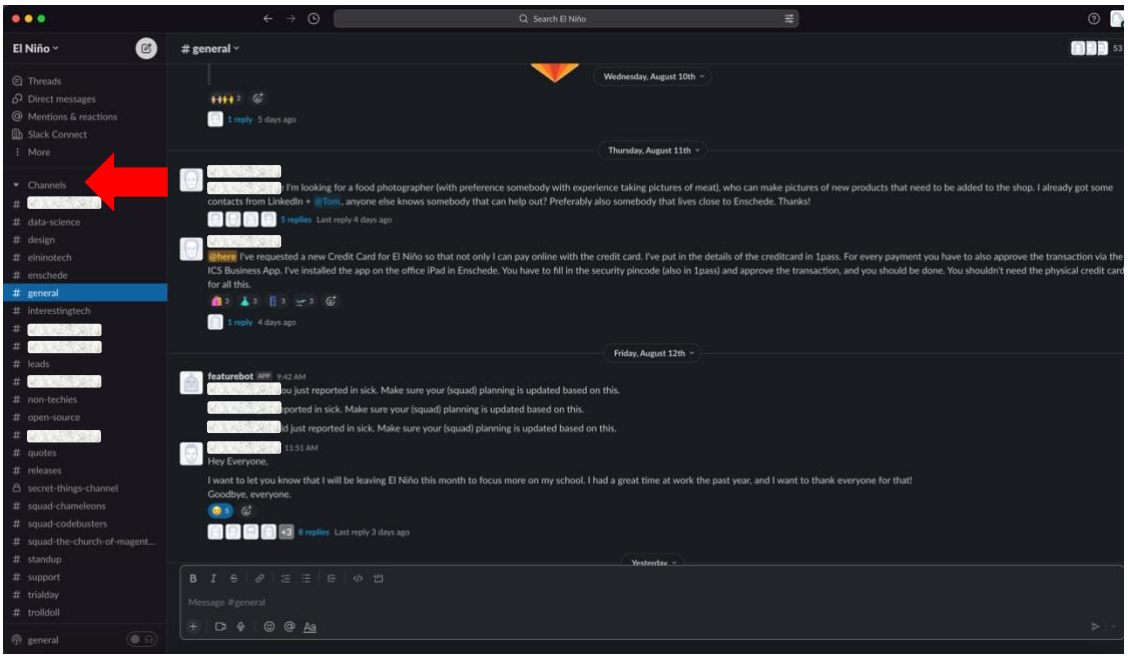

Figure 4: Slack application

This communication is done by the use of different "channels", a group that any person can join depending on its privacy settings, or by the use of private messaging. In the "Channels" people can add attachments and tag other people, most channels are visible to everyone in the company. Therefore, people can see or join them as they wish.

The app also supports calling and the use of "bots" with automation. The last is used for the written standups, for example, where employees add what they did in their last working day, their plan for the day and if they have any blockers (see *Figure 5*). The metadata from these inputs are being collected and eventually used by the managers, as it is displayed in an internal dashboard.

Though, real data is still not being used, as it would require more sophisticated analysis, such as the use of natural language processing.

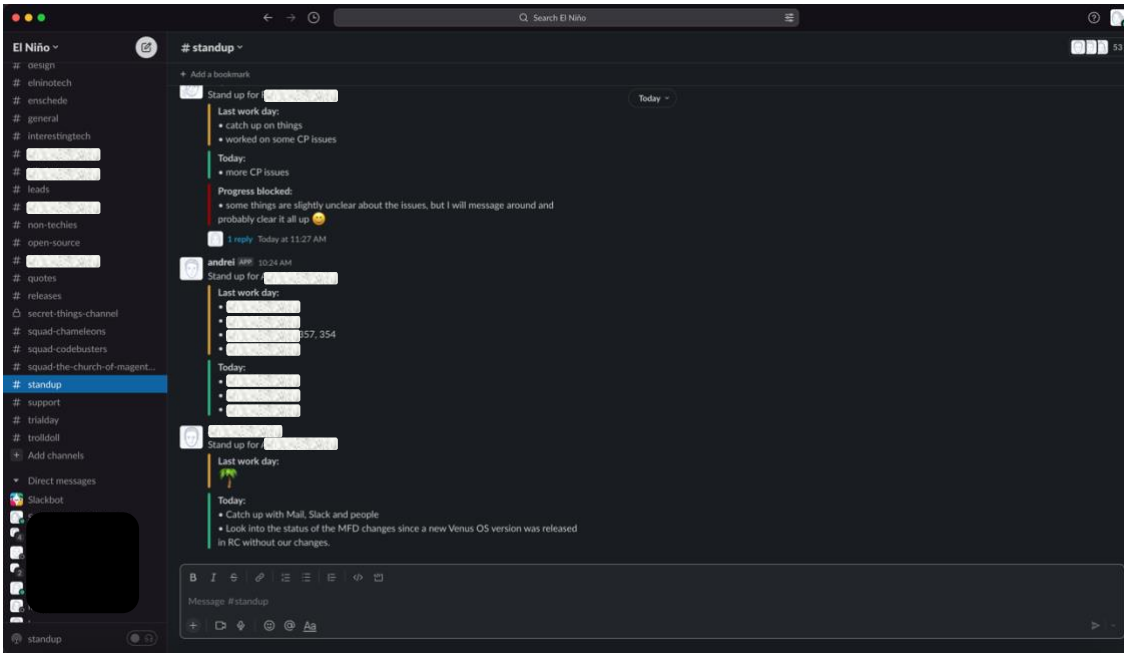

Figure 5: Written standup

Slack is an important communication tool for the company and helps bring transparency to it. While meetings are time-consuming and limit the number of people involved, by Slack messaging anyone can join the discussions and have a clear understanding of different matters in the company. Besides, more urgent matters can quickly be discussed through Slack compared to the GitLab system. Differently from the wikis, which will be discussed in the next subsection, Slack notifies employees of urgent matters and can be used more informally by employees. Though, it was noticed that general guidelines are often given through Slack app, but not updated in the Wikis (which will be discussed in the following section). Therefore, the information is given to the people currently in the company, but not to the new people, who would join in the future, which could possibly become a cause of miscommunication in the company.

2.2.2. GitLab wikis

The GitLab wikis are important sources of information for the company employees, especially since the company have many part-time employees. Whenever those employees have missed a meeting or important discussion, they would be able to find key information about the company, squad or project in their respective wikis.

The “Internal wiki” is used by the company to share general information, especially to new employees, that are doing their onboarding at the company. Although the internal wiki is a very useful tool, people onboarding would frequently notice incorrect and outdated information. Having incorrect information can confuse and bring more doubts to the people onboarding, which is the opposite goal of the wikis.

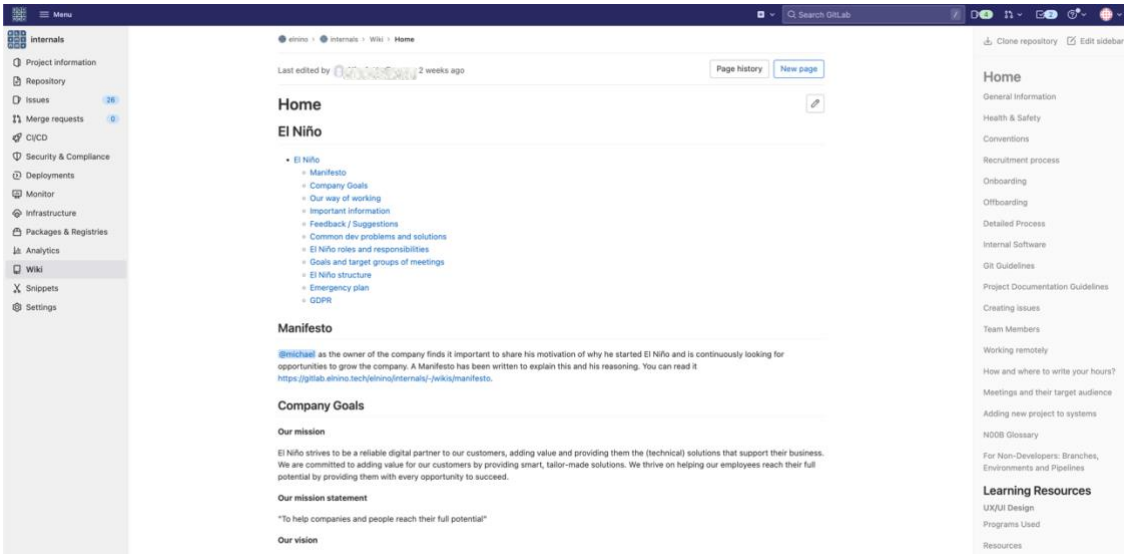

Figure 6: Internals wiki

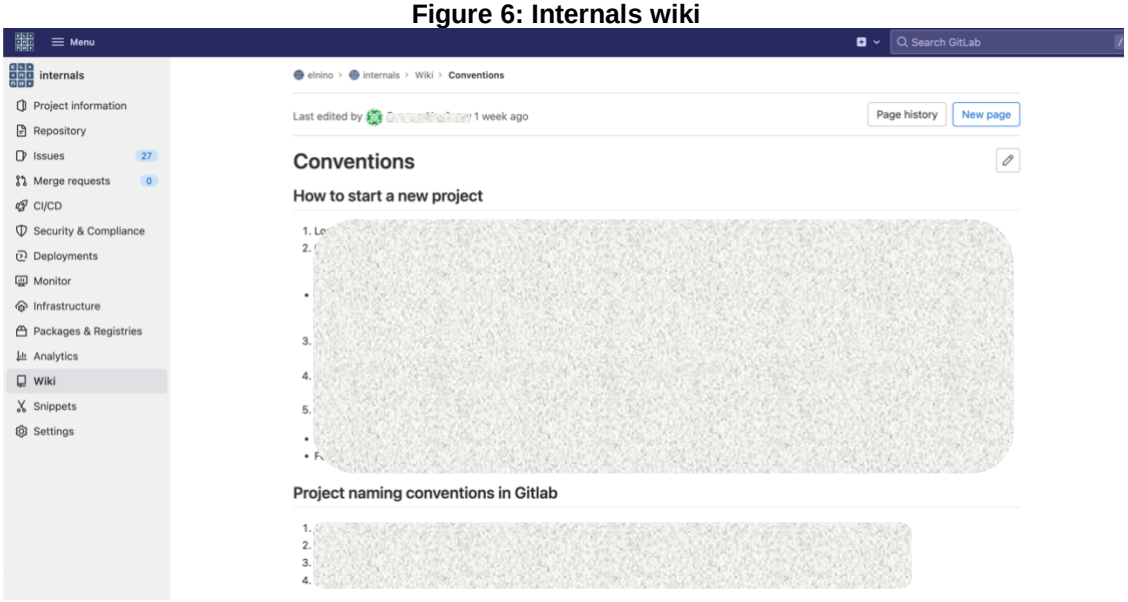

Figure 7: Internals wiki page example (Conventions)

The images in the next pages exemplify the differences between each squad's wiki, the main characteristics that can be noticed are updating frequency, page structure, and how loose or strict the general guidelines within each squad are.

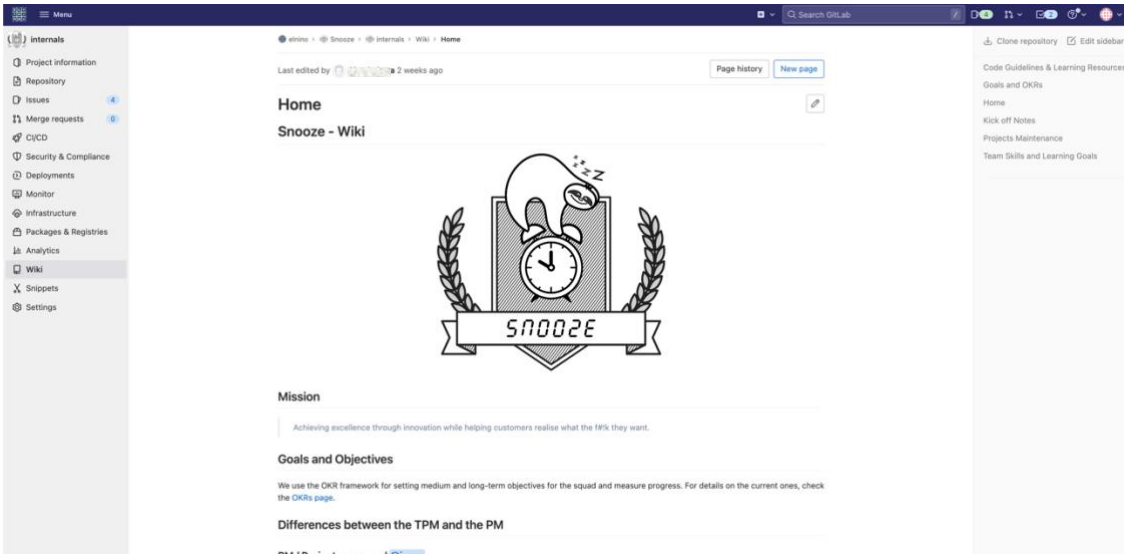

Figure 8: Snooze wiki

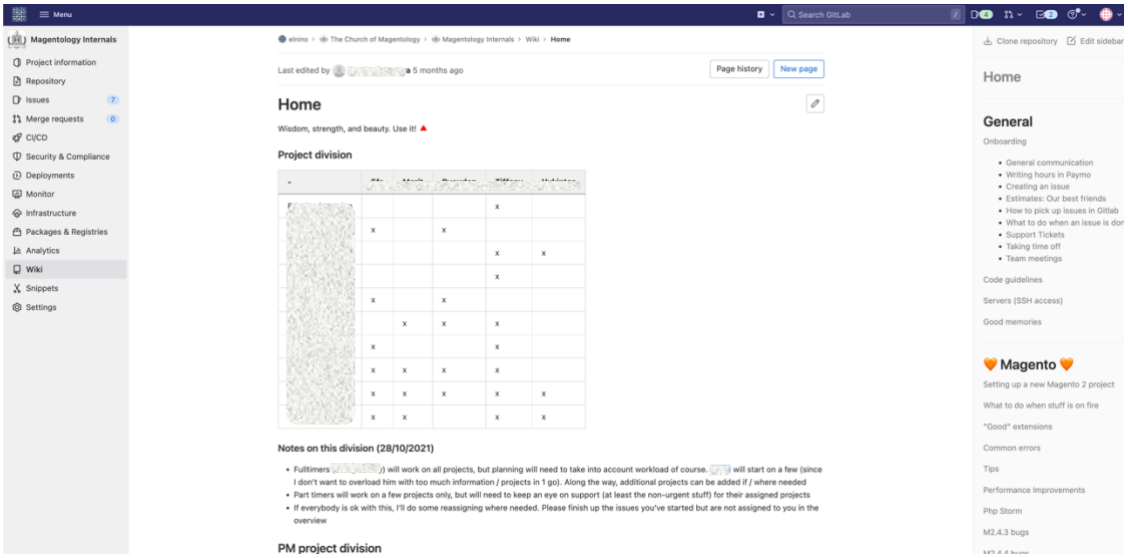

Figure 9: The Church Of Magentology wiki

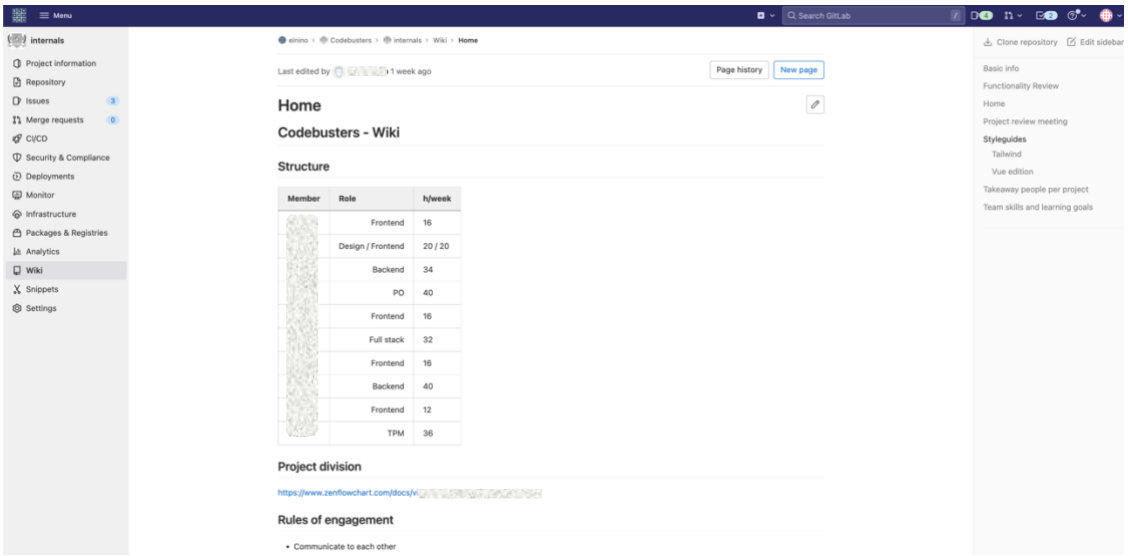

Figure 10: Codebusters wiki

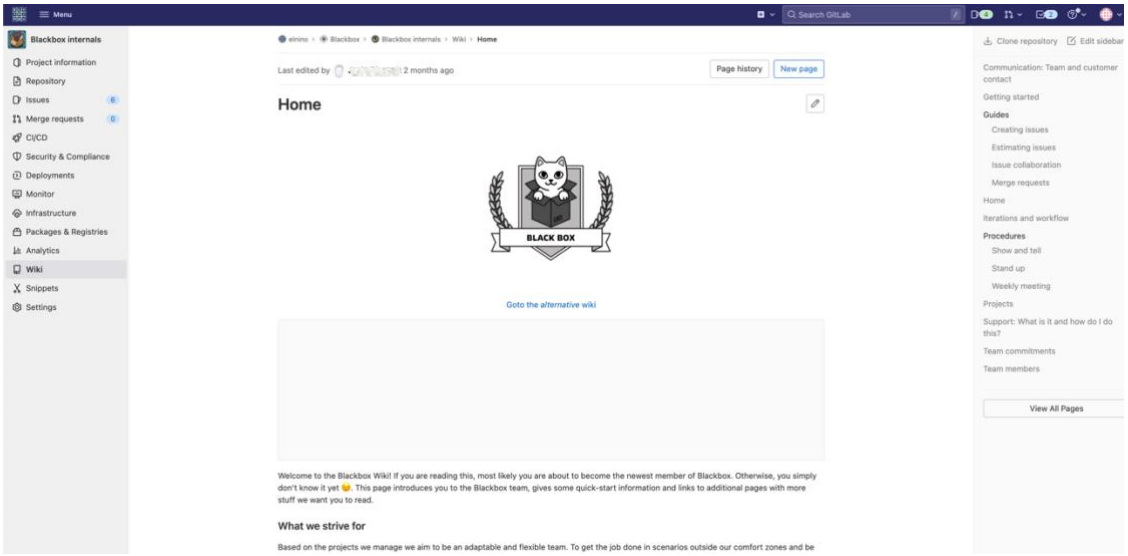

Figure 11: Blackbox wiki

From the pictures above, it is possible to notice how the squads' wikis differentiate in their structure and show different information. The project wikis reflect what will further be discussed in the interviews, they lack a common structure for the wiki pages and are frequently outdated, showing the lack of organization in reviewing them. Previous literature has discussed that this lack of organization (related to the design and maintenance of the pages) can negatively impact the use and contribution of the wikis (Garcia-Perez & Ayres, 2009).

The other type of wiki that appears multiple times, is aimed to the customer and its projects, and therefore each of El Niño's projects has its wiki. If the customer has more than one project, each project will have a different wiki, even though they are from the same customer. Within each of those wikis, different pages are available, which usually are shown in a sidebar as presented below (*Figure 12*) inside the red square:

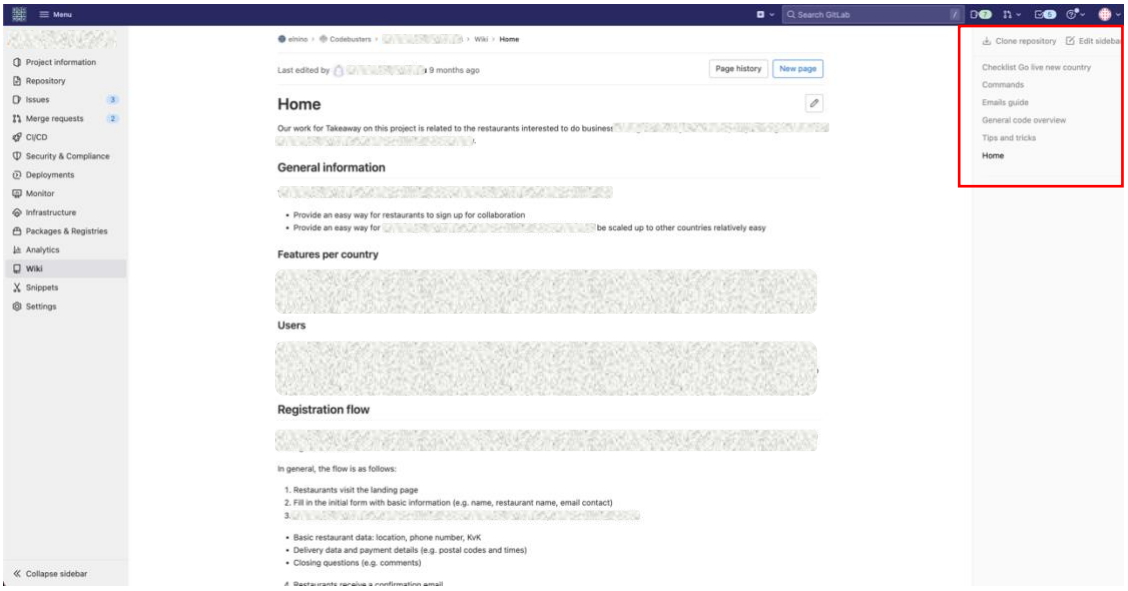

Figure 12: Wiki sidebar example

The customer wikis are created when new customers/projects are initiated at El Niño. Those are important, as developers work on different projects and the relevant information in these wikis can help them understand more about the project they are working on.

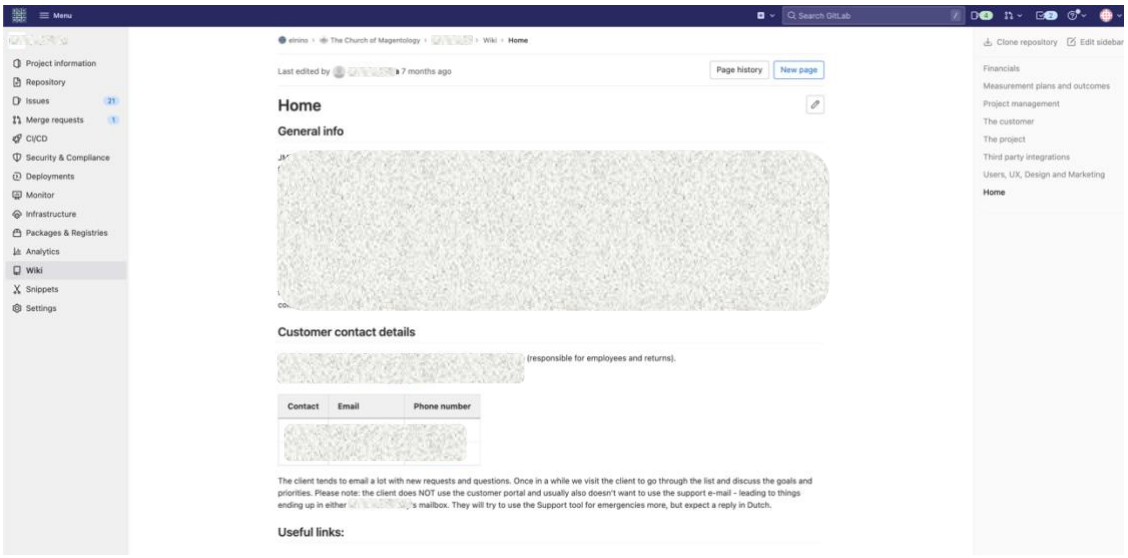

Figure 13: Customer wiki - The Church Of Magentology

As it is possible to notice in *Figure 13*, which shows a project from The Church of Magentology squad, there is no separation between the pages and the content of the wiki. Besides, the page was updated a long time ago. Although it needed to be blurred to maintain the company and its customers confidentiality, some of the people mentioned in the wiki no longer work for El Niño, demonstrating that wikis often get outdated.

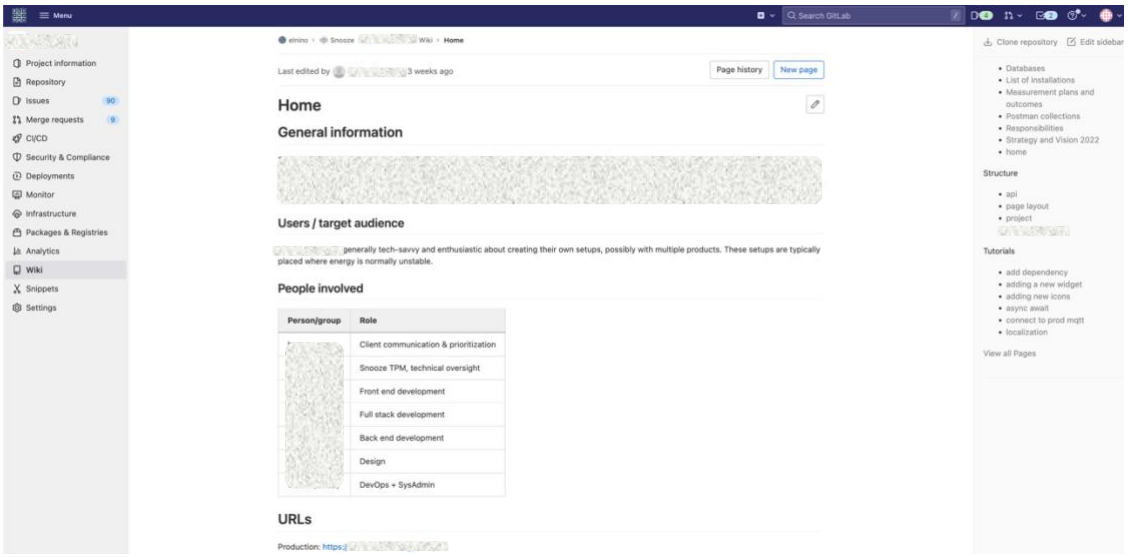

Figure 14: Customer wiki – Snooze

The project wiki in *Figure 14*, from Snooze squad, does have a structure and seems to be updated. Though, the structure differs from other project wikis, which can cause confusion and can be a less effective way of transmitting the information.

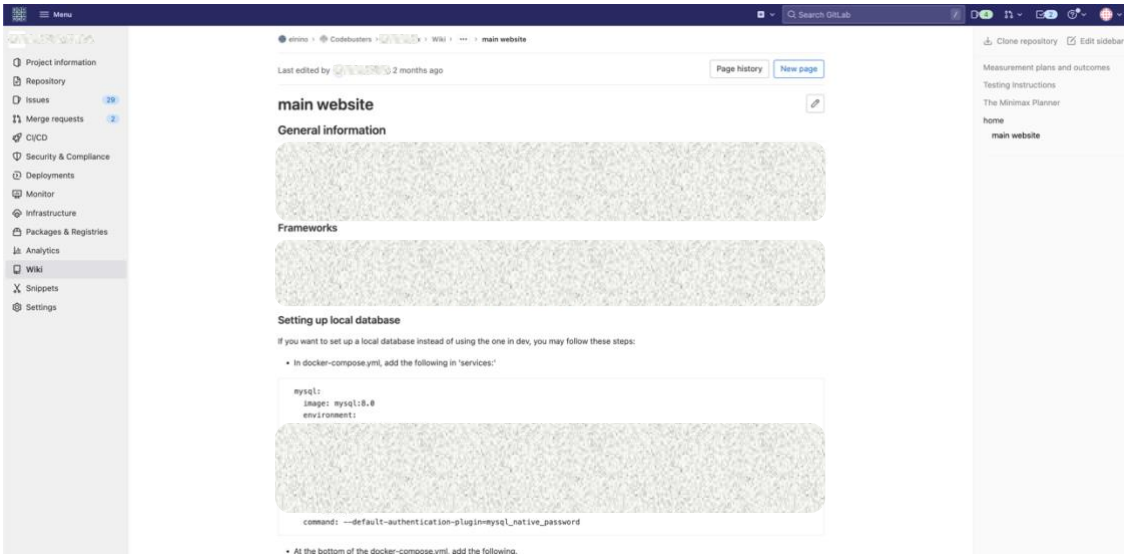

Figure 15: Customer wiki – Codebusters

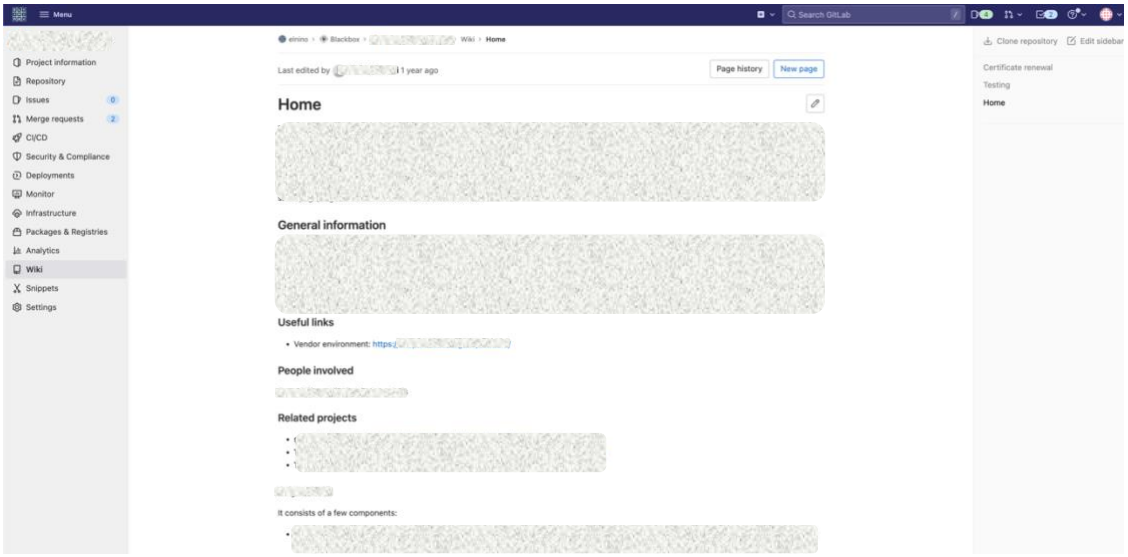

Figure 16: Customer wiki – Blackbox

Turnover at the company pressed the wikis to be more present, but the sudden push to write wikis also caused them to become more disorganized, as employees do not receive clear guidelines on how to structure them. Therefore, different projects could be adapted to their needs and require less or more information depending on the complexity and importance of the project for El Niño. Though, a basic structure could provide some guidance and support a basic understanding and overview for every project.

The difference between the structure and each of the wikis, as well as the last update dates, show that each wiki is managed differently. This is especially worrying for the Chameleons which is a team that works with different squads, on demand. The Chameleons includes marketing, data, hardware and Human Resources employees. For the Chameleons, a common wiki structure and planned updates are important, as they are involved with the projects more superficially and having bad quality wikis can lower their effectiveness considerably, as they would spend more time looking for information.

2.3. INTERVIEWS

To tighten the *Exploratory Research* and the *Archival Analysis* with the practical reality of the company from this study case, different interviews with stakeholders of the company were conducted regarding the main topics of this research: Knowledge management, ideation, company processes evaluation and digital product evaluation.

In the further sub-sections, the participants, materials, and procedures followed for the interviews will be discussed. Besides, the conclusion reached from the sum of the interview, literature review and archival analysis findings will be presented for each of the main topics of the research in the following section (*Findings*).

2.3.1. Participants

In this sub-section, we discuss the findings from the interviews conducted with 12 stakeholders. The interviews aimed to get an in-depth understanding of the research problems investigated in this research. To recruit participants, we looked for representatives of each team in different roles in the squad. *Table 1* lists the profile of the selected participants:

Table 1: Interview participants' details

Interviewee ID	Role	Time in the company
1	Product Owner	23 months (> 1 year)
2	Product Owner	4 months
3	Product Owner	2 months
4	User Experience & Design	52 months (> 4 years)
5	Tech Lead	75 months (> 6 years)
6	Tech Lead	66 months (> 5 years)
7	Tech Lead	50 months (> 4 years)
8	Tech Lead	38 months (> 3 years)
9	Developer	22 months (> 1 year)
10	Developer	15 months (> 1 year)
11	Developer	10 months
12	Developer	8 months

The selection of participants mostly depended on the employee availability to participate in the research, though we tried to select participants from different squads.

2.3.2. Materials

The scripts for the interviews were designed following a semi-structured approach, as defined by Myers & Newman in their book (Myers & Newman, 2007). Following Myers & Newman, we designed the script with an opening section, some (but not all) prepared questions and a closing section. The introduction section aims to communicate the goals of the interview and some ice-breaking questions to help interviewees feel comfortable (Myers & Newman, 2007). The pre-written questions serve as a guideline, but the interviewer should not be too strict, meaning that follow-up questions and unplanned questions were asked according to the goals of the interview and its development. Finally, the closing section aims to give participants an overview of the research and information about how to follow up the interview. The closing section is also an

opportunity to ask the current interviewee for recommendations of other participants. The complete script used for the interviews is presented in the following sub-sections. Though, as it is a semi-structured interview, some questions might be added, while others could have been avoided, depending on the interviewee's answers[3].

2.3.2.1. Interview's introductions and definitions

Before going through the interview questions, an introduction is necessary to let the interviewee get contextualised and get aware of how their contributions will be valuable to the research. Besides, all the answers given and data from interviews were strictly used for the study; therefore interviewees could be completely open, as no one in the company can get access to it.

For each of the main topics of this research, the goal was to define what to start, stop or continue doing within each process; allowing a further understanding of the requirements and the relevant matters for each interviewee. This will give hints for the construction and/or adaptation of each company's role in the tool/frameworks, which is the goal of this study.

Definitions were introduced, so participants would be aware of and fully understand the goal of the research:

Knowledge management: As Knowledge Management is an important topic, it is crucial for the interviewees to have a clear understanding of the topic. Therefore, the following definition will be considered. In simple words, Knowledge Management (KM) is "the process of identifying, organizing, storing and disseminating information within an organization" (IBM Cloud Education, 2020).

Ideation: We will use the concept of ideation given by the Interaction Design Foundation (Dam & Siang, n.d.):

> *"Ideation is the mode of the design process in which you concentrate on idea generation. Mentally it represents a process of 'going wide' in terms of concepts and outcomes. Ideation provides both the fuel and the source material for building prototypes and getting innovative solutions into the hands of your users."*

Evaluation: In this study, evaluation is going to be approached from two perspectives: process evaluation and customer evaluation. In process evaluation interviews, the goal is to find a better manner of gathering feedback from squad members and from the support roles, such as the marketing team, testers, etc. Besides, understanding how to act on it is valuable to the squad and the company. On the other hand, the customer evaluation interviews have the same goals, but from the customer's perspective. To be able to understand how customers want to be heard and responded to.

[3] To access the full interview data, email the researcher in the email address in the colophon.

2.3.2.2. Developers

The developers are key characters in the implementation of the ideation and the evaluation processes. First, in the ideation, they will have a place to share their ideas freely. Second, they will be able to give feedback more frequently. Thus, it will be expected that they share their opinions, which will be used to improve the product development in the further sprints.

Interviews began by explaining the reason for the interview, giving a brief introduction regarding the final project topic and saying the definitions for Knowledge management and ideation.

Knowledge management questions:

1. Regarding knowledge management at El Niño, what is your opinion about how things are currently being done?
    a. At which processes would you want the squad to improve?
2. What do you think the company is doing right?
3. How is your communication with the rest of the team? What do you think could help to improve it?
4. How long do you spend commenting on Gitlab issues (percentage of the time spent on the issue)?
5. How long do you spend reading issues? What would help to lower this time?
6. Is context from projects important for you to solve issues? How important?
    a. How do you currently gather or look for context information?

Ideation questions:

1. What is your opinion regarding ideation? Have you ever participated in an ideation session? How was it?
    a. Were the outcomes of it useful? How?
2. How often do you have ideas for the projects? Do you usually share them with anyone? Who?
3. Would you see the ideation sessions as a way to “create” work in the areas that you want to grow?

Project evaluation questions:

1. Do you evaluate your own work? What about your team’s work? How do you do it?
2. Regarding the project’s end result, what is your opinion on them? Do you usually evaluate it?
3. Do you feel comfortable suggesting changes or improvements in the projects that you work on? How often do you do it?
    a. Were there any actions taken after the suggestions?
4. Do you currently track your own progress and the goals you achieved with each project?
5. What do you define as success within a project?
6. How often do you hear about customer evaluation? How often would you prefer?

General questions:

1. What is your usual process when you assign or get assigned an issue to you?
2. What is your usual process to comment on the issue to send it for testing? Where did you learn about it?
3. During our onboarding did you read all the wikis? Did it help you? OR why not?

2.3.2.3. Tech leads

The technical project managers support the squad regarding the tech stack and processes, as well as coach the developers. Their interest in this project is broad, as the end result will help their job, though they are not necessarily involved with it.

Knowledge management question:

1. Do you feel responsible for Knowledge Management inside the squad?
    a. What about inside the company?
2. Who, in your opinion, is responsible for writing wikis? Is there a separation regarding who should write which wikis?
    a. Which ones do you feel responsible for?
3. When you are writing a wiki, what is your process to determine what should be there?
4. Including wikis and other knowledge management processes, what is your opinion regarding how knowledge management is currently being done?
5. Which processes do you think the company could improve?
    a. Which processes the company is doing right?
6. What is your opinion regarding the use of processes and templates? For example, having a clear process of who and how to assign and comment on issues?
    a. What about other processes such as the ones connected to ideation and evaluation sessions? How long should a person spend commenting on an issue? (Percentage of the total time spent on the issue)
    b. Having a template would be good or bad? Why?
7. How do you make sure that developers are well-aware of the context of the issues they are working on?
    a. Is it important for them?
8. Regarding issue or project context, what could be helpful?
    a. What is your opinion regarding the current methods that we use to transmit context?
9. Are you happy with the % of the time that developers spend reading or commenting on Gitlab issues?

Ideation questions:

1. What is your opinion regarding ideation? Have you ever participated in an ideation session? How was it?

    a. Were the outcomes of it useful? How?
2. Do you currently use any ideation methods in the projects?
    a. Which ones? How do they help your squad?
    b. Why not? Would it help to have it implemented?
3. How often do you receive suggestions from the squad members? What is the process when that happens?

Project evaluation questions:

1. Do you evaluate your own work? What about your team's work?
    1. How? What is the evaluation process?
2. Do you evaluate the end result of the projects you work on? How is it done?
3. Do you currently track if customer goals were achieved? How?
10. What do you define as success within a project?
11. What are important KPIs for TLs?
4. We have a lot of data from estimations and tasks at Gitlab. Are we currently using them in a systematic way for new contracts? How or why not?

2.3.2.4. Product owners

Ideation and evaluation processes have the potential to support POs in their jobs. The evaluation process, for example, should be the PO's responsibility, as they would be greatly benefited. Feedback might never have gotten verbalized or exposed otherwise, so they must keep motivating squad members and customers to share their opinions.

Start the interview by explaining the reason for the interview, giving a brief introduction regarding the final project topic and saying the definitions for Knowledge management and ideation.

Knowledge management questions:

1. How do you evaluate knowledge management at El Niño?
2. Regarding knowledge management, is there something you would change?
3. What do you think the company is doing right?
4. Have you experienced communication problems within projects? How can this be avoided in the future?
5. How do you gather context regarding new projects?
6. Is it shared with the rest of the team? How?

Ideation questions:

1. Have you used ideation before? How was the experience?
    a. Were the outcomes of it useful? Was there an implementation plan for the ideas that were discussed?
2. Do you currently use any ideation methods in the projects?
    a. Which ones? How do they help your squad?

b. Why not? Would it help to have it implemented?

Project evaluation questions:

1. Do you evaluate your own work? What about your team's work?
    a. How do you currently do the evaluation of your own and your team's work?
2. How do you evaluate the end result of the projects you work on?
3. Do you feel comfortable suggesting changes or improvements in the projects you manage?
    a. How does the conversation usually go with the customer? Do you think data or research would help with your arguments?
4. Have you ever received suggestions from other members of the squad? How often?
    a. Did you take any action? What was the impact of receiving these suggestions?
5. How do you currently track if customer goals were achieved?
6. What do you define as success within a project?
7. How often do customers relate to expecting something different than what was implemented?
8. Do you define project KPIs? How?
    a. Is it discussed with the squad? How?
7. How is KM currently being handled at El Niño? What is your opinion regarding this? Are you satisfied with it or not?

General questions:

8. Do you work with UX/Designers and Marketing to bring the market and customer perspectives together? How does it work?

2.3.2.5. User experience/Design

The user experience (UX) team are responsible for understanding customer needs and making sure they are considered by the POs, TLs and Developers. The developers should use UX work and input for their own work. As the ideation process is relevant for them to reach their goal, it should also be their responsibility.

Start the interview by explaining the reason for the interview, giving a brief introduction regarding the final project topic and saying the definitions for KM and ideation.

Knowledge Management questions:

1. How do you usually get informed about a customer? Do you also use Google Analytics or other sources?
2. After initiating a project, how do you inform others regarding the designs that you created? Does it work?
3. How do the developers know how to create the features? Are your ideas usually implemented correctly?

4. What could help you in this process?

Ideation questions:

1. How does the ideation happen?
2. Have you organized any ideation sessions? How did they go? OR why not?
3. User experience is directly connected to user stories, do Product Owners use your help to create the user stories? Why? AND How? OR why not?
4. What would you like to start doing regarding ideation? How would it help?

Project evaluation questions:

1. How do you define success within a project (from the UX perspective)?
2. What are important KPIs for UX?
3. How do you think customer evaluation should be done?
4. What are your thoughts regarding the Data Thinking Canvas? How can it be used? What would you change?

2.3.3. Procedures

After conducting the interviews, we transcribed them for the analysis process. We started the analysis by selecting and labelling relevant statements. The categorization was done in two levels. The first-level label aims to identify to which of the research's topics the statement is related to (Knowledge Management; Ideation; Process Evaluation; and Customer Evaluation).

The second-level label aims to identify subtopics. For instance, a statement may be labelled as "Knowledge Management" (1st level label) and "Lack of Structure in the wikis" (2nd level label). We consider as a relevant statement, any contribution from the interviewee that helps us understand the problems investigated in this research. Once the statement is labelled, we check whether it's a recurrent label (among the contributions of different interviewees) or a singularity (only one interviewee addressed this label). While recurrences point to us what multiple participants see as relevant, the singularities may help us better understand some of the recurrences or help us start new lines of investigation.

Figure 17: Interview analysis per topics

The *Interview analysis per topics* figure illustrates the connections between the labels, the recurrences and singularities found after the analysis of the interviews.

2.3.4. Interview analysis

In the following sub-sections, the 2nd level labels from *Figure 17* will be further analysed for each main topic of the present research (Knowledge management, ideation, process evaluation, and product evaluation).

2.3.4.1. Knowledge Management analysis

Lack of structure in the documentation process. The company uses Wiki pages to document each project. In the interviews, participants mentioned the lack of structure in the wikis, corroborating the findings obtained in section *2.2.2* of the *Archival Analysis* phase. Besides, there is no common pattern of which employees use to create a wiki page, so they end up being created in a dispersed manner, lowering the quality of information, and therefore user satisfaction (Alexandre & Isaias, 2012).

Table 2 lists the quotes extracted from the transcription of the interviews[4]. Employees also mentioned that there is not an established reviewing moment, the result is old-dated information (mentioned in QKM1, QKM11), which was also discussed in section *2.2.2*. Every employee is supposed to collaborate with writing the wikis (QKM7), although this can lead to a lack of ownership, which is one of the causes for wikis to be missing information (Garcia-Perez & Ayres, 2009). For instance, participants mentioned other kinds of lack of structure (besides the document structure), such as a schedule for updates (QKM11) and central coordination for the documentation of work (QKM4).

Table 2: Quotes from Interview regarding Lack of Structure in the documentation process

Interviewee ID	Quote ID	Quote	Topic
1	QKM1	*"I do think that it would be good to review the wiki maybe twice a year or sometimes once a year that we kind of like put a thermometer into it and see if we have everything up-to-date."*	Frequency to review wikis.
1	QKM2	*"Adding information to the wikis is more ad-hoc and we do it continuously"*	The reason that leads to lack of structure.
2	QKM3	*"Sometimes logic is missing on how we store things. For example, I was searching for the 'acceptance environment' link' and it took me some time and when I found it (in the wiki), it was the wrong link."*	Lack of common tooling convention.
2	QKM4	*"Some things I don't know where is stored, maybe you know, but I don't."*	Problems related to lack of structure.
2	QKM5	*"In the team, some people use Google Sheets, others use Excel (Microsoft), so would be nice if we make one choice."*	Lack of common tooling convention.
5	QKM6	*"There are different types of wikis (…). The global (company level), squad and project wikis."*	Example with the complexity of the wikis.
5	QKM7	*"I think everyone (is responsible for the wikis) to a certain degree."*	Opinion on the wiki responsibility.
8	QKM8	*"Me, being the Tech Lead, I was always mostly responsible for the knowledge management in my squad, now that we have a Product Owner that is shifting towards her."*	Opinion on the wiki responsibility.

[4] The full interview data can be asked by emailing the researcher in the email address in the colophon.

8	QKM9	*"We didn't store enough information (in general), but also didn't share enough with everyone."*	Relevance of the wiki.
9	QKM10	*"I think everyone should feel responsible (for the wikis).* *It could help if the product owners and team leads make it part of the issue resolution. To write things down, or if it's a pawn, I think everyone should be aware that they need to do this. And I think what we have with more junior people is that they don't often feel like they can make this change (in the wikis). Something I think that should be encouraged more is to keep things up to date."*	Opinion on the wiki responsibility.
11	QKM11	*"Our wikis are not the best. (…). We need to update our wikis."*	Frequency to review wikis.

As mentioned, the quotes above were extracted from the interviews, they highlight the different topics that emerged related to the "Lack of structure in the wikis". These topics are important as they directly relate to the mode of work at El Niño. The quotes demonstrate that without this structure, the information is unevenly distributed. Besides, it can lead to misinformation and misunderstandings, which slows down work progress and innovation.

The findings in the paper from Phuwanartnurak (2009) show that the "lack of structure in the wikis" situation should be improved, as it is suggested that meaningful labelling and page layout promotes successful sharing of meaning. At last, Phuwanartnurak (2009) also mentioned that people in their study often complained regarding the difficulty to find information, something also noticed through the interviews and that we hope to solve by improving the wiki structuring.

Sharing information between squads. Sharing knowledge between squads is not regularly done at El Niño (QKM9), although it could improve quality (Meher & Mishra, 2019). One of the interviewees mentioned "*Communication between squads could be improved*" (ID: 8). Sharing more could lead to fewer mistakes, as they can learn from other people's mistakes, but could also improve performance (de Vries et al., 2006) by, for example, learning new things or new solution to current problems.

Templates for issues[5]. Having a template to create the description of complex issues was mentioned by the participants with IDs 5, 7 and 8, as being a good solution to avoid miscommunication or delay due to lack of understanding. Quote QKM12, in the following table, supports the usefulness of templates, on the other hand, two other participants said QKM13 and QKM14. In this case, it is important to take into consideration when creating templates that they are suggestions that give guidance (Gregorio, 2012), but more experienced people can work in the way that makes them most productive, as long as they follow the basic conventions.

[5] Issue is a task in GitLab. For each customer demand that emerge a new "issue" is created (GitLab, n.d.-c).

Table 3: Quotes regarding templates for issues

Interviewee ID	Quote ID	Quote
8	QKM12	*"Templates are very useful"*
5	QKM13	*"Templates and established processes could be useful for new people, but restrict the seniors"*
6	QKM14	*"Templates are very helpful, but also limits people"*

2.3.4.2. Ideation analysis

Lack of ideation techniques knowledge. From the interviews, it was clear that most people did not know about different ideation techniques, besides brainstorming. When asked "Besides brainstorming (the technique most commonly used in the company), do you know other ideation techniques?", interviewees most commonly would not know other techniques. This indicates that ideation initiatives are not a strong point of the company. Though, most of the interviewees mentioned ideation as a positive aspect to be used in the company, as well as something that they would participate in.

Absence of results tracking. Some people mentioned the use of brainstorming sessions to create ideas, though they could not tell whether those ideas were tracked. Not tracking the development of ideas, means that they could not evaluate if the ideas brought value to the company. One of the interviewees mentioned, "I think it would be good to know from them (the customers) whether the ideas and feedback we gave, were useful or not useful" (ID: 11), this points out that it is also valuable for the employees to know whether their ideas brought value to the customers.

Absence of an open approach to communicating ideas. The interviews revealed that when an employee has an idea, they simply "let it go". Sometimes because they think the idea does not apply to the project, other times because they do not have enough time to improve it, as suggested by the quote: "I think it's a bit hard to have ideas on a project 'cause we have very structured milestones, so whatever we do, we want to finish our issue as fast as possible" (ID: 11). Not being able to further build on the ideas, on a later moment, for example, can result in less creative ideas.

2.3.4.3. Process evaluation analysis

Data & research. Interviewees, especially POs, agreed that data can give support when discussing with customers. Though, it was also mentioned there is not an active step in the company processes to link customer and project goals with the development, Key Performance Indicators (KPIs) tracking was mentioned as a factor that increase project value.

2.3.4.4. Product evaluation analysis

Customer feedback scarcity. Another improvement point mentioned in the interviews was the collection of feedback from customers. Currently, there is no structured process to collect feedback from customers, that is done without a regular frequency and by different people in the

project. Not having a structured process reflects on the team, as some of them do not get regularly informed about customers' opinions.

2.4. FINDINGS

Following the *Literature review, Archival Analysis* and *Interviews* different requirements are designated for each of the different topics discussed. In the table below, different findings regarding the KM topic are presented. Their coding were created according to the topic and references, therefore finding IDs that begin with FKM relates to Knowledge management, if they begin with FI relates to Ideation and if they begin with FPE they relate to Project evaluation, either internally or externally.

Table 4: Findings and sources

Finding ID	Finding description	References
FKM1	The artefacts must work in a team setting, following Agile characteristics.	Salameh & Bass (2019)
FKM2	The artefacts must adapt to the company's culture.	al Saifi, (2015); Sergio Ruiz-Castilla et al. (2016)
FKM3	The artefacts created must have an "owner". Besides, wiki responsibility should be decided how to be split between the squad members.	Sergio Ruiz-Castilla et al. (2016) and Section 2.3.4.1
FKM4	Knowledge management benefits must be presented to the company. Employees should understand the tools goals and structure.	Offsey (1997) and section *2.3.4.1*
FKM5	Knowledge must be stored in a manner to allow easy access at a later time.	in't Hout et al., (2010); Razmerita & Kirchner (2011)
FKM6	Announcements that are given in Slack, must also be documented for new employees.	Section 2.2.1
FKM7	Wikis must be organised and follow a clear structure.	Sections *2.2.2* and *2.3.4.1*
FKM8	Wikis must be updated and reviewed more frequently.	Garcia-Perez & Ayres (2009) and Sections *2.2.2* and *2.3.4.1*
FKM9	Tools that are used in the company must be decided, as well as the way to store documents created using them.	Section 2.3.4.1
FI1	Data must be used for the ideation stage (for evidence-based solutions).	Chen et al. (2019), Kaufmann (2019), and Lim et al. (2018) and section 2.3.4.2
FI2	The identification and use of data sources must be facilitated.	Kronsbein & Mueller (2019)
FI3	Design Thinking techniques must be adapted to B2B characteristics and to the Agile methodology.	Kronsbein & Mueller (2019); Salameh & Bass (2019) and section *2.3.4.2*
FI4	A process to facilitate idea sharing and reflection on each other ideas must be created, in which they can be later assessed and improved.	Chen et al. (2019) and section 2.3.4.2
FPE1	The team must be able to collect, store and use the colleagues' feedback.	Matthies (2019b); Matthies & Hesse

		(2019) and section 2.3.4.3
FPE2	Customer goals and quality standards must be connected with end-product results.	Jain et al. (2018); Subih et al. (2019) and section *2.3.4.4*

These findings guided the creation of the Research Questions in the next chapter and will be used in the artefacts' creation, presented in the following chapter (*3*) of this research.

2.5. SOLUTION OBJECTIVES AND SCOPE OF THE PROJECT

Following the *Findings* extracted from the previous sections of the *Exploratory Research*, a main research question and four sub-questions were used to conduct the further development of the research:

- **What are the key components of a Knowledge Management system for El Niño B.V., an Agile medium-sized digital agency with a high turn-over rate, to avoid knowledge loss throughout the digital product development cycle?**
  - **Sub-RQ 1: Which Knowledge Management practices can support the creation of a Knowledge Management system for El Niño?**
  - **Sub-RQ 2: How to operationalize the use of a collaborative data-driven ideation tool for El Niño, considering KM practices and customer goals?**
  - **Sub-RQ 3: How to iteratively collect and present internal feedback data to allow knowledge sharing?**
  - **Sub-RQ 4: How to collect external feedback to support the alignment between digital product development and customer expectations?**

Based on the presented research questions different solution objectives were defined according to each subtopic of the research. The ideation subtopic will be responsible for generating ideas and offering inputs for the ongoing projects at the company. The process evaluation subtopic will give the management of the company input to modify and adapt the current strategy being used in the squads and for each customer. At last, the Knowledge management subtopic will serve as the basis for the other subtopics, offering structure for the previous subtopics and ensuring homogeneous and effective distribution of information.

With the guidance of these questions, different artefacts were designed and developed using the Design Science Research methodology from Peffers et al. (2007) (*Appendix C* can be consulted for more details). As a result, the research goal is to develop a KM system that will have ideation and process evaluation as motivators of change in the company, while knowledge management ensures that those ideas and information are correctly distributed within the company. The framework will be successful if it can generate innovation grounded in facts, that come from data from the ideation and evaluation processes.

3. ARTEFACTS DESIGN & DEVELOPMENT

In addition to the interview findings and based on the research questions presented in the previous chapter, different artefacts were created. In the following section, each of the artefacts will be presented. The goal is to demonstrate how the artefacts work individually; as well as clarify the factors that were considered during their design. Besides, in the following chapter (*Workflow*), a diagram that combines all the artefacts is presented, which is also the goal of this research.

The artefacts presented further are separated into the main topics of the research.

3.1. KNOWLEDGE MANAGEMENT ARTEFACTS

Knowledge Management is “the process of identifying, organizing, storing and disseminating information within an organization” (IBM Cloud Education, 2020). Based on that, we designed a few concepts, which can be added to the implementation of the wikis. Some are in the form of suggestions and some in form of requirements that should be considered. Besides, it is important to observe that the artefacts’ creations were based on the processes and tools that were already being used at El Niño previously presented in the earlier chapters.

Turnover happens when employees leave a company, which can lead to loss of knowledge inside that company. To avoid that effect, different practices are suggested below, based on the *Findings*, for the implementation of a successful KM system.

3.1.1. Wiki templates and topics

As previously discussed, knowledge management is a way of preventing key knowledge to leave the company together with the employees that stop working at El Niño. Well-structured wikis are a good way of organizing, storing, and disseminating knowledge within a company (Diaz & Puente, 2012), as they are always available and shared with the whole company. Besides, this way of knowledge management started to get pushed within the company, after people with fundamental information for El Niño left the company without documenting their knowledge.

Previous research has explored different solutions for companies with the implementation of wikis. Passant & Laublet (2008), for example, have suggested the features and architecture for wikis, based on semantics and ontology-based data with the goal of uniting Semantic Web and ontologies to enrich browsing and querying capabilities. Though, our goal is to achieve a higher semantic capability and not necessarily increase querying capability, considering the limitation of the topics presented in the wikis and necessary for El Niño, indicating the solution should be less complex than the presented in Passant & Laublet (2008) work. During the *Interviews*, the main problem that was brought by interviewees was the lack of structure in the wikis, presented in the *Knowledge Management analysis* section, culminating in the finding *FKM7*.

As previously discussed in the *GitLab wikis* section from the *Archival Analysis*, there are three main types of wikis at El Niño. In a general manner, the information is separated into General El

Niño wikis, Squad wikis, and Project wikis. Although, a basic structure, regarding how the Wiki pages should look, is still missing. Therefore, a basic structure should be created, as it would improve the organization of information.

We suggest two main changes based on finding *FKM4*:

1. The creation of a suggested structure for each type of wiki; and
2. A wiki page explaining the importance of the wiki, that contains the explanation of the new suggested structure, which will be place inside the El Niño's internals wiki.

For the structure of the wikis, we based on the findings *FKM4, FKM5, FKM6,* and *FKM7*, to prepare some questions that employees should answer to improve the way the wikis are used in the company:

1. What are the main topics that should be considered for each of the following wiki levels?
    a. General El Niño wiki
    b. Squads' wikis
    c. Projects' wikis
2. What should the sidebar of the wiki look like?
3. Which pages should contain the technical information and which pages should contain the business-related information?
4. What are the criteria to add or exclude information from the wikis?
5. What are the benefits using wikis in a structured manner?

Wikis change frequently and are modified by different people in the company, so should be constantly checked and updated to maintain their value. For this reason, the wikis must become a responsibility within a company role. Having a wiki owner would improve the quality and, therefore, the usability of the wikis. A study by Arazy et al. (2016) has shown that employees are more motivated to contribute to the wikis if it is seen as part of their role in the business. Besides, during *Interviews*, shown in the quotes in the *Knowledge Management analysis*, contradictions appeared regarding the ownability of the wikis (*QKM7* and *QKM8*), showing the need to have it stablished and documented at El Niño. Therefore, having a wiki owner, who can promote and ask other employees for contributions, would improve the wiki in the aspects mentioned before.

To decide regarding the Wiki "owner" responsibilities finding *FKM3*, *FKM6*, and *FKM8* indicates that the answer to the following questions are necessary:

1. What are the wiki criteria for quality?
2. How often should the wikis be reviewed? Who should be in charge of it?
3. Who will be in charge to promote the wiki and ask people to add more information?
4. How to motivate and influence employees to share their knowledge?
5. Should the Wiki's writing style be fixed? What should it be? How to promote it?
6. Which process should the information sharing follow (ex. Update wiki and notify people in Slack channels)? How should the wiki owner be involved?

At last, wikis are a knowledge management tool that is already being used by the company and allow the finding *FKM5* to be achieved. Though, to enhance the usage of the wikis, different wiki topics are suggested below, based on the findings *FKM7* and *FKM9*. Besides, the topics below would give new employees the knowledge they need to quickly understand company processes and start their jobs without assumptions (Diaz & Puente, 2012), which would reduce negative turnover effects (Ongori, 2007).

The new suggested Wiki topics are:

1. Importance of the Wikis
    a. For El Niño (organization)
    b. For the Squads
    c. For the projects
2. Wiki's structure documentation.
3. Wiki's glossary.
4. How to differentiate small from big projects: How does it impact the way El Niño interact with them?
5. El Niño Code of Conduct.
6. Available company tools and resources: Wiki page explaining the different systems that store information from the company (NAS, Google Drive, Microsoft Word, etc) and how each system should be used.
7. Process flow overview: How issues should be handled at each phase in the company process?
8. Idea formulary: What is it? Why is it important?
9. Data Thinking Canvas: What is it and how to use it?
10. Sprint cycle summary: Data, teams' collaboration, and iterations.
11. Issues comments: Template + team expectations regarding time spent on it and updates.

The topics above are a combination of topics that will give structure to the logic in the wikis and a summary of the new procedures being suggested for El Niño, further explained in the sections below. Besides, a focus group was conducted to validate these ideas, where the participants had access to the suggestions beforehand and used "sticky notes" to state their opinions. The focus group was composed by 5 employees with different roles and from different squads in the company. The result of the focus group is presented in *Appendix D*.

3.1.2. El Niño Code Of Conduct

Following the suggestions of the wiki structure, we see as a valuable addition a Code Of Conduct (COC) for the company, where it can be formally stated the expectations from the management towards the company employees. This artefact could make the company's culture stronger and deep-rooted, as they would be externalizing their way of working, instead of only implicitly expecting it.

One example for which a COC would be valuable is regarding the Request for Comment (RFC) issues. The RFCs are issues in which managers ask for opinions and suggestions, regarding projects or proposals they are working on. For example, one of the interviewees, although working at the company for more than a year, mentioned that did not know what RFC was. This lack of knowledge regarding the basic mode of operation in the company highlights the implicit expectations from employers to employees, who might not be aware of these expectations, therefore not achieving them.

Topics suggested to be approached by the COC of El Niño, contributing to the findings *FKM4, FKM6, FKM8*, and *FKM9*:

1. What is the medium that each “type of communication” should be done? Think of the communication goals and communication impact of each media.
2. Expectations regarding meetings. How general or specific should it be considering the people involved?
3. Expected contribution from employees to wikis, differences between being a wiki “owner” or not.
4. When creating new artefacts for the company and its customers, which tools should be used and how should they be shared?
5. Standardization: Project names and issue creation.

During the focus group (*Appendix D*), participants were also asked regarding the COC suggestion. In this case, only one participant did not see value in it, in their words “I was here for more than 6 months and did not miss having it”. Though, other participants disagreed, stating it would help with transparency in the company.

3.1.3. Gitlab Issue Guidelines

At last, when working together with a team, it is essential to keep the team updated and aware of the work that is being done. On a higher level, that is already being done in the company with the written and spoken stand-ups (daily meetings, common in SCRUM), as well as through the Gitlab issues. On a lower level, each issue should be updated, if adequate. Though, Gitlab issues are assigned and developed by different people, implicating in different modes of dealing with them. The previous situation can confuse and might appear as disorganization. To contribute to findings *FKM1, FKM4, FKM5*, and *FKM6*, it would be an advantage to have guidelines, that can be followed by the team. The guidelines can be created using the suggested topics below and shared by documenting it in a wiki page and making Slack announcements.

1. How to approach an issue? Developers should be motivated to think of the possible impacts of their proposed solutions to an issue.
2. Who can create issues? And how should it be done? What are the criteria?
3. How to give updates on an issue and when to write an “issue summary”?
4. Issue tagging – How to make better use of tags in Gitlab.

5. Could the establishment of issue "goals" help with linking business requirements to issues? Using checkboxes to help the understanding of the issue.
6. RFC – Request for comment issues. What is it? Who can comment on these issues?

Regarding this topic, during the focus group different topics standout for different participants (*Appendix D*). The topics mentioned in the focus group are summarized in the questions above.

3.2. IDEATION ARTEFACTS

This section will present the artefacts created based on the *Literature review* and *Findings*. A system can be considered as a combination of processes; therefore, in the next section, multiple processes will be described as artefacts, in order to create an ideation system. The goal of the ideation artefacts is to allow the company to work on ideas in an agile way; achieving more innovation by generating more synergy between current and future projects.

To improve ideation in a company that uses Agile methodology, different artefacts are suggested, and later presented together in a *Workflow*. Besides, data is an important entity for the different artefacts presented. The reasoning behind the importance of data is in tracking ideas and feedback over time, to keep improving the suggestions. The data sources considered are previous data collected, new data about the project/client itself and El Niño internal data, as these data sources can support open innovation (Chesbrough, 2003). The first artefact to be presented is a canvas which was adapted to be used by El Niño, which allows the interrelation between all the data mentioned before.

3.2.1. Modified Data Thinking Canvas

During the *Literature review* the Data Thinking Canvas created by Kronsbein & Mueller (2019) was presented. The goal in this section is to adapt it to contribute to findings *FKM1* and *FKM2* from KM perspective, and *FI1*, *FI2* and *FI3* from Ideation to create a process for it to be used within the company activities.

The Data Thinking Canvas have the goal of helping the ideation and bringing together customer characteristics and goals together with the data aspects. The canvas can be easily completed by the team by using different links, which are Google forms that have the questions for each phase of the Canvas, which are presented and further explained in *Appendix E*.

When the Google forms are filled and submitted, the data is saved in a Google Sheets, which feeds the dashboard presented in the next session (*3.2.3*). The Google form format has a few purposes:

1. Record the input data from every team member (*FI4*), supporting open innovation (Chesbrough, 2003).
2. Facilitate the ideation process (*FI2*).
3. Allow team members to individually fill the canvas, so they can do it on their own time, supporting the Agile methodology (*FI3*).

The process that the teams should follow to fill the canvas, described in *Appendix E*, later will become a wiki page in the internal documents of El Niño. As mentioned in the appendix, the artefact has a few goals:

1. It should consider customer goals in the ideation process of new projects (*FPE2)*;
2. It should allow squad members to share their ideas and get involved with customers (*FI4* and *FPE2*);
3. It should define Key Performance Indicators, so the idea can be tracked along with the customer goals (*FI1*); and,
4. It should provide a visual tool with general information, which can be accessed at any time by the team (*FKM5* and *FI4*).

The DTC (*Figure 21*) would be used in an ideation session, each ideation session will focus on one customer. At the end of the first phase (Explore), the team should have a clear idea of who is the customer and its end-user, as well as the goals of the customer. To get there, each squad member will be oriented to fill in a form with different questions regarding the company for which they are ideating. After having done that, the team should gather together to brainstorm ideas, taking into consideration *FI3*.

After the brainstorming phase, one of these ideas will be chosen based on a quick assessment, explained in the following section (*Idea Scoring*). In the later phases, which are Idea Development and Results Assessment, the team would discuss, having the canvas to direct their discussion topics, though it would only be filled in at a later time (after having the spoken inputs from the team) by the PO, TL and/or Marketing team participants.

During the Idea Development phase, the idea would be further understood by the team and specified. This would bring tangibility to the idea, so it can be implemented in the future. The Results Assessment phase, on the other hand, would establish which are the important metrics to follow, to check whether the idea was indeed valuable for the customer and El Niño.

To get to the final version of the Data Thinking Canvas, an evaluation was done through a pivot session with the Operations Lead (who is also a PO for Codebusters squad), Engineering Manager (who is also a Tech Lead for Snooze squad) and the Marketing Specialist of the company. The pivot session was done by asking the participants to effectively use the canvas (*Figure 18*) for one of El Niño's customers, which all of them already had knowledge and experience with. Though, due to the number of questions that participants had, as well as the time required to use the tool, the evaluation session took longer than stipulated and had to be continued on a different day. This evaluation demonstrated that, although participants had positive feedback regarding the artefact, it was not ready to be put into use yet.

In the following Data Thinking Canvas evaluation session, more feedback was collected regarding the artefact (*Figure 18*), after having asked them to revise the last phases (which were called Ideation and Evaluation). During the second artefact evaluation session, it was also noticed that the "Idea evaluation" being done by the end of the "Evaluate" phase should be moved to the

beginning of the “Ideate” phase. The reason is that the Canvas requires great effort and time from team members, which, in a digital agency, is more valuable to be spent with current projects. That change was done, so ideas would be scored, and one would be selected to go through the next phases (Ideate and Evaluate) thoroughly, depending on that score.

Pegden et al. (1990) have previously defined “Validation is the process of determining that we have built the right model, whereas verification is designed to see if we have built the model right”. Although the Data Thinking canvas had the mentioned changes (related to its verification), which transformed it into *Figure 21*, the evaluation session still highlighted the artefact’s validity. Positive feedback was given relating to the artefacts goal, especially related to helping squad members to be more involved with the customer. It was mentioned by one of the participants during the pivot session: “(By filling the first page of the canvas) everybody is in the mindset before you start a session like this (brainstorm), everybody already thought about and could sympathize with the users”[6].

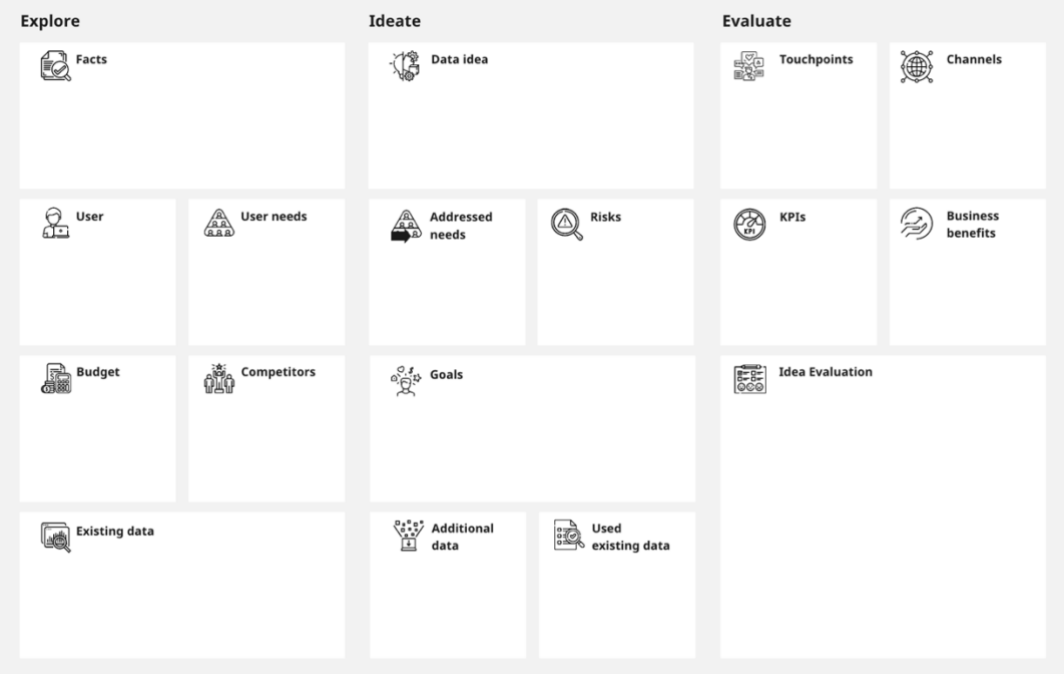

Figure 18: Data Thinking Canvas structure before artefact validation

To build the final version shown in *Figure 21*, first, some perspectives were added to the canvas, such as business customer goals, budget, competitors, idea goals and business benefits (perspectives are the squares vertical to each phase of the canvas).

Then, during the second iteration, some perspectives were changed to a different section. Besides, some section names were also changed to properly match the perspectives in each section. The “Ideation” section became “Idea development”, while “Evaluation” became “Result assessment”.

[6] The evaluation transcript of the tool by the team can be requested by email to the researcher.

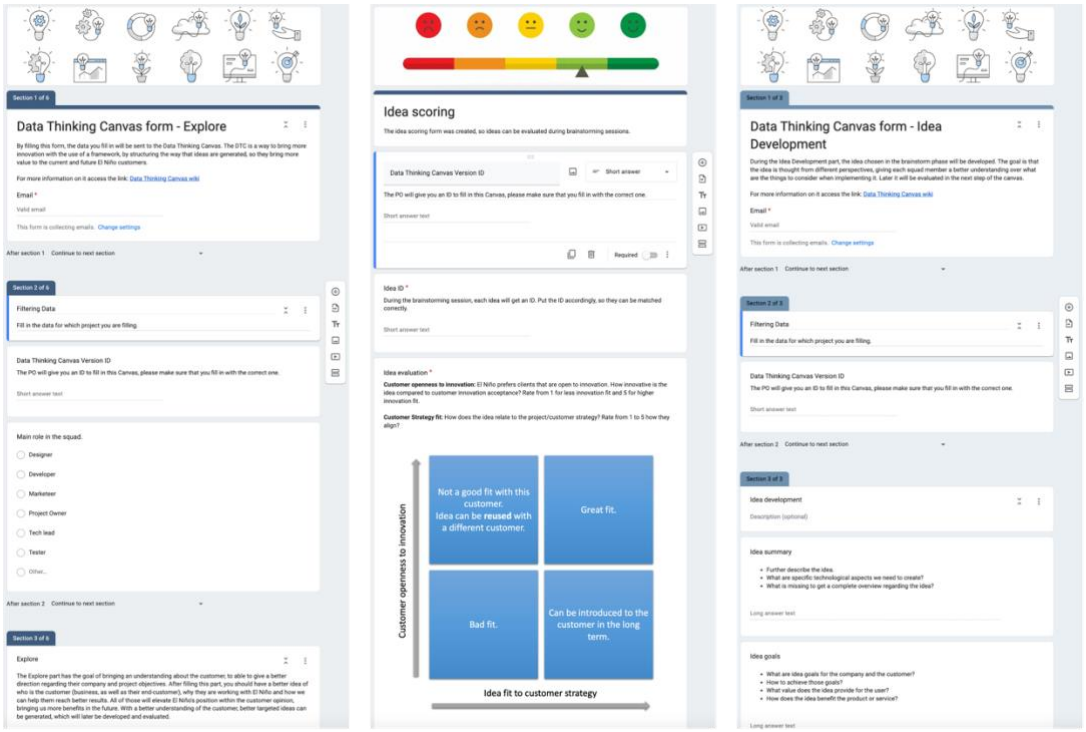

Figure 19: Data Thinking Canvas Explore to Idea Development

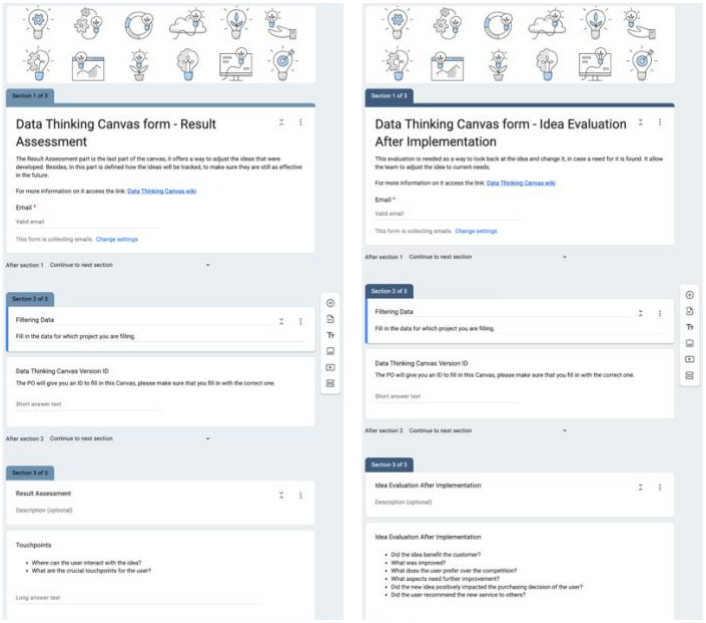

Figure 20: Result Assessment and Idea Evaluation After Implementation

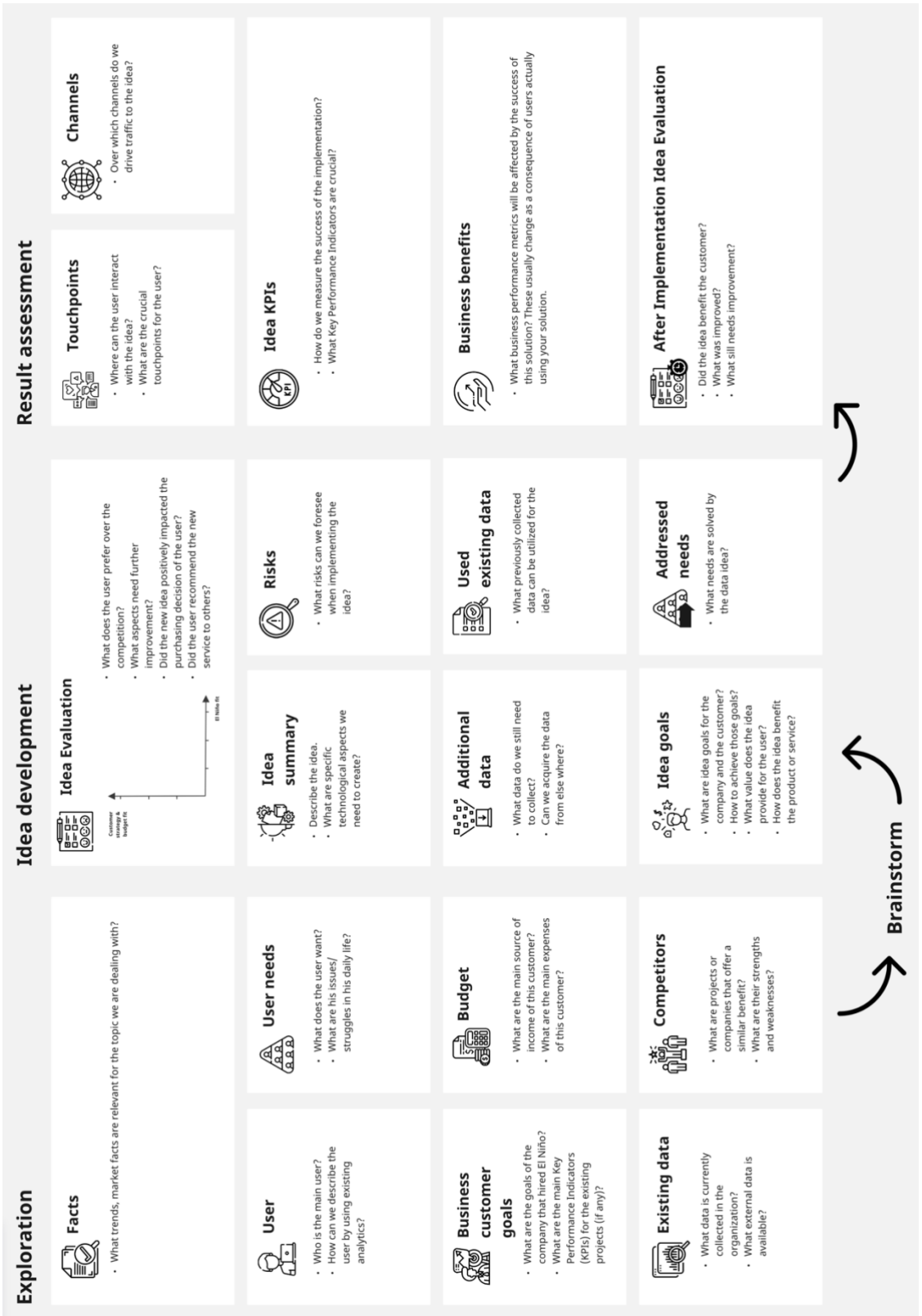

Figure 21: Data Thinking Canvas Main Phases

These changes are considered relevant and essential for the tool to deliver the most value to El Niño. When implemented, the tool is expected to output new ideas that are ready to be offered to the squad's clients. If works as expected, the tool would facilitate and speed up the process in

which ideas are put into production, also giving more structure to later evaluate those ideas and reach better results in the long term.

3.2.2. Idea Scoring

During the focus group done for the Data Thinking Canvas (DTC) evaluation, we received the feedback that before choosing an idea to go further in the process, the team would like to evaluate the ideas, which also aligns with finding *FI4*. The proposed solution is an idea scoring system, and it will be used during the ideation session, before the "Idea Development" and "Results Assessment" phases.

Full details and an explanation of how the Idea Scoring System works is presented in *Appendix E*, though it can be simply explained by the steps below:

1. Ideas are gathered after the Exploration phase of the DTC.
2. Ideas are presented during the brainstorming session, using a word cloud with the name of the ideas, which is in one of the pages of the DTC dashboard.
3. Each idea gets an ID, using this ID people score the idea per **"Customer openness to innovation"** and **"Idea fit to customer strategy" (***Figure 22*).
4. The ideas with a high score will be reviewed by PO, which will have the final say as to which idea will be chosen to go further in the process.

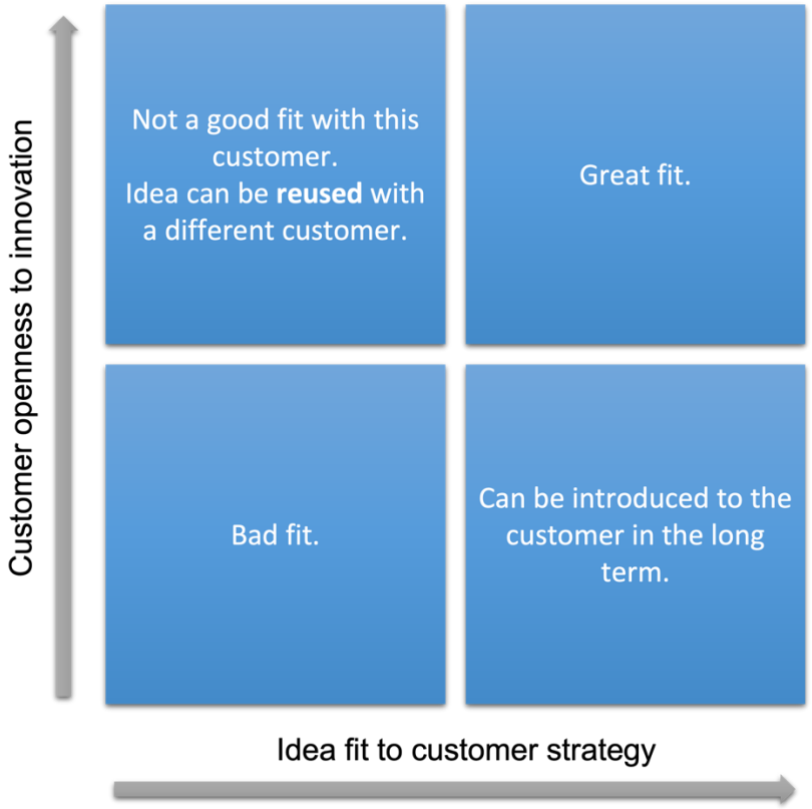

Figure 22: Scoring matrix

The scoring matrix was created to allow more transparent decision criteria for the ideas that appear during the brainstorming. Moreover, it allows more discussion, which can result in increments to the ideas that already exist, making the final output a team effort.

As a conclusion, the scoring will be based on two perspectives: customer openness to innovation and idea fit to customer strategy. The idea that achieves the higher score (from the combination of both perspectives) will be selected to go further in the ideation process, having the PO as the "final judge" in case of similar scores.

3.2.3. Ideation Dashboard

The *Ideation Dashboard* will be the result of the ideation session, it allows the team to have an overview of the discussion they had and will be used as a summary for people that did not join the session, but would like to learn more about the idea, which contributes to findings *FI1, FI2*, and *FKM5*. The dashboard can be filtered by Data Thinking Canvas version ID, customer name, date (that the input was created), squad name and idea ID.

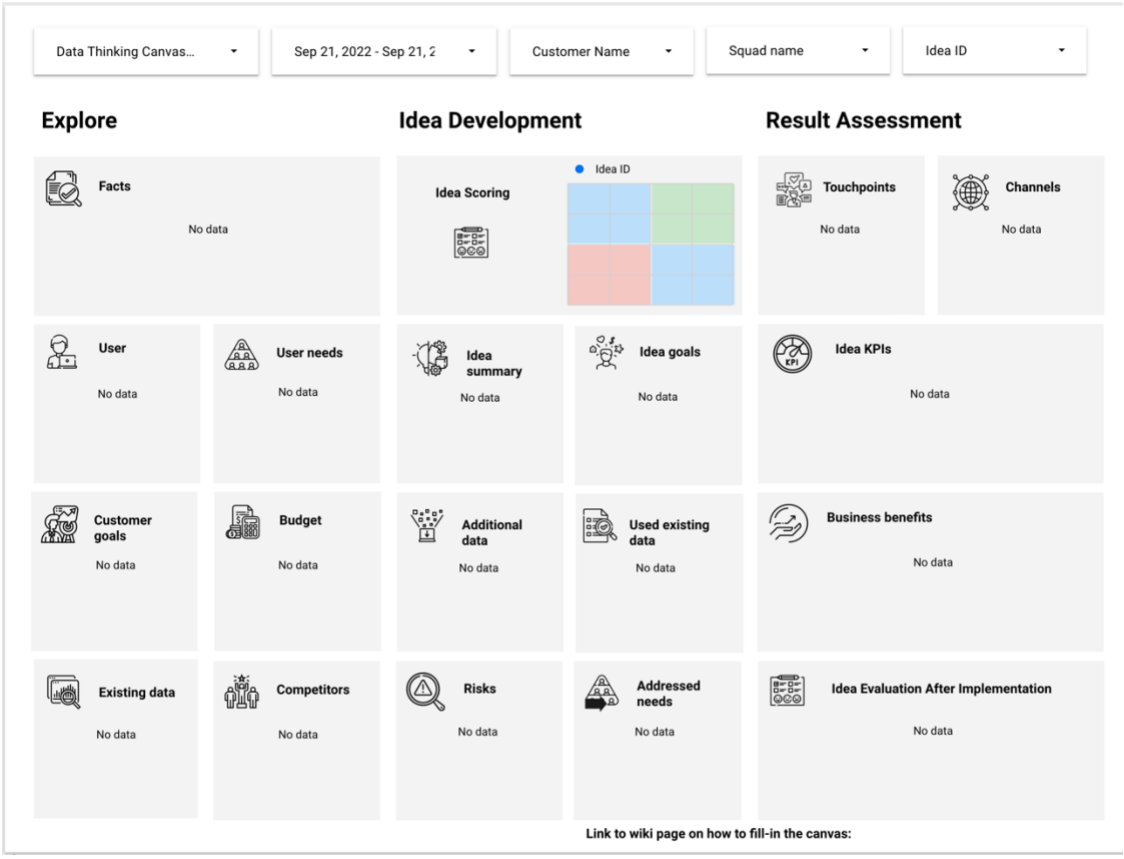

Figure 23: Ideation Dashboard

When implemented, an image (screenshot) can be created of it and placed in the project's wiki. This facilitates the communication regarding the idea but also gives a complete summary for the new people joining the project.

3.2.4. Idea form

The "Idea form" was created based on the finding that developers might not have a lot of time to discuss ideas with the POs during the milestones (*FI4*). With a Google form dedicated to idea collection (*Figure 36*), they can be saved to be discussed at a later time, especially during the

brainstorming session done for each client, facilitating finding *FI4*. The link to access the artefact can be found in *Appendix E*.

During the *Interviews* (presented in the *Ideation analysis*), one person mentioned they do not feel comfortable sharing ideas, due to being an introvert, and another participant mentioned they did not want to interrupt someone else's work to share their ideas. The situation presented, resulted in the introduction of this artefact. Though, when the idea form was used in the pivot session by other participants, they mentioned that it was not very relevant for the company. Since they were not aware of the situations mentioned, if the tool would be implemented, its usability and goals should be clear from the beginning.

3.3. PROJECT EVALUATION ARTEFACTS

Project evaluation, as previously discussed, is divided into two topics: internal evaluation (focusing on the squads) and external evaluation (focusing on the customers). While the internal evaluation gives us feedback regarding the day-to-day activities and products that are developed, the external evaluation gives feedback from a customer point of view.

3.3.1. Sprint Review Survey and Dashboard

The "*Sprint Review Dashboard*" was built to gather internal data, mainly feedback from the people working on the issues for each milestone, contributing to finding *FPE1*. It was designed to fit an internal process that already existed at El Niño, which is the weekly meeting. Each squad usually has a meeting called "Weekly", in which they review their past week and prepare for the next. Before the introduction of the *Sprint Review Dashboard*, participants of the meeting would talk about their week using different methods and none of it would be tracked over time. This changed with the introduction of the tool. The process after the introduction of the tool followed the steps below:

1. Before the meeting, squad participants answer some questions (found in *Appendix F*) regarding the meeting using a Google form (*Figure 24*).
2. Participants are also asked to rate the sprint; this allows comparisons over time. When the score happens to be very different than expected or different from past weeks, it is possible to get the reasoning behind it through the answers to the other qualitative questions.
3. The answers from the Google form are displayed as shown in *Figure 25*, which everyone has access to, therefore during the meeting the person leading it can go over the answers and motivate a discussion.

For the validation of the tool, a pilot testing session was done. The participants mentioned that the tool is helpful, as they can fill it in before the meeting. This allows them to have time to reflect and put some thought into what they are filling in, which shows that the artefact corresponds with *FKM1*. Though, they also mentioned that they do not usually look at the past data, which shows

that although it contributes to finding *FKM5*, they might need more motivation to effectively use the past data.

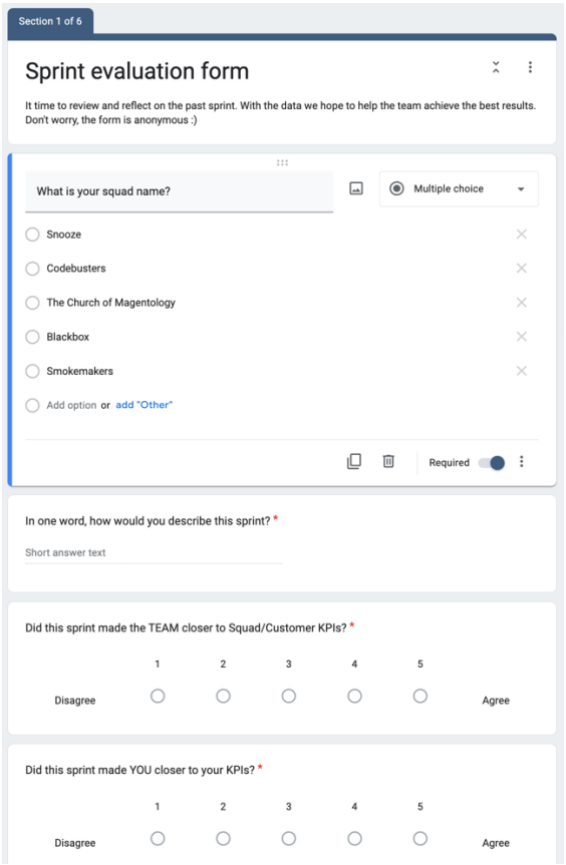

Figure 24: Sprint Evaluation Survey

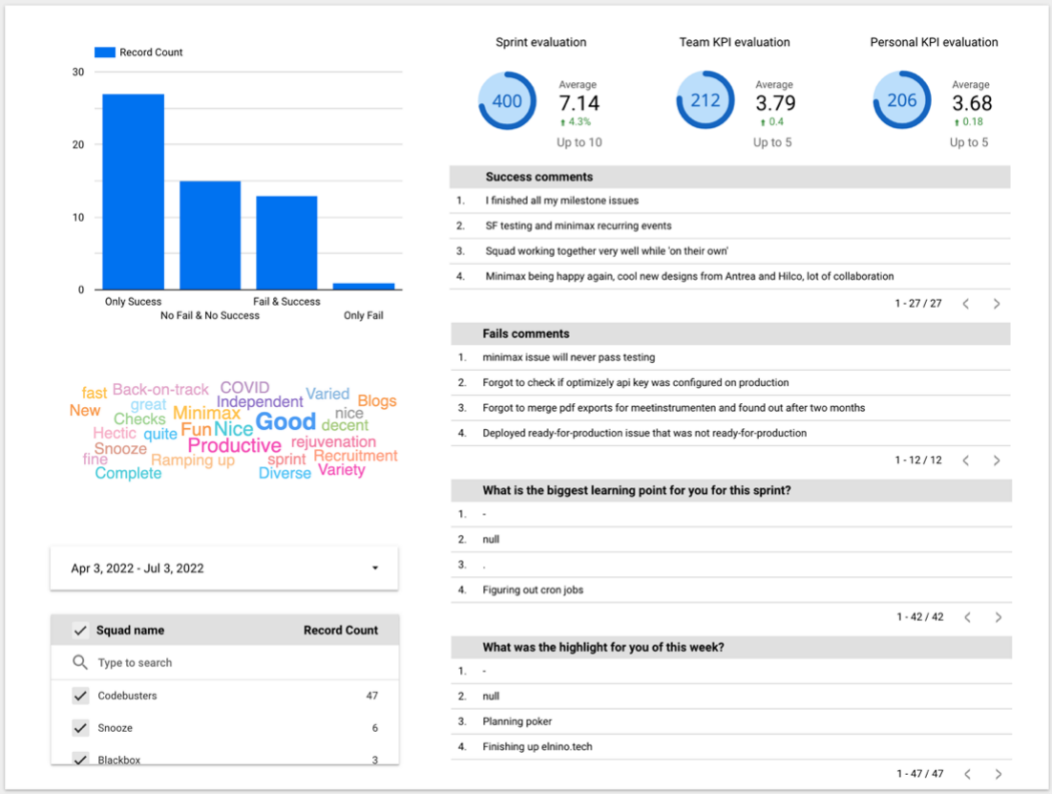

Figure 25: Sprint Review Dashboard

Participants of the evaluation session also mentioned that one sprint can be different from the next, working on completely different projects for different customers. For this reason, they do not currently see a relation between the sprints feedback and future projects.

3.3.2. Customer Satisfaction Survey

The *Customer Evaluation Survey* (*Figure 26*) is a way of collecting external feedback, especially from customers. On a day-to-day basis, POs mentioned not having enough formal feedback from customers, although it can be a valuable source of information for the company and contribute to findings *FKM5* and *FPE2*.

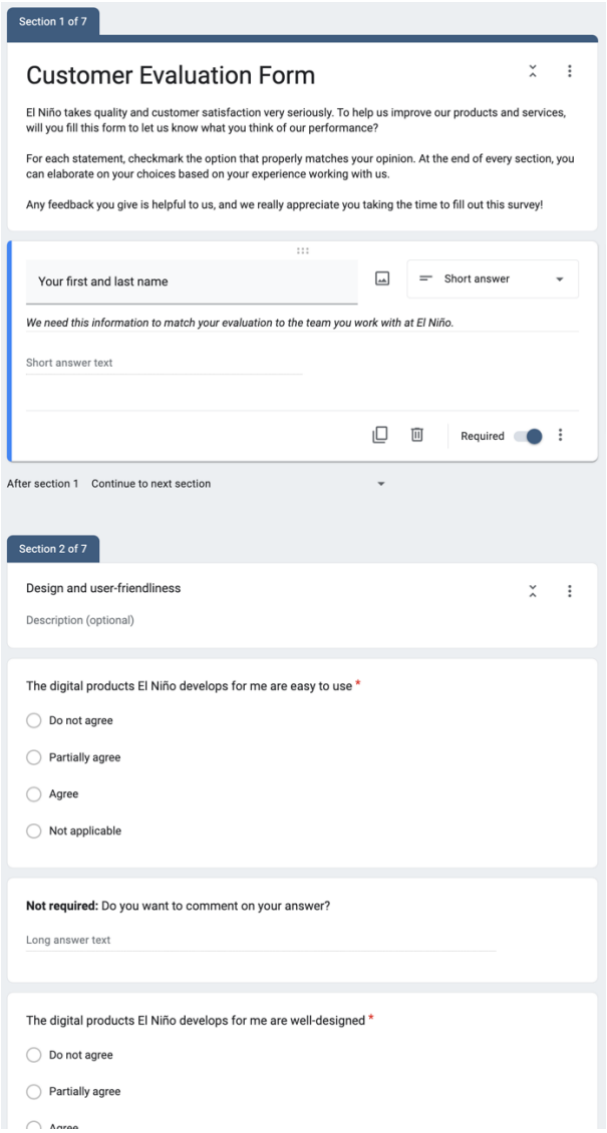

Figure 26: Customer Evaluation Survey

The article from Nylen & Holmstrom (2015) brings a framework developed to improve the digital innovation strategy of businesses. For this reason, the framework will be customized for El Niño to best fit the process flow, as well as “optimize digital innovation efforts”. The first version of the tool took into consideration the perspectives that are important for El Niño, as well as the concepts

introduced by Nylen & Holmstrom (2015). The User Experience and Value Proposition questions were adapted to collect customer feedback.

After creating the first version of the survey, it was evaluated by the Operations Lead (who also act as a PO at El Niño) and the Marketing Specialist of El Niño. Both had suggestions for the survey, which were mainly regarding the composition of the questions. Besides, the satisfaction form and its questions were verified by one of the customers, the main feedback received was regarding the addition of one open question after each of the closed ones, so more feedback could be given towards each of the perspectives being raised.

Further in the implementation of the tool, the Product Owners should be responsible for collecting the answers and arranging a discussion meeting with the rest of the squad. At the end of that meeting, the squad is expected to have action points for the perspectives that the company did not perform well.

The last version, which contains all suggested adaptations, of the Customer Evaluation Survey can be found in *Appendix F*.

4. WORKFLOW COMPONENTS

In this section, it will be presented how the artefacts previously presented can be incorporated in the general process workflow of El Niño. Based on El Niño's current processes and *Organizational chart*, a workflow was developed on how to include all the artefacts in an organised manner and following Agile principles, so that they can add the most value.

The workflow is represented by a diagram that was developed following the Business Process Model and Notation (BPMN) standard, presented in the *Figure 27*. It is separated into lanes, and each lane refers to a different role in the company. The grey “tasks” require input and actions from multiple roles.

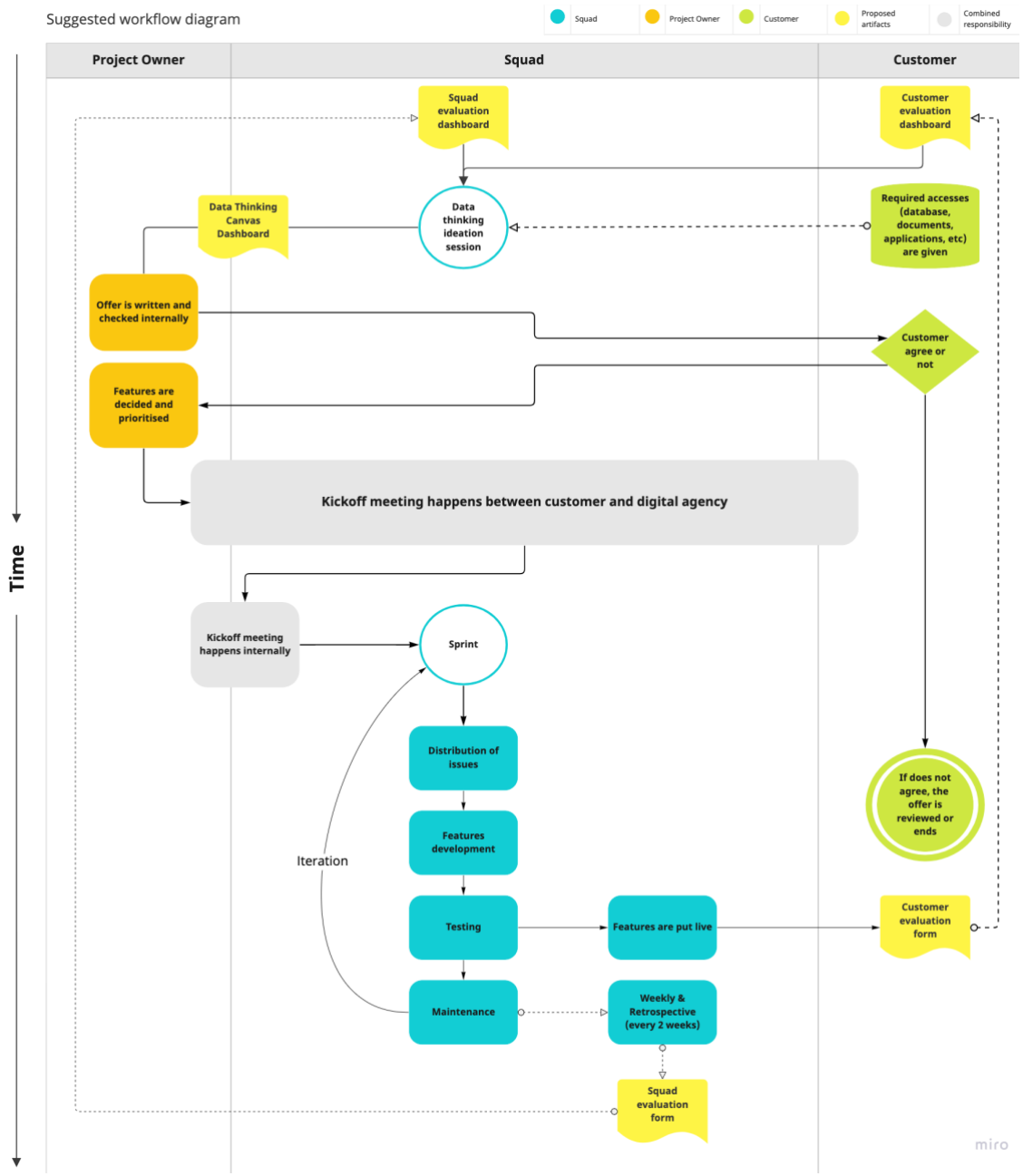

Figure 27: Diagram of the process

This workflow describes the processes that a new project should go through. Expectation is that when workflow will be implemented, projects will become more innovative and achieve a higher customer satisfaction. Product Owners are going to carry the main responsibility for defining deadlines according to project goals.

5. DISCUSSION

Due to the broadness of the research, some artefacts did not receive as much attention as they deserved. It would be possible to fragment the research into different parts, but this approach would lead to a loss of the systemic Knowledge Management point of view, which is a major contribution of this study. The mentioned contribution is presented in the *Workflow*, where all the artefacts are combined into one system, allowing a loop of information where the output of the last artefact can be used as input for the next iteration. To allow this iteration fluidity, data is used, which can later be analysed for further insights and improvements in the company processes.

Further research could be conducted for each of the main topics. To further validate the current artefacts more socio-technical and empirical testing is needed. The artefacts were based upon the results of systematic literature research and qualitative analysis. We expect that using these artefacts El Niño would be able to transform employees' tacit knowledge into explicit knowledge (Nonaka, 1994). Cross-section research would be needed to verify how the artefacts impact the company, while longitudinal research would be needed to analyse the artefacts adoption during time.

The case study introduced an original research perspective unifying knowledge management, ideation, and project evaluation in the context of digital agencies. Though, the artefacts were designed for a single company resulting in a more specific approach, the research could be improved by adding more companies to the sample, to avoid bias in the results. For El Niño this specificness has a positive effect, though the application of the created artifacts to different companies might not be as simple, requiring more adaptations. It would be beneficial to make the research more general, by considering more companies in the sample.

At last, data was collected depending on the availability of the interviewees. This resulted in one squad being more active in the research than others. Thus, part of the input could have been more specific to this squad rather than the company as a whole, although all the squads follow a similar process. For the design of artifacts with a broader applicability, random selection could be used in future research.

6. CONCLUSION

The goal of this research was to develop an approach for knowledge management (KM) system for El Niño, a digital agency with high turnover rate, using Agile methodology. Artefacts were developed to facilitate knowledge management throughout the project development process, including data-driven ideation and project evaluation (both from internal and external perspectives). Together they make up a knowledge management workflow. The results of the *Exploratory Research* suggests that the proposed knowledge management system might improve the current KM situation in the company which was analysed during this study. The system principles could also be replicated for other digital agencies with further validations. To design the

artefacts, a systemic *Exploratory Research* was conducted. The *Findings* chapter is the result of the conjunction of the *Interviews*'s results with the *Literature review* and *Archival Analysis*, and those findings were used in the design of the artefacts, which answers the research questions below.

The sub-research questions below explore more specific topics and guided the creation of the artifacts. The combination of the designed artefacts answers the main research question.

- Sub-RQ 1: Which Knowledge Management practices can support the creation of a Knowledge Management system for El Niño?

Considering the KM tools that were already being used by El Niño, we suggested an adaptation of them, such as the introduction of *Wiki templates* and topics and the *Gitlab Issue Guidelines*. Another artefact that was designed and suggested in the study, was the creation of a *El Niño Code* Of Conduct for El Niño.

To create a KM system, KM principles had a relevant part, especially for the design of the artefacts. It was essential to understand the state-of-the-art literature relate to the topic. Besides, inputs collected during the qualitative *Interviews* and *Archival Analysis* were key to reach the research goals. These research procedures resulted in the *Findings*, which were vital for the design of the most appropriate Knowledge Management artefacts, which gave structure to the created system.

- Sub-RQ 2: How to operationalize the use of a collaborative data-driven ideation tool for El Niño, considering KM practices and customer goals?

The ideation stage is formed by the combination of various tools (artefacts) that facilitates the creation of effective ideas. From the *Literature review* and *Interviews* we derived the principles that were used to construct these ideation artefacts. They collect data from each ideation session in one place, which is expected to facilitate knowledge sharing.

The introduction of an ideation phase at El Niño, aims to promote focused and evidence-based innovations inside the company. The *Modified Data Thinking Canvas* (DTC) is the main tool created for the ideation phase. It considers customer goals, as well as other customer characteristics to guide the ideation sessions. By the end of the DTC process, the output ideas would be well-grounded to be presented to the customer, which we expect would improve customer satisfaction, as well as support the generation of more revenue to the digital agency. Moreover, KM principles were also considered for the adaptation of the ideation artefacts, which we expect to support knowledge sharing in the company.

- Sub-RQ 3: How to iteratively collect and present internal feedback data to allow knowledge sharing?

To answer this question, we also considered the results from the systemic literature and qualitative research, which were presented in *Literature review* and *Interviews*. They resulted in

the *Findings*, which also guided the construction of the Project evaluation Artefacts. We expect that teams would be able to share knowledge between employees using the *Sprint Review Survey and Dashboard*, as it collects and present internal feedback, which we hope to improve the quality of the work being done in-between Scrum sprints.

The artefact was built in a way that it could be integrated to their current process, such as the "Weekly" meetings. With the addition of Quantitative questions, the managers from El Niño can quickly see the overall satisfaction of the employees. Moreover, there also open questions, which we hope that employees would use to share and give further explanations, as well as motivate discussions during the "Weekly" meetings. The data is presented in a dashboard that can be easily accessed by anyone in the squad, allowing further reflection.

Initial feedback collected regarding the artefact indicates that it would have a positive effect in the company. Though, as it will be further discussed, the actual implementation and acceptance of the artefact within the company would need to be researched.

- Sub-RQ 4: How to collect external feedback to support the alignment between digital product development and customer expectations?

Using a similar research approach as mentioned in the previous answers, the artefact to collect customer feedback was created. The *Customer Satisfaction Survey*, is expected to guide the efforts of the squads, as well as emphasise their strong points, creating a better alignment between the delivered products and customer expectations. It was mentioned during the *Interviews* that feedback is a motivator in the product development process, which also improves delivered quality (Mohagheghi & Aparicio, 2017). The survey is an adaptation of the questions introduced by Nylen & Holmstrom (2015), in which Google forms tool was used to collect the responses.

The main research question is answered below, it is the result of the combination of the sub-questions answered previously:

- *What are the key components of a Knowledge Management system for El Niño B.V., an Agile medium-sized digital agency with a high turn-over rate, to avoid knowledge loss throughout the digital product development cycle?*

Each of the mentioned artefacts plays a unique part in the workflow, the processes were designed to incorporate the topics of Knowledge Management (KM), Ideation and Project Evaluation. The artefacts created were the *Wiki templates and topics, El Niño Code Of Conduct, Gitlab Issue Guidelines, Modified Data Thinking Canvas, Idea Scoring, Ideation Dashboard, Idea form, Sprint Review Survey and Dashboard, and Customer Satisfaction Survey.*

The KM findings and artefacts have a support function in the company and were designed to avoid knowledge loss. Besides, Ideation and Project evaluation phases are expected to bring more opportunities for employees to share their knowledge and opinions with each other. Therefore, the *Findings* indicate that with the integration of the different artefacts a knowledge

management system will be created, which we presume would bring improvements in El Niño's product development process.

To conclude, we reckon that having the knowledge sharing practices integrated with the company's processes would reduce the amount of knowledge that leaves the company when an employee decides to stop working there. The initial feedback collected regarding the artefacts show that the suggested workflow has the potential to achieve the desired goals of El Niño, though further research is needed to validate it, as it will be discussed in the following section.

6.1. PRACTICAL RECOMMENDATIONS FOR EL NIÑO

El Niño can benefit from the present research. A knowledge management system could bring many benefits to their employees, improving work quality. Besides, it could be implemented in small steps, so it can be incorporated by everyone working in the company. Considering the *Sprint Review Survey and Dashboard* and *Customer Satisfaction Survey* were already implemented by the company during the study. Its continuation could happen by, for example, the implementation of the *Idea form*, introducing the ideation perspective. And followed the implementation of the *Modified Data Thinking Canvas* to one customer, consequently one squad.

The *Findings* brought many perspectives that are valuable to El Niño, so having them reviewed by the management of the company, could spark positive change. Besides, KM perspective should also receive attention, considering its importance, to decide what should be the guidelines and how to put them in practice.

At last, the Wikis presented in *Appendix E* and *Appendix F*, contain the main explanations regarding how the tools for Ideation and Evaluation should be used in the company, so the most value can be extracted from them.

6.2. FUTURE RESEARCH

For future research, each of the topics studied throughout the research could be further developed. Knowledge Management, for example, could be quantified; using metrics, such as the number of wiki updates, number of wiki accesses, etc., that can give hints of whether the wikis need more attention. For ideation and evaluation processes, the Data Thinking Canvas process and the Sprint review process can be further adapted; especially regarding the data flow, as the data is currently being collected using Google products (Google forms, Google Sheets and Google Data Studio), which present boundaries to the capabilities.

Validation is the process that determines if the most appropriate artefacts were build, while verification is the process that determines if they were built correctly (Pegden et al., 1990). The artefacts could benefit of going through a verification process. For this verification, the artefacts would need to be implemented in the company, which could originate some challenges. The main challenge is to find suitable companies to verify these artefacts, though one way to avoid it would be to further adapt the artefacts.

A simple validation was done for the *Sprint Review Survey and Dashboard*, for example, through a pilot testing. The employees mentioned that the tool is helpful, but it is difficult to see the relation between the sprints feedback and future projects. Though, the users must be aware of this type of relations to be more motivated in the job. Therefore, the pivot test appoint that the artefact is in the right track to bring a positive effect into the company, though, it could be further verified to ensure greater effectiveness.

Besides, the effects of the implementation of the artefacts could be researched. In the case of the *Customer Satisfaction Survey*, for example, about 3 weeks after the survey was implemented and sent to the customers, its effects started to appear in the company. In one situation, for example, a customer complained regarding the quality of some issues that were finalized. After analyzing the issues (related to the problem) and the processes in place at the company, it was found that some issues were skipping the “Testing” team, which is an essential process to maintain the product quality of the products.

The situation mentioned above has already attested to the importance of the Customer Evaluation Survey. Though, during the validation with the customer, the interviewee mentioned that "*it is important thinking about communication, transparency and improvements*”. The quote attest that the customer also feels heard when the company acts on a problem mentioned by them. Acting on the feedback mentioned in the survey would improve stakeholder relationship, demonstrating that it would be valuable for the research to receive more focus on this topic.

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APPENDIX A

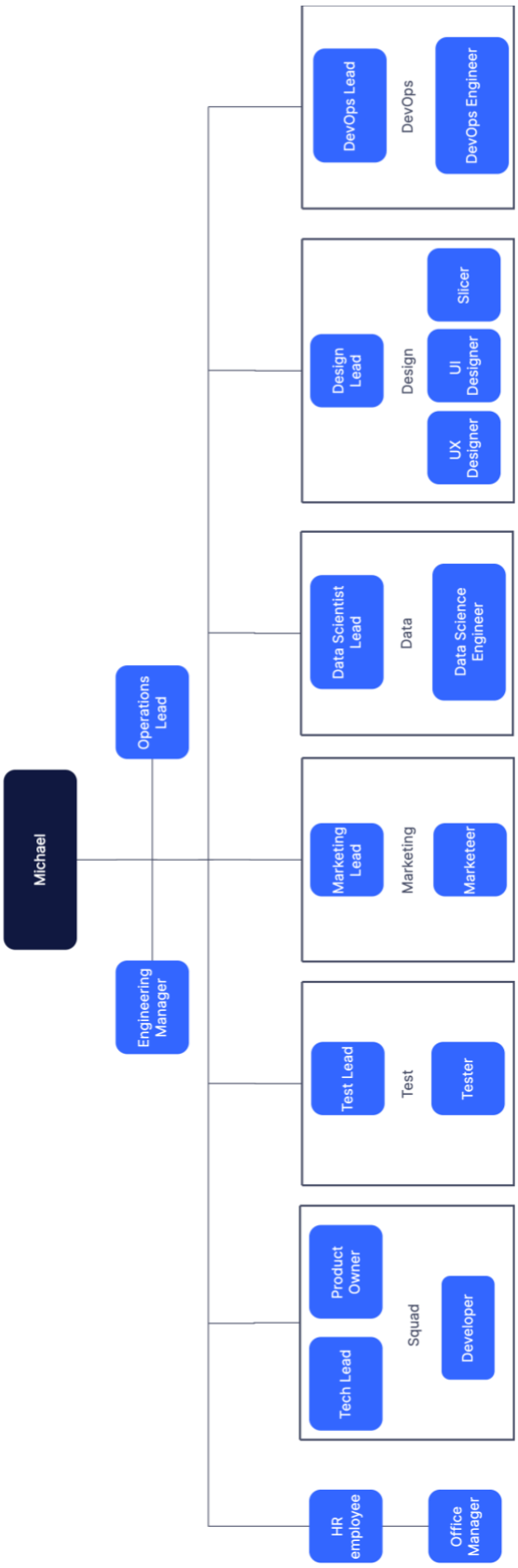

Figure 28: Organizational chart
Source: Company internal documents (July 2022).

APPENDIX B

Based on the exploratory research and the *Problem identification*, Literature Research Questions (LRQ) were determined to guide the *Literature review*. The questions are presented below:

- **LRQ 1 Knowledge Management:** How does Knowledge Management practices impact companies that use Agile Methodologies?
- **LRQ 2 Ideation:** Which tools make use of data to support innovation through ideation?
- **Project evaluation:**
    - **LRQ 3 Process evaluation:** How does the feedback gathering impact projects in teams that uses Agile Methodologies?
    - **LRQ 4 Customer evaluation:** What are the evaluation methods available, which are used to gather external feedback in digital agencies?

Theoretical framework

The research was based on the grounded theory, a systematic literature review method, by Wolfswinkel et al. (2013), which received inputs from Webster & Watson (2002). Later, snowballing technique was also used to complement this literature review (Wohlin, 2014). Using the methods above, we were able to produce the literature review based on the steps and procedures described below.

First, we chose the research queries for each one of the topics and looked for the related papers in the Web of Science (WoS) database, which offers a scientific citation indexing service and gives access to multiple databases that reference cross-disciplinary research (Elsevier, n.d.).

The data collection was done in March/2022. Different filters available in WoS were used to refine the research, the ones chosen are described below:

- Keywords by field: All fields, Title, or Topic
- WoS Categories: Computer Science/Information Systems or Business/Management/Economy
- Language: English or Portuguese

That process was applied to all the queries. Below (*Table 5*) is shown the table with the research queries and count of the results.

Table 5: Research queries

Main topic	Query for "All fields"	Query for "Title"	Query for "Topic*"	Count of results
Knowledge management			("product" OR "project* develop*" OR "process*" OR "team*") AND ("digital" OR	175

			"softwar*" OR "agil*" OR "web develop*" OR "scrum") AND ("knowledge* management*") AND ("cultur*" OR "process* implement*")	
Ideation	("project*" or "product develop*" OR "agile") AND ("tool*" OR "framework*")	("idea*" OR "creat*" OR "brainstorm*") AND ("data*" OR "evidence*")		80
Process evaluation			("project*" OR "process") AND ("ongoing" OR "on going" OR "on-going" OR "iterativ*") AND ("agil*" OR "scrum") AND ("team*" OR "personal" OR "self*" OR "squad*" OR "member*") AND ("evaluat*" OR "assess*" OR "measur*" OR "fact*")	70
Customer evaluation	("digital" OR "softwar*" OR "web develop*") AND ("agil*" OR "scrum")	("product") AND ("evaluat*" OR "assess*" OR "measur*" OR "fact*" OR "effect*" OR "indicat*" OR "analy*" OR "invest*" OR "quality")		40
Total				365

**Topic searches for title, abstract, author keywords, and Keywords Plus.* Developed by the author.

After analysing the result of the queries and reading each Title and Abstract, the papers were filtered further and that resulted in the “Count of selected papers” from the table above (*Table 5*). In total 365 Titles and Abstracts were analysed, and 130 papers were analysed thoroughly. After assessing the 130 papers, 46 of those were selected. At last, other papers were found in the references of the selected papers (using the snowballing technique). After using the snowballing technique (Wohlin, 2014), 21 articles were added, resulting in 67 articles, that have been used for the literature review. Below is the diagram that explains the division between each topic.

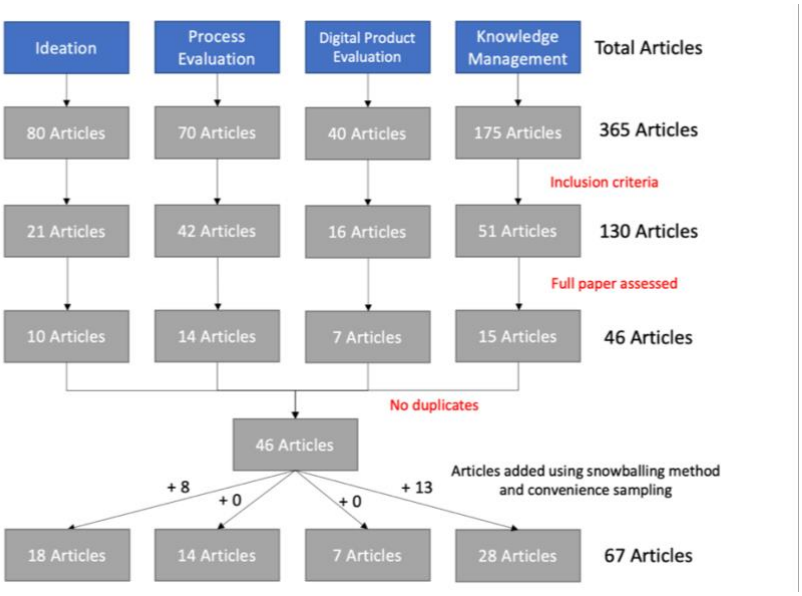

Figure 29: Literature review diagram

The 67 articles served as a state-of-the-art theoretical reference to the further research that was developed, which is presented in the *Exploratory Research* chapter.

APPENDIX C

Design Science research

This study uses the Design Science Research methodology from Peffers et al. (2007), to create the IS artefact, which is the goal of this research. Their work is well-known and accepted for IS design research.

The model below is presented in their research and shows all the phases which will be followed, to get to the final result.

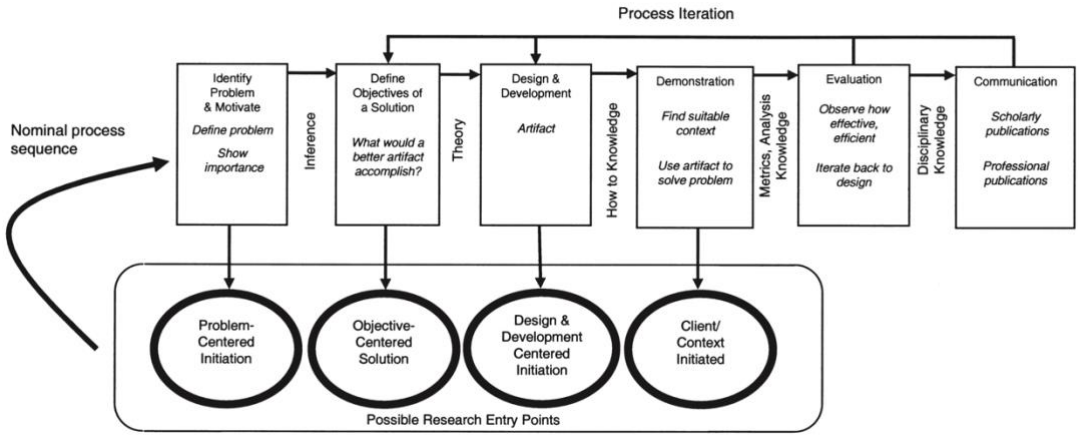

Figure 30: Design Science Research model

Developed by Peffers et al. (2007)

Before starting this research, I had a different experience at El Niño as an intern, where I created a management data dashboard-related project. Besides, during the research, I am also part-time working as a Marketing Analyst, which gave me a previous background to the problem and helped me delineate the boundaries of the present research. In this case, bias is present, though this also allows me to achieve a contextualized and more detailed picture of the problem.

As some of the problem's identification and motivation have been already presented, the following chapters bring more context and details regarding the problem. This will be achieved with the interpretation of the results of qualitative research. To do that, semi-structured interviews with the current employees of El Niño will be done. Moreover, interview questions were formulated based on the research questions presented in the literature review.

This type of interview was chosen, as other questions might arise from the answer of the interviewees. Besides, the investigation can also lead to the "constructing knowledge" effect (Myers & Newman, 2007), as people's answers might trigger changes in the company. This happens because interviewees may not have considered or rationalized matters before it was raised in the interview. The effect can, therefore, cause bias.

APPENDIX D

Figure 31: Focus group outcome

APPENDIX E

DATA THINKING FORM

The Data Thinking Canvas (DTC) has different formularies as sources, each for each phase of the Canvas.

- The Explore form covers the first phase of the DTC (*Figure 32*)
- The Idea Development form covers the second phase of the DTC (*Figure 33*)
- The Result Assessment form covers the third phase of the DTC (*Figure 34*)
- At last, the Idea Evaluation After Implementation form is related to the last question from the Result Assessment part in the DTC (*Figure 35*)

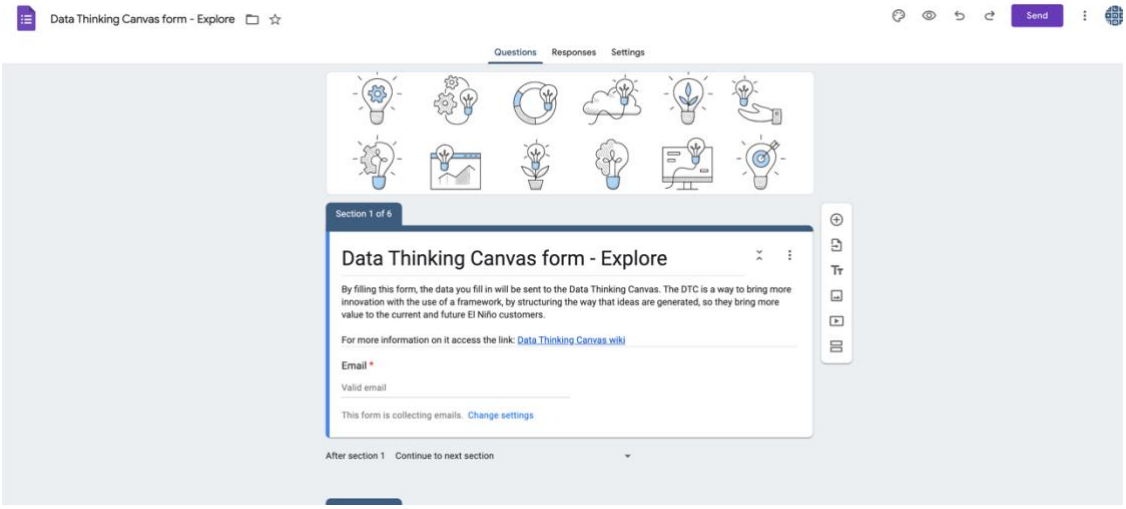

Figure 32: Explore phase form

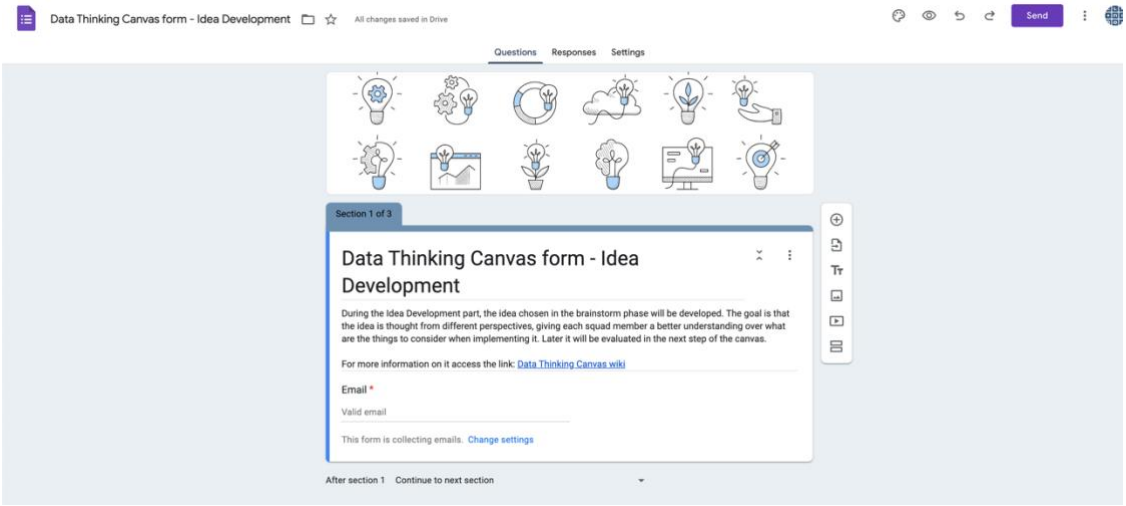

Figure 33: Idea Development phase form

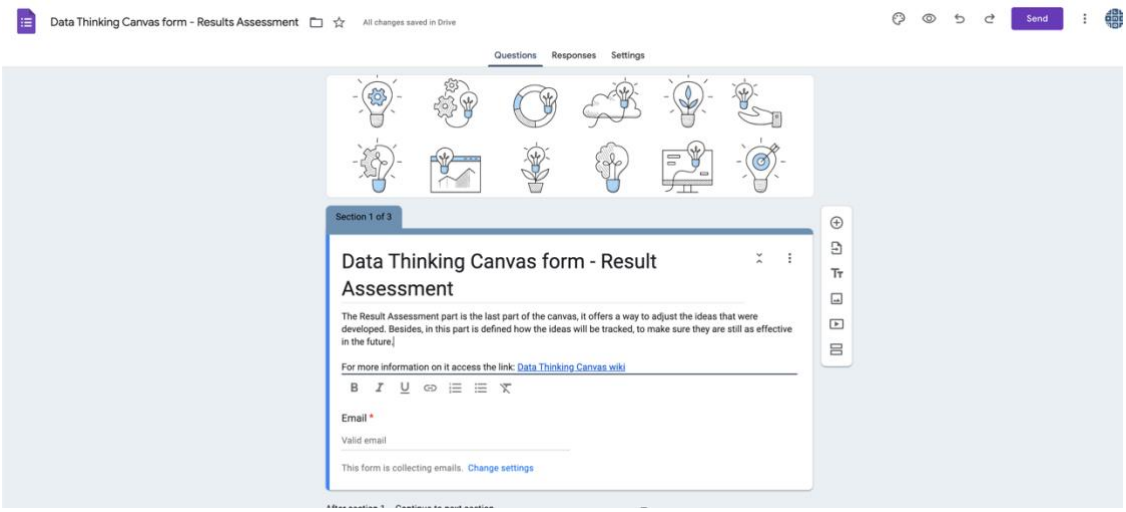

Figure 34: Result Assessment phase form

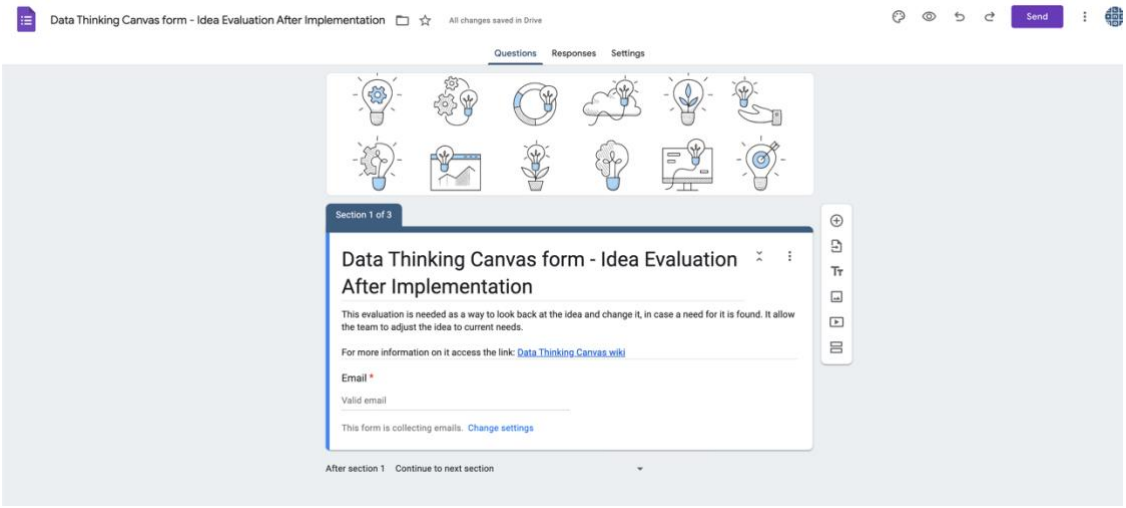

Figure 35: Idea Evaluation After Implementation form

DATA THINKING CANVAS WIKI

DTC Goals

The Data Thinking Canvas is a tool to facilitate ideation at El Niño. It was developed to reach four main goals:

1. Consider customer goals in the ideation process of new projects.
2. Allow squad members to share their ideas and get involved with customers.
3. Define Key Performance Indicators, so the idea can be tracked along with the customer goals.
4. Provide a visual tool with general information, which can be accessed at any time by the team.

How to fill the DTC?

The canvas is divided by different phases, in the process explained below. A new ideation session to fill in the canvas start for each new customer that the ideation is required. The process to fill in the Data Thinking Canvas should follow the steps below:

1. The PO and Tech Lead of the project will **fill in the Explore part** with some basic data regarding the customer and its goals. The PO should also manage the Version ID table document.
2. The Explore questions link and Version ID will be sent through the project Slack to the other people working with the customer, so they can also fill in individually the Explore part, at **the end of the Explore part**, ideas will be asked to be shared.
3. A **brainstorming session should happen** when everyone has filled the canvas. In the brainstorming session, the previous ideas sent should be visible to everybody participating, this can be done using the dashboard page with a Word Cloud chart with the name of the ideas. The ideas should be "challenged" and further discussed, so more ideas can be generated on top of them.
4. At the end of the brainstorming session, the ideas should be evaluated according to **"Customer openness to innovation"** and **"Idea fit to customer strategy".** That evaluation should be done during the brainstorming session by each person in the meeting. The "Idea scoring form" should be used, so one idea can be chosen to follow the next steps of the DTC (Idea building and evaluation, and Results tracking).
5. After ideas were evaluated, a graph with the average points that each idea got should be shown (will be a graph in the Data Thinking Canvas Dashboard) and asked if everyone agrees. If so, the idea in the top right should go to the next phases. If more than one idea is in the top right OR if no idea is, PO should be the "judge" of which idea will go further in the process. To be the "judge", the PO should consider other aspects, such as customer budget. **Brainstorm session ends here.**
6. **For the Idea Development phase**, squad members and chameleons in the project will fill in individually the Idea Development part of the canvas. To fill in this part, a deadline will be given by the POs.
7. POs and Tech Leads should analyse it to create the "issues" in Gitlab, related to the idea. **The ideation phase ends here.**
8. The last phase of the Data Thinking Canvas is the Result Assessment **part**. This mostly concerns the POs, Tech Leads and Marketing team. They will fill in until the "Business benefits" perspective, based on the results of the "Idea Development" part, as well as customer inputs, if the idea was presented to the customer.
9. The "Idea Evaluation After Implementation" perspective will be filled after the idea was implemented. **This is the end of the Result assessment part**, as well as the Data Thinking Canvas process.

Notes for POs – Regarding Forms and Google Sheets set up:

1. Data Thinking Canvas – Version ID (Google Sheets)
    a. Access with El Niño email account.
    b. If a customer is not on the list, it has to be added manually to the "Data Validation" sheet. The query below (from the "Scrum" database) can be used to update it completely:

```
"select * from customers where active = 1 and last_activity >=
'2022-01-01 00:00:00' order by name"
```

    c. The Version ID must be added manually by selecting the option from the column lists in the "ID list" sheet. After that, the ID should be given to participants of the Data Thinking session, so they can fill in the DTC forms.
    d. During the Idea Development part, the POs should also fill in the Idea sheet, with the ideas that have risen during the Brainstorm phase.
2. Data Thinking Canvas – Explore
    a. POs are the first ones to fill in because they have the most information regarding the customers. They should also use the "Version ID" created with the document mentioned above.
    b. The link and Version ID should be given to the team that will participate in the DTC session.
3. Data Thinking Canvas – Idea Development
    a. POs, Tech Leads and the Marketing team are responsible for reading the answers given by the squad and deciding if another meeting is needed. If not, a summary should be posted for the squad in the project or squad Slack channel.
4. Data Thinking Canvas – Result Assessment
    a. POs, Tech Leads and the Marketing team are responsible for filling the Result Assessment part.
    b. After having it, it should be added to the project wiki.
5. Data Thinking Canvas – Idea Evaluation After Implementation
    a. After the idea was implemented, a meeting could be organized by the PO or just have it together with the Weekly meeting. During the meeting, the last questions for the Canvas should be answered.

IDEA FORM

The idea form allows squad members to share ideas, so they can later be discussed with the team during Weekly meetings or Brainstorm sessions.

Link to access the artefact: https://forms.gle/GiiD9Z1iNVfWkJoYA

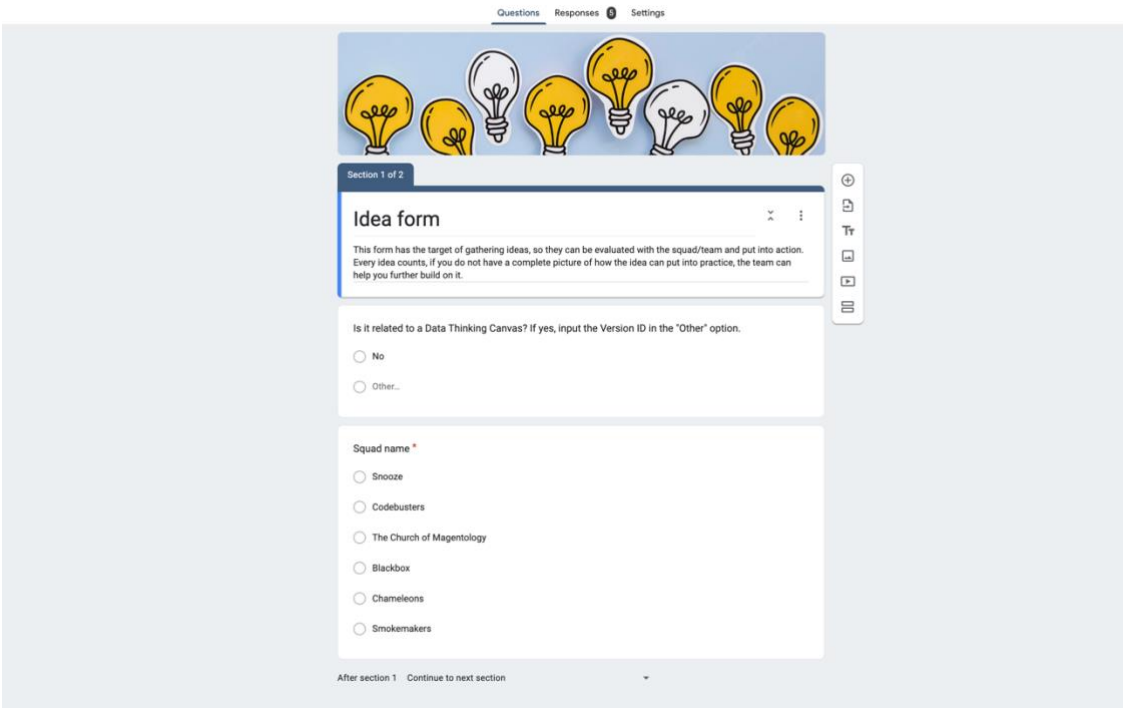

Figure 36: Form for new ideas

APPENDIX F

SPRINT REVIEW WIKI

The Sprint Review is a process in which squad members use a form with different questions regarding the sprint, so they can reflect and give feedback about their work. Besides, during the Weekly meetings, they have the chance to discuss and hear each other's experiences.

It should work in the following way:

1. Before the Weekly meeting, the form link is sent to the squad Slack channel and squad participants are asked to answer it.
2. The PO or person leading the Weekly meeting will open the Sprint Review Dashboard and share it with the whole squad. During the meeting, is important to go through the answers and motivate the team to share answers, as well as develop them further.

Using the Sprint Review process motivate people to reflect on their work, but also each other's work.

CUSTOMER SATISFACTION SURVEY WIKI

The customer satisfaction survey was developed to find improvement points in the work that is being done to current customers. It is important to have it, as it offers a different view on different perspectives.

The Customer Satisfaction Survey is divided into multiple perspectives:

1. Design and user-friendliness: Focused on User Experience (UX)
2. Communication/Product Owners: Focused on understanding their business challenges and placing El Niño as a strategic partner for their customers.
3. Estimates and Budget: Focused on El Niño (perceived) development speed and financial impact on customers.
4. Technical Knowledge (know-how): Focused on El Niño's ability to solve technical problems and maintain current technological structures.
5. Customer expectations: Focused on understanding the customer's expectations and El Niño's perceived results (in meeting or not those expectations).
6. Overall satisfaction: Focused on getting a score from 0 to 10, after a reflection on all these different perspectives above were done. This allows El Niño to see where there's room for improvements.

To access the results of the Customer Satisfaction Survey, squad members can ask their squad's PO.