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Implement a BI solution using the soft system methodology approach.

A use case in a resource-constrained non-profit association

Marta Madalena Sobral Pereira

Project Work

presented as partial requirement for obtaining the Master Degree in Information Management

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IMPLEMENT A BI SOLUTION USING THE SOFT SYSTEM METHODOLOGY APPROACH

A use case in a resource-constrained non-profit association

by

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Project Work presented as partial requirement for obtaining the master's degree in information management, with a specialization in Knowledge Management and Business Intelligence

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STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

[Lisbon, 15 July]

DEDICATION

This thesis is dedicated to the volunteers of every institution and association who generously share their personal time to provide and do better. Your unwavering commitment to achieving a greater good deserves to be celebrated and recognized.

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I would like to express my deepest gratitude to all those who have supported me throughout the process of completing this thesis.

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ABSTRACT

Non-profit associations (NPA) have concurrently faced the bottleneck of having an overload of manual tasks, potentially hindering their efficiency and motivation to work. Different methodologies are pursued to achieve the most efficient solution to each institution. The soft system methodology is being paved a way for innovate methods to streamline NPA´s volunteers processes. This project investigates the effectiveness of implementing this methodology in a resource-constrained non-profit association in order to develop a business intelligence (BI) solution by following its seven different stages within a non-formal association led by nine volunteer leaders. After identifying the problems, a centralized data structure was created as a solution by developing a website to enable more automated and detailed tracking of membership and financial management through a BI model. Despite the association's non-profit focus, unlike private organizations, the implementation resulted in increased process efficiency. The SSM proved effective due to its iterative and cyclical stages, leading to a final solution that aligns well with real-world outcomes while considering the environmental constraints of limited knowledge and investment. The use case presented can be seen as a viable solution for associations or even small businesses that don´t have the amount need to invest in an implementation and maintenance of a data warehouse. In future research it would be viable to arrange a way of measure the real impact of efficacy and efficiency of the adoption of the soft system methodology.

KEYWORDS

Soft System Methodology; Non-profit association; Business Intelligence

Sustainable Development Goals (SDG):

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LIST OF ABBREVIATIONS AND ACRONYMS

SSM	Soft system methodology
BI	Business intelligence
NPA	Non-profit association
DW	Data warehouse
SK	Surrogate key

1. INTRODUCTION

Over the past decade, investments in business intelligence (BI) tools in Europe have seen a significant uptick, reflecting a broader global trend towards data-driven decision-making. This growth is fueled by the increasing recognition of BI's role in enhancing operational efficiency, competitive advantage, and innovation (Tavera Romero et al., 2021). The adoption has been widespread across industries, driven by advancements in technology, the growing volume of data, and the need for insights to navigate complex business environments. European companies, both large and small, have increasingly prioritized BI investments to harness data for strategic decision-making, customer insights, and market competitiveness (McKinsey, 2023).

Non-profit institutions are also increasingly eager to adapt and implement BI methods. However, unlike the private sector, they face challenges due to a lack of financial investment and technical expertise among their volunteers, especially the ones more focus on social field (Nault et al., 2020). For this reason, these organizations show a slower pace compared to their private counterparts, to improve their operational efficiencies and enhance their impact measurement capabilities.

The scientific project aims to use Soft Systems Methodology (SSM) to find a way to set up a BI system in a non-profit group. According to Paramita et. al. (2023), this methodology significantly adds value in examining needs and structuring a tangible business intelligence solution. The authors validated it through a study with a religious non-profit organization. Yet, the project looks to further explore how this methodology applies in the implementation phase and the challenge of applying this approach in a non-profit association focused on a different area.

In this case, the project will focus on a non-profit association (NPA) dedicated to non-formal education. The association relies entirely on volunteers who devote a huge part of their free time to fulfilling their mission. However, besides the main goal-oriented tasks (activities, meetings, camps), the association presents many bureaucratic processes that are entirely manual. Thus, this project aims to assist one of the 32 groups within this association by using this philosophy methodology, designed by Checkland to create and implement a BI solution in order to improve volunteer leaders' time efficiency. Furthermore, the lack of technical knowledge, the available time to learn and adapt to changes, and the limited investment budget must be seen as critical when planning this solution.

This leads to the foundational research question that guides this scientific project focus on the investigation of implement a BI solution in an effectively way in resource-constrained non-profit association by using the Soft Systems Methodology.

In order to address the research question, the study will be focused on achieving the following research objectives:

1. Explore different scenarios of the SSM´s data solutions application.
2. Identify the real problem situation of a non-profit association's group by applying the soft Systems methodology's 7 stages.
3. Develop and implement a business intelligence solution considering the lack of technical knowledge and low investment of the volunteer leaders.
4. Give autonomy to the non-profit association to maintain the offer solution over the time.

This solution can be extended beyond the rest of the groups of this non formal education NPA. Besides, it can be adopted to other non-profit associations, being an example of a low budget and simple BI solution focused on answering and improving the principal needs.

The next chapter of this scientific project comprises a literature review exploring the methodology that will be explored – SSM. Then, the "Methodology" chapter will explore the non-profit association and presents a real use case where each stage of SSM was described showing the framework's construction process. Hence, "Results and Discussion" chapter analyzes the transformations in the association, presenting the efficiency of the final solution – a dynamic dashboard. The "Conclusions and Future Works" chapters cover project implications, limitations, main conclusions, and future steps.

2. LITERATURE REVIEW

2.1. SOFT SYSTEM METHODOLOGY APPLICATION

SSM offers a strategic approach to tackling complex issues by examining them from various perspectives. This methodology involves investing time in listening to and interviewing different participants, considering the real scenario, and adapting it to a systematic and analytical tool. This structured approach represents an organized and flexible method, rooted in systematic perspectives, to address challenging situations, making them more understandable and manageable (Checkland and Poulter, 2007). Essentially, SSM acts as a learning system, aiming to navigate the constraints of a situation and implement targeted actions for improvement (Mingers and Rosenhead, 2001). This methodology invests time in listening/interviewing different participants, considering the real scenario, and adopting it to a system and analytical tool by following 7 different stages.

Given these characteristics, SSM is employed to analyze problematic situations characterized by multiple stakeholders, perspectives, and complex aspects. Notably, SSM has proven beneficial in various governance contexts such as data governance, corporate governance, energy governance, and security governance (Aliahmadi et al., 2022).

For example, Faezirada and Khoshnevisan (2023) utilized SSM to create a comprehensive understanding of the complex issue of data access within a bank. They extracted key system definitions and gained a deeper understanding of purposeful activities. Instead of directly applying SSM in the policy development process, the authors described the situation and fundamental actions to lay the groundwork for policy formulation. In conclusion, the data access problem was identified with various dimensions, leading to the development of 13 support policy rules categorized into data application, risk, processing, infrastructure, route, and access.

On the other hand, Paramita et al. (2023) selected soft system methodology as the framework for developing data storage and business intelligence models tailored for non-profit organizations, particularly those within the religious sector. This choice was made due to SSM's process-oriented approach, which excels in comprehending and navigating complex situations. Widely recognized for its association with interpretive and learning paradigms, SSM aids in structuring the thought process around a given problem (Azar et al., 2019). By embracing this methodology, the study aimed to enhance understanding of the underlying needs within a non-profit association, diverging from profit-oriented objectives to delve deeper into the societal impact of NPAs.

Given the importance of studying the soft system methodology in different areas of NPA and since Paramita et al. only completed the 1st phase of SSM, focusing on the evaluation stage, there is a gap for continuing testing the use of this methodology in the creation of business intelligence solutions. In order to follow the future research studies challenged by

those authors, this project will pursue the complete process of SSM. Being a NPA, aspects such as low investment, lack of knowledge in the area will be present when reaching the problem situation.

3. SOFT SYSTEM METHODOLOGY

3.1. NON- PROFIT ASSOCIATIONS

Non-profit associations emerged as key players in society when it was evident that neither the public nor the private sectors could fully meet the diverse needs of the populace. These organizations prioritize doing good (Herzlinger, 1999) over profit-making (Courtney, 2002), thus lessening the emphasis on competition with other non-profits. Due to their unique qualities, their requirements in terms of mission, outcomes, resources, and adaptability can vary significantly (Drucker, 1990). Nonetheless, ensuring sustainability is crucial for all non-profits. To this end, fostering volunteer participation and securing financial stability are essential for the effectiveness and longevity of these organizations (Wisner et al. 2005).

To effectively pursue their goals and bridge identified gaps, these institutions increasingly rely on the commitment, skills, and active participation of their volunteers (Park et al., 2018). Defined as individuals or groups contributing to community service without monetary reward (Warburton and Terry, 2000), volunteers engage primarily for non-material gains and symbolic rewards (Randle and Dolnicar, 2011). While volunteering often brings satisfaction and fulfillment, it can also present challenges leading to adverse outcomes, including volunteer burnout. In a study examining volunteers, lack of motivation and dissatisfaction was linked to disorganized work practices, vague role definitions, and inconsistent daily procedures (Kreutzer and Jager, 2010). To mitigate burnout risks, it's crucial for volunteer organizations to thoughtfully design volunteer experiences that meet these unspoken needs. To guarantee the association´s sustainability, the recruitment, retention (Bussell and Forbes, 2002), and effective management of volunteers (Carvalho and Sampaio, 2017) have become pivotal concerns for those overseeing volunteer activities. For this reason, leaders should be aware of the main strategies to fulfill their resources such as a well-functioning framework for daily operations combined with flexibility, respect, recognition, and support (Tse, D. C. K,2020). This is especially relevant as successful volunteerism is associated with enhancing volunteers' overall satisfaction and well-being (Lewig et al. ,2007). The challenges of non-profit associations extend beyond the mere contentment or attrition of the volunteer force. There are other general concerns that will bring difficulties such as the demographic trend of an aging populace, the lack of talent, and importance of maintaining a work-life balance. Due to this, the association’s management strategy should be focused on other assets that present a multitude of benefits. For instance, integrate technology to streamline processes to reduce the human capital needs can be a powerful tool for NPA. Given that the primary motive for a volunteer is to contribute positively, alongside maintaining a balance with their personal flexibility, and vigilance against the risk of exhaustion. It would be prudent for these types of associations to dedicate their volunteers' precious time to tasks that have a real impact with the organization's intrinsic aspirations.

As mentioned before, even not being the main goal making profit, NPA can see the profit companies as an example of being sustainable and competitive and use them as benchmark on the tools/strategies that they can incorporate to help to achieve their mission. For instance, by integrating technology in the daily basis of the NAP, investing in operational efficiency seems to be a low-hanging fruit to take into consideration by them, since automated processes can save time and resources. Also, it can be applied in different type of tasks such as email correspondence, financial record-keeping, sustaining the reason behind subsidies based on performance and quality indicators of the work developed, or even the quantification of the association's reach (Huang et al, 2022; Djerdjouri,2019).

However, when comparing a non-profit association with a profit company, mainly due to their distinct objective and resources constrains the needs are very distinguishing. While for the second one the focus is maximizing their profit, a NPA main aim is achieving social impact and mission fulfillment (Connolly & Hyndman, 2013; Dobrzykowski et al., 2016). In terms of resource allocation, NPA often face budget constraints and lack technical expertise, relying on cost-effective BI solutions and volunteer support, while for-profits invest in sophisticated technologies and specialized personnel (Bovaird, 2006).

Taking this into consideration, each association or company must reflect on its true needs. Nevertheless, they must also consider the capabilities or adaptability of their technological framework and software for that purpose, as well as the maturity level of work members in using data. Hence, an organization should begin at a rudimentary level of development and progress towards a more mature state, if using maturity models (Lahrmann,2011).

Refocusing our attention back to non-profit associations, they increasingly recognized the importance of transparency within their operational, financial and in evaluating the impact of their programs aimed at mitigating social issues. Due to this, NPA turned to the adoption and use of information systems, especially BI, as a critical tool to refine decision-making processes and to fulfill their objectives more effectively (Oakley et al.,2015).

In reality, the integration of business intelligence and general technology in organizations that relies on volunteers to survive in no longer just a possible idea. Use Cases such as Charity Water, Feeding America, and Global Giving show the success of using data management.

Table 3.1 – Use cases of volunteer´s associations

Use Case	**Mission/Purpose**	**Data Management example**
Charity Water	Providing clean drinking water globally	Developed a volunteer management platform, which simplifies the process of volunteer recruitment, training, scheduling, and optimizing resource allocation. Additionally, with collaboration

		with Accenture Labs, integrated IoT sensors for real-time monitoring through a cloud connection
Feeding America	Extensive network of food banks across the United States	Designed and implemented a mobile application, which allowed shift management, task assignment, enhanced communication and coordination among volunteers and staff. Moreover, created an automated financial report contributing to a better transparency and operational efficiency
Global Giving	Crowdfunding platform that connects non-profits with donors	Online platform to decrease geographical boundaries. Volunteers can apply with their personal skills (marketing, web site development, data analysis) to help other associations. They also have a financial report system that gives real time updates in terms donations and investments

Despite these use cases showing innovative solutions of using data and technological platforms, it should be considering the lack of volunteer´s data skills and due to the fast flow that they get in and get out from the association, one of the main barriers to integrate technology and BI systems is related to the poor quality, cumbersome, or even existence of data. (MacKrell, 2012) Also, because of the use of multiple tools and locations in which data is located, it is difficult to find a centralized structure of information where they are not able to fully benefit from the data advantages. As a complement, awareness is also note as a challenge since volunteers feel that they put first line the service delivery part when comparing with data management because most of them don´t really know for what data analytics can be for. Another problem that can be seen among the volunteers is that sometimes there are people inside of the association that are averse to change. This can be explained by different motives such as the fear of pulling you out of your comfort zone, concerning of getting more work to do, or even worry about to be substituted by technology. One the other hand, the cost of the implementation of these technological tools can be seen as the major obstacle since these associations depends on crowdfunding and pensions to achieve their mission. Hence, investing in these systems can be seen as not a priority. (Nault et al., 2020).

In summary, given the benefits and challenges of implementing business intelligence methods, it is crucial to attend to the core needs across the associations and the varying levels of maturity among volunteers. Conversely, efforts are risked being counterproductive instead of being a potentially asset.

3.2. USE CASE IN A RESOURCE-CONSTRAINED NON-PROFIT ASSOCIATION

This project applies a use case within a non-profit association to demonstrate the effectiveness of using the soft systems methodology in a resource-constrained environment to implement a BI solution. The non-profit association is dedicated to non-formal education and relies entirely on volunteers who devote significant amounts of their time to fulfilling the organization's mission. This section explores and explains the various steps involved in each of the seven stages of SSM, aiming to create and implement an appropriate business intelligence solution to enhance the time efficiency of volunteer leaders.

3.2.1. FINDING OUT

The first stage has the purpose of identifying the problem within the real-world context, and the situation is assessed. The aim at this point is not to define the problem precisely but to clarify the objectives and what is being sought. Based on the last presented section, non-profit associations focus on their mission instead of maximize profit and rely on volunteers as the main actor to pursue this goal, whom usually don't have technical expertise. The capacity of investment in different areas of their mission (ex: technology) is low. In the observation group, the situation is similar. Across the informal education area, this group is composed of 70 members aged between 6 and 17 years old. From the moment the members are 18 years old they become leaders of the group and commit their time to focus on their mission: to provide girls and young women the opportunity to fully develop their potential as responsible global citizens, through a unique method. However, to guarantee sustainability in the short and long run, there is a fundamental part besides planning activities or being present in a weekly meeting or in holidays events. There is a huge management component that makes these volunteers available 24/7 due to a high level of back-office manual tasks (e.g.: answers to the legal guardians and to the headquarters, financial managing and transparency, activity member´s confirmations). In summary, it is difficult to find a balance between their personal life and being a volunteer capable of maintaining the sustainability of their group, also because they are just around 7-10 people, in general.

In resume, there are three core sections:

- Follow the values and mission of the association – through informal education, educate girls to be universal citizens and maintain the relationship with the headquarters.
- Managing association members – an ideal group should be composed between 70 and 96 association members, since they follow their own method to accomplish their values.
- Financial sustainability and transparency – since it is a non-profit association, there are no regular profit activities. The monetary sustainability of the group comes from the member´s fixed fees and government subsidies.

3.2.2. EXPRESSING PROBLEM SITUATION

In the second stage, the individuals get involved in the situation and the structure of the problem is illustrated in a rich picture. Creating a rich picture of the problem serves as an indirect method to access the key establishments, structures, and perspectives involved in the current situation and ongoing processes, facilitating a deeper understanding of the problem (Checkland and Poulter, 2007). The rich picture highlights the involved and effective roles and the relationships between them, based on types of communication such as interactions, opinions. Focusing on the 3 core activities, several interviews were conducted with the NPA's volunteer leaders. Four legal guardians also participate in 1 interview to have their opinion about possible solutions. In the SSM methodology, it is often used a 'rich picture' approach, so a general picture was created to give an overview of the problem.

Figure 3.1 – "Rich Picture" representing the problem situation

Regarding the figure, it is visible that the volunteer leaders are responsible for different tasks and they have difficulties to manage their time in order to have a work life balance. Between the focus on the mission, guaranteeing the sustainability of the group, sleep and studying, there is little time dedicated to their personal life. The content retrieved from the rich picture can be related with the literature from the section 3.1 since this type of association is leading with higher risk of burnout in their volunteers (Kreutzer and Jager, 2010). At this point, it is also important to bring the point of view of Nault et. al. (2020), since these non-profit associations can be composed by volunteers adverse to change, with lack of technological knowledge. Also, since non-profit associations depend on crowdfunding and

government subsidies, the investment in technical tools is seen as unnecessary most of the time. In the interviews, volunteer leaders also mentioned these points.

3.2.3. ROOT DEFINITIONS OF REVELANT SYSTEMS

The third stage transitions from the real world to a conceptual and systemic perspective, where the problem's root definition is established. This root definition outlines an ideal system, its goals, and the individuals involved, including those who influence or are influenced by the system. To develop a root definition using rich pictures, the CATWOE method is employed. CATWOE helps define the problem by examining the following dimensions:

Customers (C): Identifies the customers, stakeholders, and individuals who will benefit or suffer from the system.

Actors (A): Determines the participants and players within the system.

Transformation process (T): Specifies what inputs are transformed into what outputs through the process.

World View (W): Provides the underlying worldview that shapes the system.

Owner (O): Identifies who has the authority to control or stop the system**.**

Environment-related factor (E): What environmental constraints must be considered in this system?

This mnemonic was adapted by Bhattacharjya et. Al. (2006) to result better when used in non-profit organizations. The acronym CATWOE was redefined as BATROE, with the original C for Customers changed to B for Beneficiaries, to better align with the cultural context of NPA. Furthermore, the W for Worldview was substituted with R for Reasons, to reflect the motivation more accurately behind the desired transformation. The exercise was done in terms of the adapted mnemonic in the next paragraph.

Table 3.2 – BATROE exercise

Item	Definition
B (Beneficiaries)	Association members Member´s legal guardians Volunteer leaders City council Regional headquarters
A (actors)	Volunteer leaders Member´s legal guardians
T (transformation)	Reducing the leader´s manual tasks

	Answer in a more efficient way to the city council and headquarters (association members and financial management) Simplify the communication between leaders and legal guardians
R (reasons)	Balance between the volunteer leader´s personal and volunteer life Financial transparency Focus on the mission getting the most efficiency behind the bureaucracy tasks
O (owners)	Volunteer leaders
E (environment constraints)	Lack of technological / data knowledge Availability and desire to learn the changes Low monetary investments Adoption of new rules after a long time of doing things in a certain way

3.2.4. MODELING CONCEPTUAL MODEL

In this fourth stage, a conceptual model is created using root definitions that include a diagram of activities and their interconnections. In this model, targeted actions are defined by imperative verbs and organized based on their interdependence (Azar et al., 2019). SSM performance measures for system evaluation are summarized by three main criteria: efficacy, efficiency, and effectiveness. Efficacy focuses on the correct transformation and creation of outputs as a result of the process. Efficiency concerns the optimal and minimal use of resources. Effectiveness measures the ability to achieve long-term goals at higher levels (Checkland and Poulter, 2007).

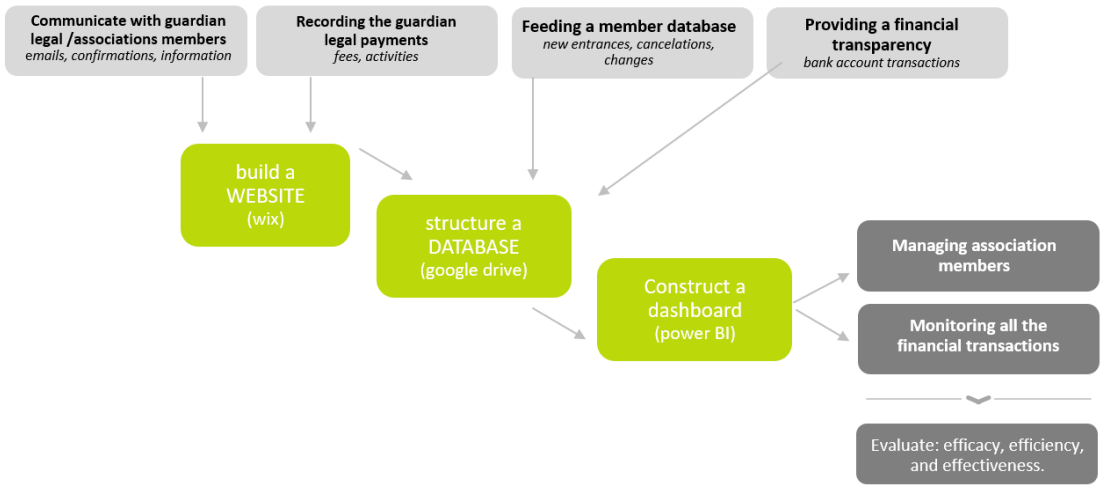


Figure 3.2 – Idealization of a conceptual model

Considering the problem analysis made up to this point, a common and central structure which brings together all the back-office tasks in a single place is missing. Hence, the conceptual model presented keeps this in mind. Different data sources resulting from automated tasks will be summarized in one single model capable of answering to the two major areas of the group – members association management and financial reporting. Also, regarding the low budget and the lack of technical knowledge, the solution was adapted to use freemium tools and was kept agile, direct, and simple. To do so, the first segment of the process schema is to understand the dynamics of data sources and storages. The developed transformation and cleansing procedures will increase the value and purpose of the data (Piechorowski, 2018). According to Piechorowski, procedures would use this architecture with the goal of increasing business purposes. Even though the traditional structure of a BI solution consists of a set of well-defined steps and processes (Tavera Romero et al., 2021), the business intelligence solution developed in this work does not involve the creation of a data warehouse (DW). As a result, the data was imported using Power BI's tools and applications, and the relational model was fully created in the same context.

3.2.5. MODELING A BUSINESS INTELLIGENCE FRAMEWORK

At this stage, it is important to ensure that the business intelligence model developed addresses the real needs of the association group. Based on the NPA's actual needs, the main questions and corresponding metrics were developed to ensure that the final dashboard encompasses all the views required by the group.

Table 3.2 – Metrics aligned with the NPA's real needs

Metrics	Questions?
# Inactive Association members	How many members left the association per year? What are the main reasons for leaving the association?
# Association members actives **# Association members actives (new)** **# Association members actives (paid)**	How many members belong to the group per section and per school year? Which members joined the association this year (new members)? How many members paid the membership fee per term? Who are the members and their respective emails that haven't paid the term fee?
# Payment proofs **Amount paid by legal guardians (€)**	How many payment proofs were uploaded via the website? What is the amount already paid by the legal guardians per type of activity and per term?
Inflows amount(€) **Outflows amount(€)** **Net Balance amount (€)**	How much inflow entered the group bank account per typification (N1/N2) and per period of time? How much outflow left the bank account per typification (N1/N2) and per period of time?

	What is the net balance amount per period of time? What was the profit per event? What is the final balance at the end of the school year?

According to the needs described before, a star schema was developed. This follows a multidimensional model being organized with the fact table at its core, encircled by dimension tables that detail attributes of the fact table (Inmon, 2005). The fact table contains information on the business process events of the association, in other words, each entry in the fact table signifies a specific event measurement, with a level of detail referred to as grain. The dimension tables provide the context for the business process event captured in the fact table, elucidating the "who", "what", "where", "when", "how", and "why" related to the event (Kimball & Ross, 2013).

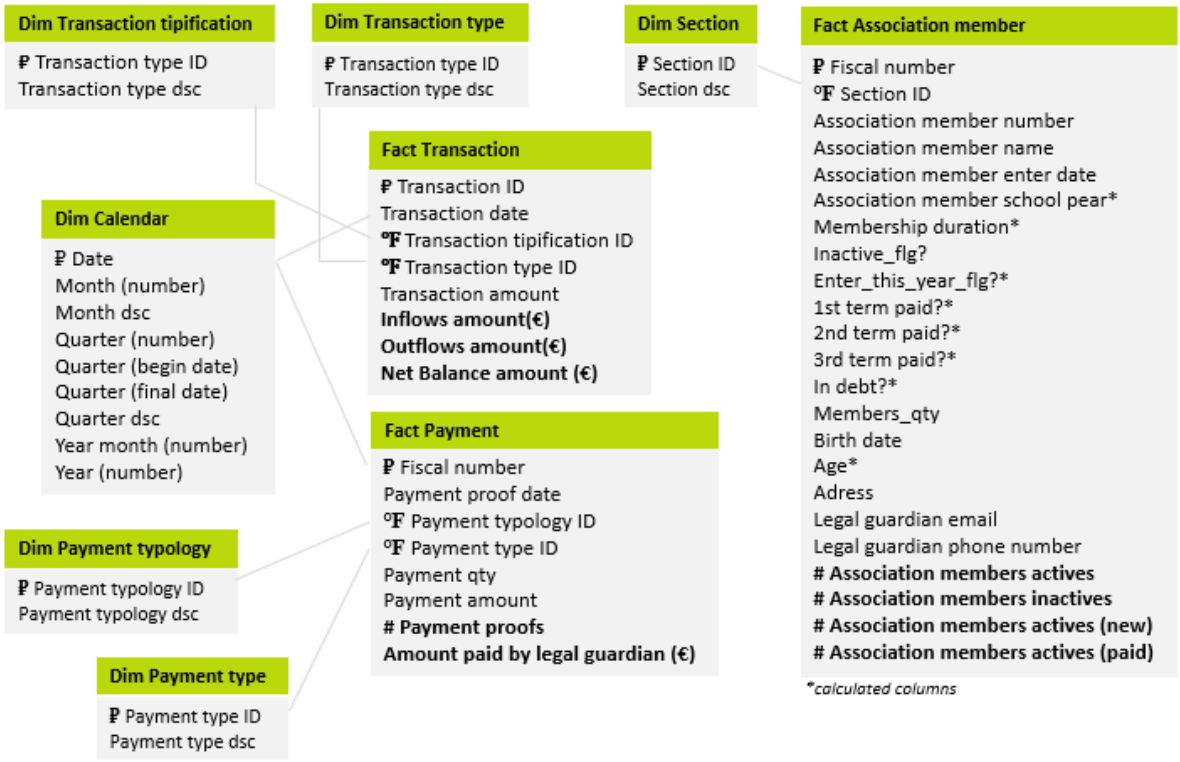


Figure 3.3 – BI star schema

As depicted in the image, the star schema model will incorporate three distinct fact tables. These tables are intended to assess three specific segments: association members, payment proofs, and transactions.

Currently, the transaction fact table includes details that may render the payment fact table redundant in the future. This evolution hinges on banks acquiring more comprehensive information in disposable datasets. This enhanced data capability would allow for a direct connection between association members and their corresponding transfers. In essence, the

transaction fact table's expansion and detail could eventually replace the need for a separate payment fact table, streamlining data analysis within the BI model.

The payment fact table is designed to manage legal guardians' proof of payments for each member association across various expense types. It integrates data submitted through the "Payment" section of group´s website, which is linked to Google sheets. Simultaneously, the transaction fact table tracks all transactions recorded in the association's bank account. Volunteer leaders play a critical role in categorizing each transaction, ensuring accurate financial reporting. The association member table serves to identify and categorize all NPA's members. It distinguishes between active and inactive members and provides detailed member information such as addresses, allergies, age, and membership dates. Some calculated columns were created in the power BI to achieve the metrics needed. This fact table also facilitates verification of member payments, linking with the payment fact table through the fiscal number as a primary key (1-1 relation).

Additionally, various dimensions have been incorporated to provide supplementary information. These dimensions aim to enhance the ability to extract more insightful conclusions directly from the dashboard.

- Dim payment typology categorizes proof of payments by typology, detailing which expenses have been paid by each member. The dimension represents the three fundamental areas of "what" was already paid by each member, and the surrogate key is the "Payment typology ID".

- Dim payment type provides further granularity within payment typologies, enabling comparison of received amounts in the bank account against proof submitted by legal guardians. It uses the "Payment type ID" as SK.

- Dim calendar tracks payments and transactions over time, essential for quarterly reporting and trend analysis.

- Dim transaction type categorizes transactions as debit or credit, facilitating understanding of financial inflows and outflows. In this way, the volunteer leaders can have a perspective of "what" are the main expenses vs "what" they are receiving from crowdfunding, fees, and subsidies. Its surrogate key is the "Transaction type ID".

- Dim transaction typification classifies transaction descriptions, ensuring consistency in financial reporting and supporting detailed analysis for financial reports shared with Regional's headquarters and the City Council. It presents a hierarchy of 2 levels, due to the different level of granularity needed in the different annually reports presented.

- Dim section refers to a specific classification using by the group to segment the association members in different stages depending on their school year. It uses the “section ID” as surrogate key.

3.2.6. DEFINING THE CHANGES

After defining the BI solution and comparing it with the real problem statement, in this stage it is important to identify all the changes that must occur in the group in order to achieve the presented solution and improve the Back-office manual tasks. However, an analysis must be done to guarantee the feasibility, priorities, and the risk of implementing these new tools.

From the beginning, despite being very keen to improve their processes and adapt to new systems, the group consistently conveyed the same message - they wanted a simple solution that wouldn't deviate much from their primary tool - Google drive/sheets. On the other hand, the group was not willing to invest a lot of money in new tools/systems.

Regarding the cultural changes in their financial organization, leaders were a little more skeptical. For example, there was a time when it was suggested that all financial transactions between legal guardians and the association should be made exclusively through the group's bank account. This required a policy of not accepting cash in any case also implying that leaders always use the association's card for various expenses. Culturally, this did not make sense to them. They were not willing to create more than one card (to make it easier to manage who has it) nor were they willing to accept the suggestion of adding the card to a digital wallet. On the other hand, in events and activities, they felt that they were not yet at the point of educating legal guardians to do everything via transfer. At this juncture, there had to be significant adaptation of solutions to find one that would work in the long term.

In the end, what mattered was that the impact of the proposed changes would bring real advantages, reminding them that their main issues were the time spent on manual tasks outside the scope of their mission, lack of task completion, and commitment to their roles. The following table shows the main proposal changes and analyzes the real impact in the leaders group “life”.

Table 3.3 – Proposal changes and their impact by problem area

Area Problem	Specific Problem	Proposal Change*	Impact
Lack of task completion Role Commitment Time Spent	There was a lack of individual information of each Associate Member since there wasn't a central structure with this data.	Creation of individual information forms. Sending the link of the forms to a member's legal guardians after 2 meetings. Filling out a form that formalizes members' cancellation. Observing the information in a BI dashboard.	Based on the parents' responses given to the existing forms, direct queries and formulas are developed to generate the official tables. Given these changes, the group leader just must guarantee the parent´s answers.
Role Commitment Time Spent	High email flow Having several emails due to activities confirmations and payments	Creation of a group association website ● Submit the payments proofs ● Calendar / RSVP forms maintenance ● Confirm the member presence on the activities (note: for parents that pay in cash, leaders should confirm receipt of the payment) Observing the information in a BI dashboard.	By using the website, the email flow will reduce, more than 50% Given those changes, a lot of manual tasks of the Leaders will be eliminated, since they have the final answer almost automated in the Dashboard. Simpler process for the Legal Guardians
Role Commitment Time Spent	Application and Insurance fees calculations for Headquarters	Automate google sheets to the calculations. Observing the information in a BI dashboard.	All the manual tasks of the Leaders will be eliminated since they have the final answer in the Dashboard.
Lack of task completion Role Commitment	Verification of membership fee payment (1 p/ quarter)	Observing the information in a BI dashboard.	All the manual tasks of the Leaders will be eliminated since they have the final answer in the Dashboard. (in the adaptation phase they will have to teach

			the Guardians change the mentality of years and use the Website)
Lack of task completion	Recording the cash flows Share the quarterly and annual financial reports	Upload the month file of the Bank Account Classify each transaction with the available typification (level 1 and 2) Observing the information in a BI dashboard.	Regarding the lack of technical skills and the available information in the back office, this change requires time once a month. However, all the Leaders agreed that even not being totally automatic is better than what they use nowadays.

3.2.7. TAKING ACTION

Reaching the final phase of the SSM, it is necessary to define an action plan. This plan should be phased, ensuring that there is closer initial support to enable the leaders to maintain and continue using it in the future. Otherwise, there's a risk of quickly reverting to old functionalities. Accordingly, the defined plan is divided into three phases, with tasks to be executed by the project and other changes already being implemented by the group in each phase. The image below reflects the various modifications addressed in these phases.

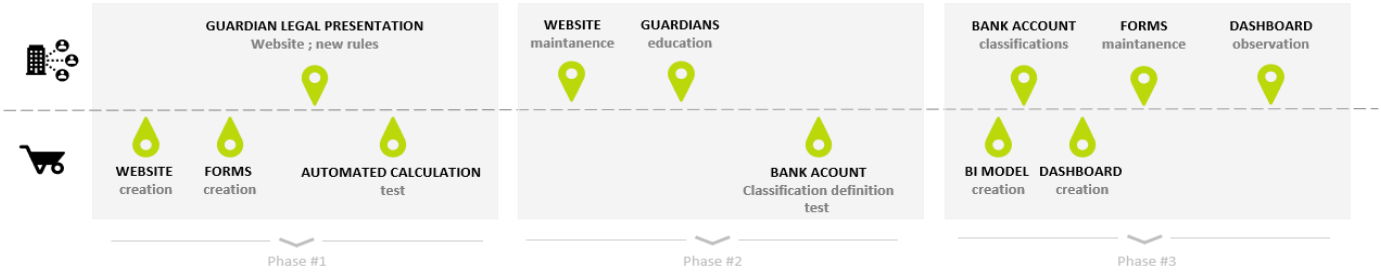


Figure 3.4 – NPA´s action plan in 3 phases

In the 1st phase, the focus is to ensure that there is a complete and well-prepared foundation so that guardians can begin to slowly adapt to the new changes. It is necessary to ensure that the website has all the required paths and pages, linked to the various forms that will feed the BI solution. After establishing this foundation, it is important to present it and make this change official, to listen to the suggestions and difficulties of the parents, and to have a period of minor adjustments and evolution. Still in the 1st phase, a test will be conducted, attempting to automate the accounting of group members and the total amount

to be paid for insurance. Taking the test into account, adjustments will be made to ensure the greatest possible positive impact for the group.

Regarding the 2nd phase, its main objective is to provide a period of adaptation for both the leaders and the associative members (including guardians). There will be a time for maintenance and learning. On the other hand, more specific rules will be established to best shape the BI solution, such as the classifications needed to construct a financial report.

In the final phase, the focus is on delivering a BI model and an interactive dashboard capable of significantly impacting role facilitation and reducing time allocated to manual tasks. It is the most demanding phase, as there will be many transformations to perform in data processing, to ensure that the solution does not require extensive maintenance and can evolve over time.

4. RESULTS AND DISCUSSION

This section presents a comprehensive examination of the detailed outcomes derived from employing the soft system methodology to this business case, aiming to establish a robust foundation for strategic decisions and planning within informal education organizations concerning the implementation of Business Intelligence solutions.

4.1. STAGES OF SOFT SYSTEM METHODOLOGY

Although the Soft Systems Methodology encompasses seven distinct stages, it fundamentally divides into two main parts.

The first part covers the initial three stages, primarily focusing on defining the problem. This phase requires the collaboration of the partnering entity; without it, implementing changes becomes unfeasible. Active listening, critical questioning, and empathetically understanding the perspectives and challenges of others are crucial for devising effective solutions. In this project, considerable time was devoted to this initial phase, and employing strategies recommended by various authors proved instrumental in identifying and articulating clear and tangible problems.

The second part centers on identifying the most effective solution, considering the key challenges highlighted in the initial phase. The crucial factor here is feasibility, ensuring that the solution is not only viable but also sustainable by the collaborating entity, such as volunteer leaders. Insights from the literature review play a significant role in shaping the direction at this stage. It's essential that the solutions implemented are beneficial and do not introduce further complications; otherwise, there's a risk of reverting to old, inefficient methods due to their simplicity. Consequently, the recommended BI solution includes a detailed training program, emphasizing the need for a solution that remains effective and manageable over time. Additionally, this phase involves a continuous cycle of testing and refinement to ascertain that the final solution adequately addresses the initial problems.

4.2. IMPLEMENTING CHANGES

As discussed in the methodology section, the principal constraints faced by the association stemmed from insufficient knowledge and a limited budget for investing in the new solution. In addition to these challenges, they lacked any existing functional structure that could be repurposed for this initiative. Consequently, aligned with the modeling framework, a simplified and autonomous structure was devised to address the critical needs identified. Moreover, to facilitate filling part of the new data structure, it was necessary for the legal guardians of the association’s members to participate actively. Thus, user-friendly, and supportive tools were developed to aid in this digital transformation process.

4.2.1. WEBSITE

The website is a key part of this proposal, serving two main objectives: reducing email traffic and creating an automated system for feeding data into the structure independently. Essentially, the website acts as a primary gateway, easing the communication between guardian legals and volunteer leaders. In the initial mockup, large blocks were drawn to ensure that the primary requirements were met. Since it would be built on Wix, the design would rely on the available free templates. For this reason, significant time was not spent on the design's conceptualization, given that the templates were already created. In the following image, the minimal requirements for the website can be observed.

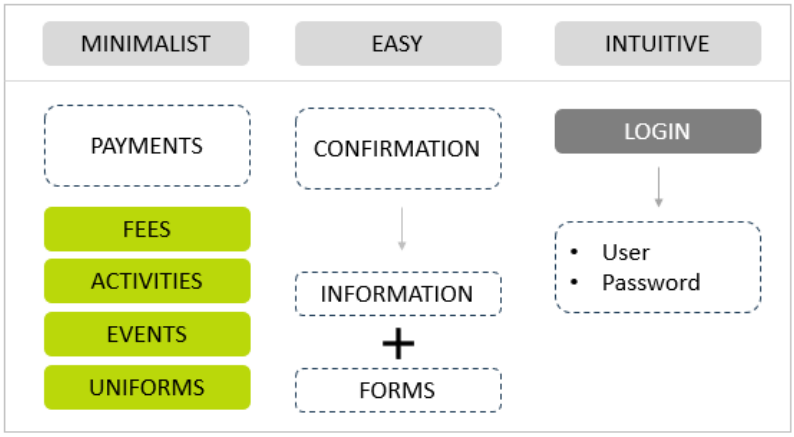


Figure 4.1 – Website requirements

On this platform, association members can log in with a universal password to perform various tasks, such as registering their attendance at activities, submitting payment proofs, or accessing a range of information. It's designed to be user-friendly and visually attractive, enabling easy access from smartphones and this is the result which was presented to the legal guardians.

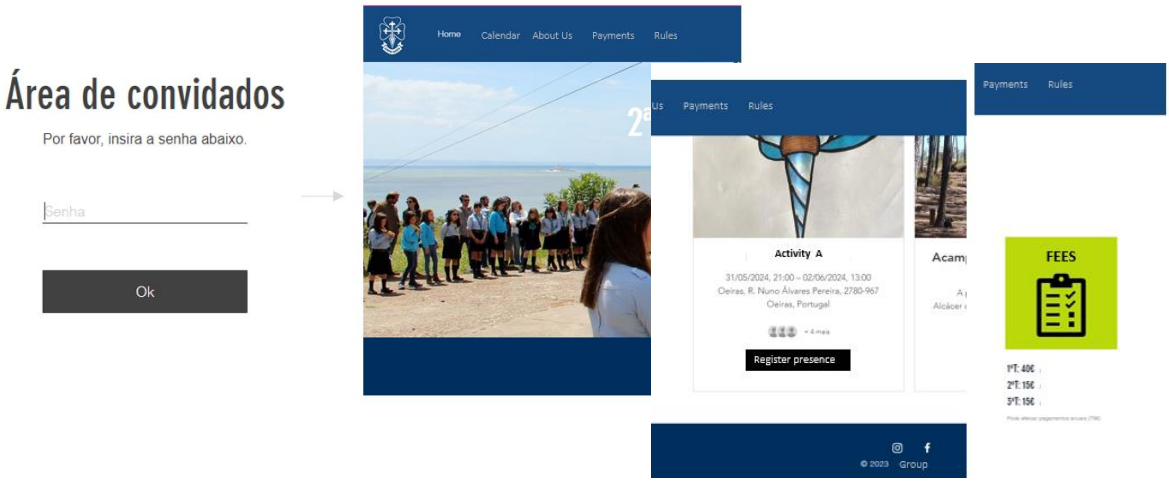


Figure 4.2 – Group's official website

Additionally, as this represents a significant change for the legal guardians and volunteers, time was allocated in the action plan for teaching them to independently use the new tool. Contrary to initial discussions, there was a greater emphasis on training the legal guardians in its use comparing to the volunteers. The introduction began with a meeting where the concept was presented alongside tangible examples for daily use. Subsequently, a detailed welcome email was circulated, providing step-by-step guidance on how to navigate various sections of the website, such as "Confirming an association member's attendance" or "Uploading proof of payment."

The website was launched at the start of the electoral year 2023/24 and was very well-received by the association members and the legal guardians. Their feedback through interviews was unanimous: the website was easy and straightforward to use, providing a centralized location for accessing all association information and managing related tasks. A preliminary analysis of the data from the website indicates a successful adoption of the tool for activities requiring registration, as evidenced by an increased number of sessions during that period. In the first term, there were five events confirmed via the website without any reported difficulties, with most users (82%) accessing it on mobile devices. The legal guardians particularly appreciated the automatic email confirmation for registrations and the option to save event details (venue and schedule) directly to their personal calendars.

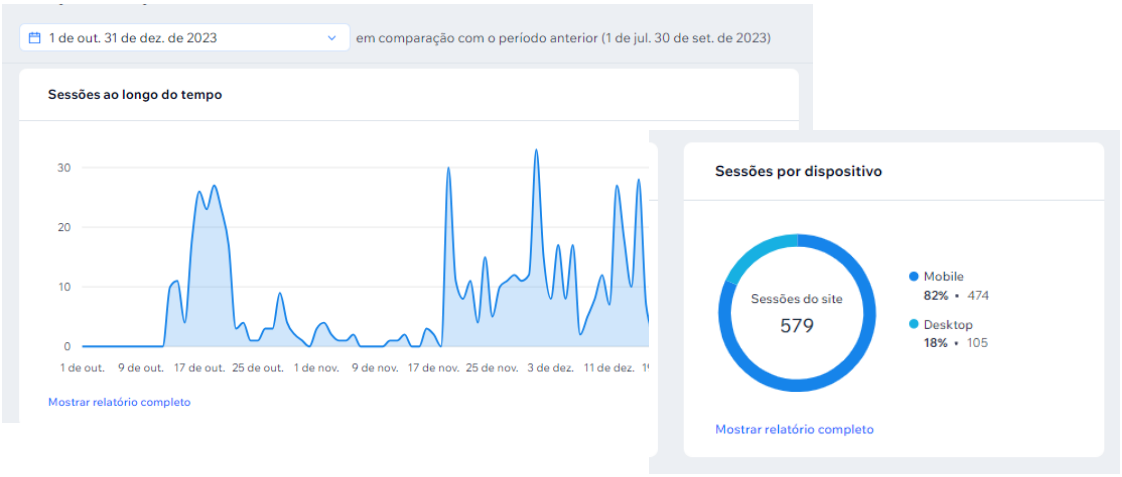


Figure 4.3 – Website utilization indicators

However, further analysis reveals that the Legal Guardians and association members primarily use the website to confirm their attendance at activities. Yet, when it comes to payments, they do not exhibit the same level of independence as they do in the confirmation section. This discrepancy can be attributed to two main reasons. Despite a meeting where the website's usage was clearly explained, there was a confusing email sent by the volunteers in November instructing parents to email proof of payment, which undermined confidence in the website and led to a setback from the progress already made. Additionally, when the website was launched in October, the solutions it presented, including the second part of the SSM, had not yet undergone the interactive process of improvement that occurs when changes are implemented in a real-world context. Consequently, some procedures were not entirely clear, resulting in errors and misunderstandings by the legal guardians due to a lack of know-how—for instance, consolidating payments for multiple activities into a single transaction, which led to a single proof of payment that was incorrectly allocated, or making a single payment for siblings, causing further confusion.

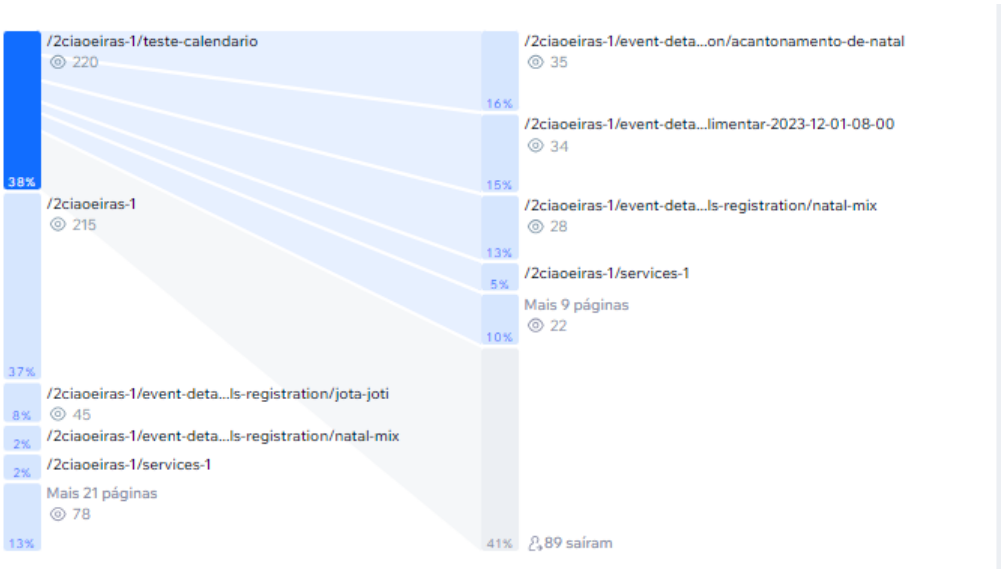


Figure 4.4 – Website pages preferences

Finally, as previously mentioned, contrary to the action plan, training volunteer leaders to manage the website autonomously was not prioritized. While they are capable of checking confirmations by themselves, they are not yet able to independently create and manage events. Consequently, there was an instance when an event was registered using the old method, which led to confusion among the legal guardians. Additionally, the level of enthusiasm for adapting to the new system varies among volunteer leaders; hence, it is essential that all are equally prepared and knowledgeable about managing this tool. To address this, before the start of the next academic year, comprehensive documentation will be provided, encompassing various scenarios and practical examples to ensure that the current tool effectively addresses the identified issues.

4.2.2. POWER BI DASHBOARD

The Power BI dashboard is a strategic solution designed to address several challenges identified in the daily activities of volunteers. Leveraging a business intelligence model that integrates various data sources, the dashboard allows for easy analysis and data extraction. The first and second pages focus primarily on the association management, enhancing the sustainability of the group association's numbers and streamlining access to diverse information about the association members. The other pages are related to the financial sector, where volunteers can easily manage the fee payments made by association members and monitor the cash flows of their bank accounts with greater transparency.

In the following paragraphs, each page of the dashboard will be explained in detail, justifying the choice of each visual while focusing on increasing the efficiency of the back-office tasks for volunteer leaders. It is important to note that the data presented in the dashboard has been adapted solely for demonstration purposes to comply with GDPR policies.

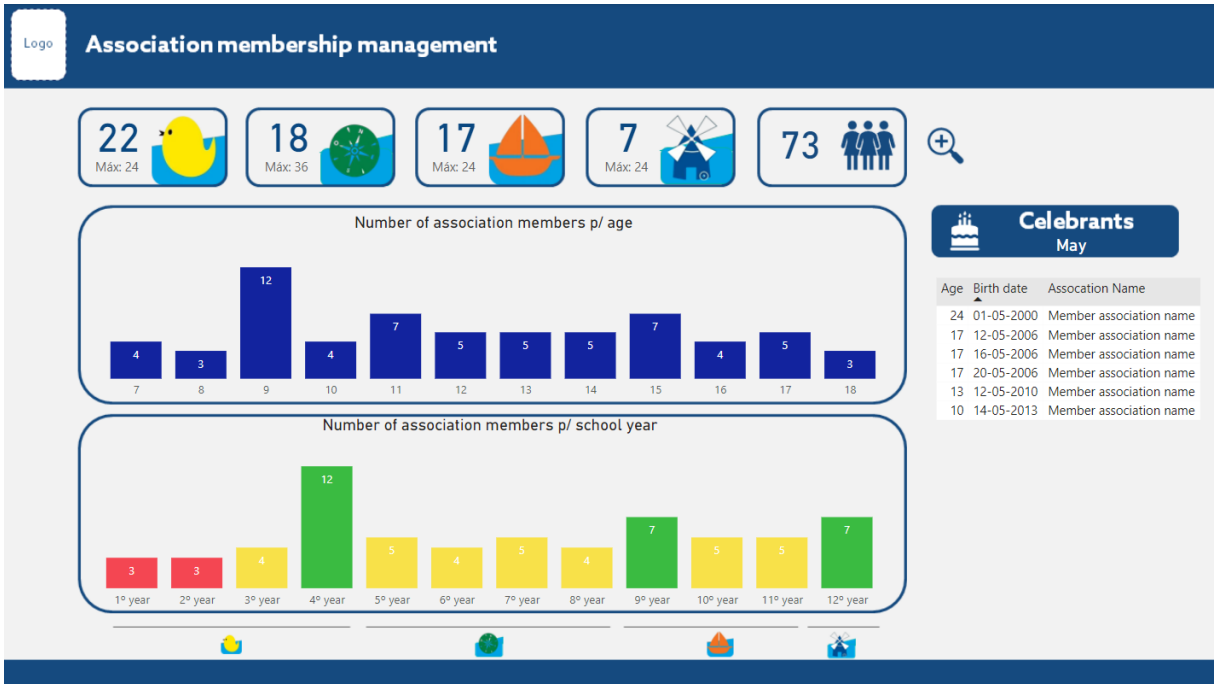


Figure 4.5 – Association management overview page

The first page of the dashboard presents a global resume of the association members. In the figure 4.5, cards on the top reveals the number of people in each section, juxtaposed against the maximum capacity the association can handle. The graphs serve dual purposes: the first, in blue, supports the report required by the City Council, detailing the demographic breakdown by age. The second graph, colored differently, identifies age gaps crucial for targeted recruitment efforts. In this case, investment is recommended in the youngest groups, particularly the first two years of school. The middle age groups represent a large yellow spot which can be seen as critical, since these ages should ideally reflect the highest membership

because after 9th grades there are high drop rates. To summarize, this graph will aid in implementing specific strategies to ensure long-term sustainability. Finally, the page includes detailed information about the members of the association, updating monthly to display names and birthdays. This feature assists volunteers in remembering important dates and facilitates the organization of special surprises for the members.

To enhance focus and support volunteers in managing their members, a zoom button has been added to the interface. Clicking this button opens a new page on the dashboard, where volunteers can access detailed information about their member associations. This dynamic tool enables them to add any necessary information by interacting with the available fields. Additionally, at the top of the page, there are available filters that can be used to reduce the number of rows in this personalized list. Furthermore, four buttons, each represented by different icons, have been introduced above the selection fields. Clicking on these icons allows for a quick pre-selection of columns. Finally, volunteer leaders can export the data into a table and easily print it for use in off-site activities.

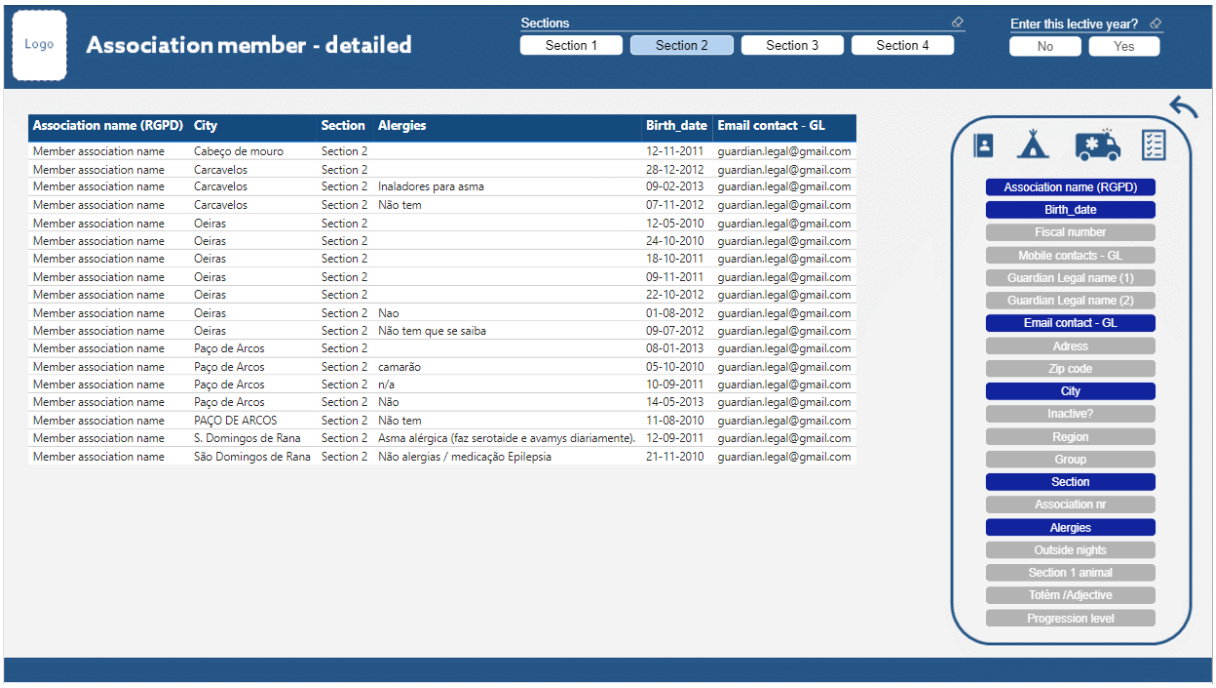
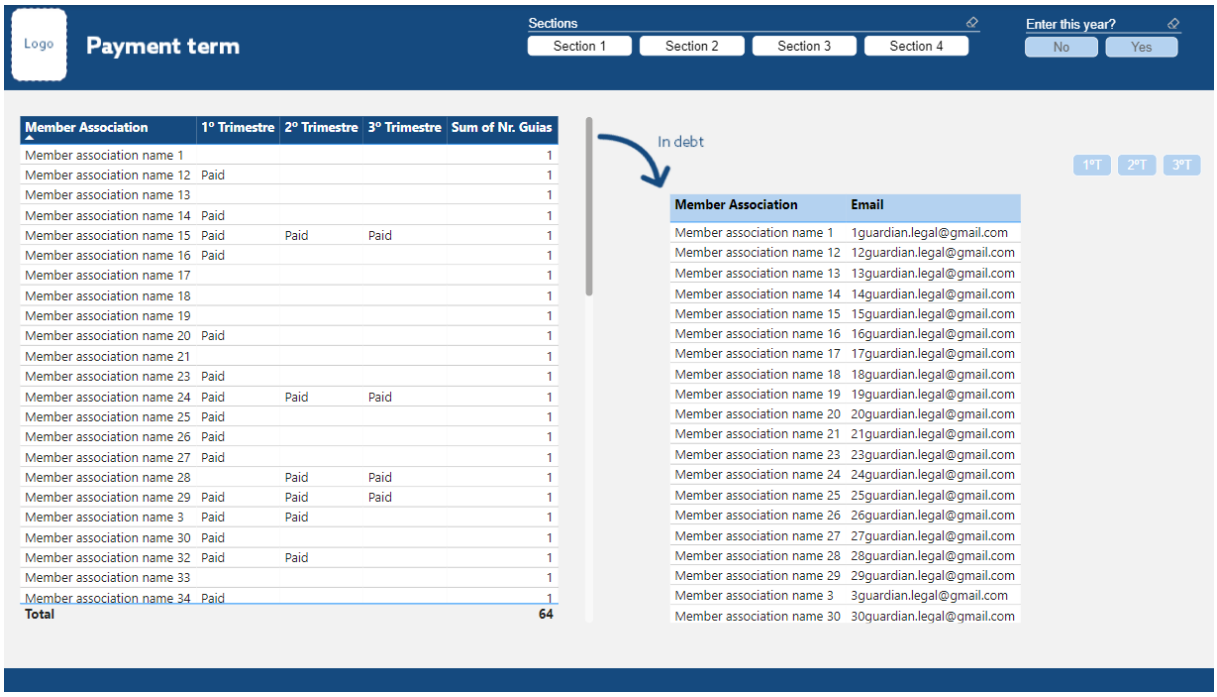


Figure 4.6 – Association management detailed page

Additionally, another page has been developed to assist leaders in tracking which members have already paid their term fees. Since investing in a more advanced system is not feasible, legal guardians upload payment proofs to the website. Subsequently, through an ETL (Extract, Transform, Load) process, this information is displayed directly on the subsequent Power BI page.

Furthermore, this page is structured such that the left side displays a table listing all the members of the Association. For each term, members who have paid their fees are marked with "Paid" in the corresponding column. On the right side, a narrower table lists the names

and emails of those who have missed payments. This setup facilitates easy communication; by copying the emails, leaders can promptly send reminders to these members to settle their accounts. The same filters from previous pages are available at the top of this page. Notably, the filter in the top right corner is crucial as it identifies members who joined in the current year, who may have different payment rules and thus can be excluded from the debt list. Looking ahead, an "email" button could be added, allowing emails to be sent directly from the association's account via Power Automate, further easing the workload of volunteer leaders.



Member Association	1º Trimestre	2º Trimestre	3º Trimestre	Sum of Nr. Guias
Member association name 1				1
Member association name 12	Paid			1
Member association name 13				1
Member association name 14	Paid			1
Member association name 15	Paid	Paid	Paid	1
Member association name 16	Paid			1
Member association name 17				1
Member association name 18				1
Member association name 19				1
Member association name 20	Paid			1
Member association name 21				1
Member association name 23	Paid			1
Member association name 24	Paid	Paid	Paid	1
Member association name 25	Paid			1
Member association name 26	Paid			1
Member association name 27	Paid			1
Member association name 28		Paid	Paid	1
Member association name 29	Paid	Paid	Paid	1
Member association name 3	Paid	Paid		1
Member association name 30	Paid			1
Member association name 32	Paid	Paid		1
Member association name 33				1
Member association name 34	Paid			1
Total				**64**

Member Association	Email
Member association name 1	1guardian.legal@gmail.com
Member association name 12	12guardian.legal@gmail.com
Member association name 13	13guardian.legal@gmail.com
Member association name 14	14guardian.legal@gmail.com
Member association name 15	15guardian.legal@gmail.com
Member association name 16	16guardian.legal@gmail.com
Member association name 17	17guardian.legal@gmail.com
Member association name 18	18guardian.legal@gmail.com
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Member association name 28	28guardian.legal@gmail.com
Member association name 29	29guardian.legal@gmail.com
Member association name 3	3guardian.legal@gmail.com
Member association name 30	30guardian.legal@gmail.com

Figure 4.7– Payment management page

Lastly, a financial report was constructed based on the templates used by the association to facilitate sharing with the district headquarters. The data populating this page originates from the bank account, including all credit and debit transactions. Since the bank data does not provide detailed classifications for each transaction, volunteer leaders are tasked with this typification through secondary pages designed to ease their duties. It is recommended that this task be performed at the end of each month to ensure that leaders can accurately recall and categorize each transaction type; otherwise, transactions will be marked as "not configured".

Figure 4.8 – Classification pages

As navigating through the page, the left table provides a summary of the financial typologies, indicating profitable areas in green and areas with higher expenses in red. The difference between the initial and final balances reflects the total value shown in this table. Additionally, the dates displayed above the table specify the reporting period being reviewed. In the worst-case scenario, without proper classification, all totals will be categorized under the typology "Not configured."

On the right side, a graph has been incorporated to illustrate the evolution of the balance over the months, further detailing the information from the table. A tooltip feature has also been added; by hovering the mouse over each month, it provides a description or observation, explaining the amounts spent or gained.

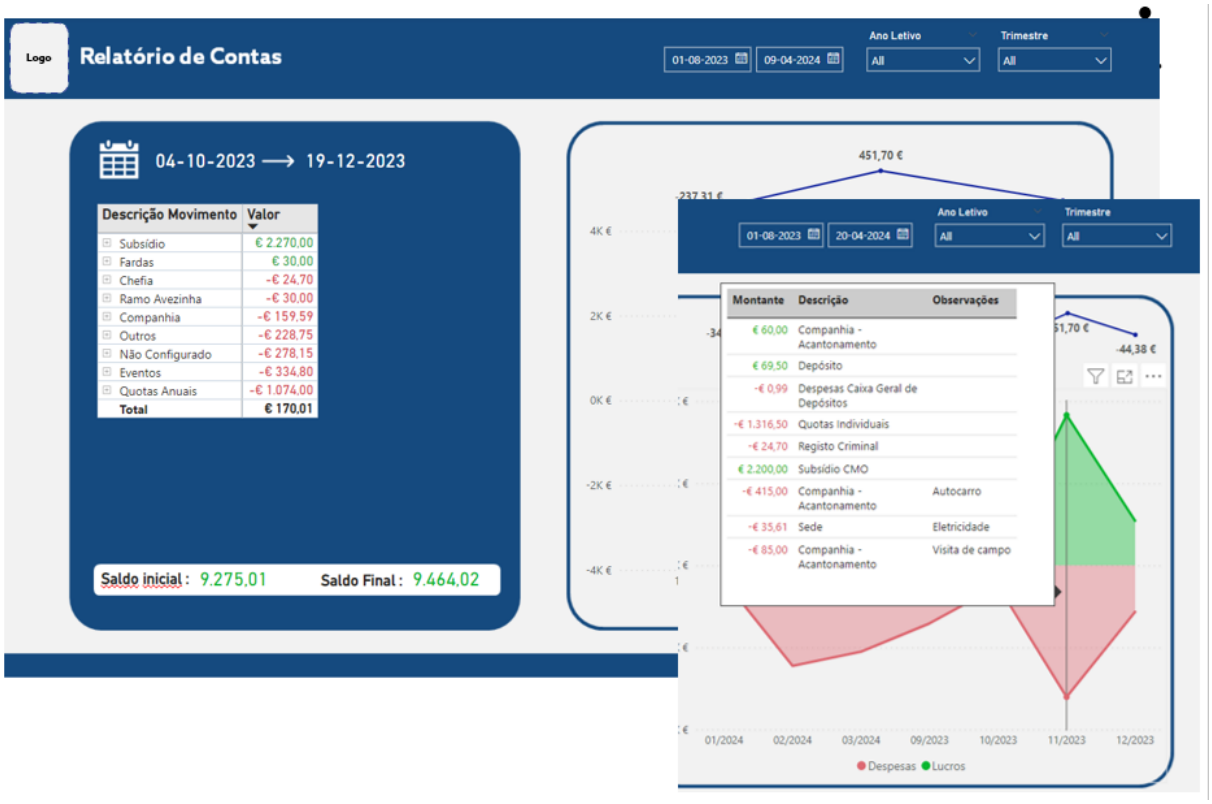

Figure 4.9 – Financial report page

By using this page correctly, the volunteer leaders can analyze their critical months and identify which expenses can be avoided to ensure the sustainability of their finances. It is also important to predict the balance at the end of the year without the subsidy from the City Council and to understand the profit contribution of each event. Additionally, it becomes easier to calculate the price of each activity based on the previous year's balance. Although it is a non-profit association, it is crucial to ensure there are sufficient operating funds to provide various activities to members without having to request higher than expected contributions from legal guardians.

4.3. FINAL DISCUSSION

In fact, non-profit associations rely mainly on volunteers to pursue their mission objectives. Due to their importance and to ensure their continued involvement, it is crucial to listen to them and address their needs, so they are not overloaded with tasks or at risk of burnout. Considering the importance of addressing the real problems, Paramita et al. demonstrated that using Soft Systems Methodology can help identify the main issues within non-profit associations, especially when integrating a business intelligence solution. While the authors focused only on the first stage of SSM for identifying and idealizing issues within a religious non-profit association, this project extended the methodology by following all seven steps, including implementation.

In line with Paramita et al.'s findings, this comprehensive approach effectively addresses the core problems of non-profits, as it provides a more personal understanding and encourages greater involvement from volunteers who possess practical knowledge of the association. Given the common barriers to implementing data tools in non-profits, such as a lack of technical knowledge and investment, it is essential to ensure that volunteers are aligned with and supportive of proposed changes. In this case, the primary challenge was managing the various tasks required to maintain the sustainability of a non-formal education association, both in terms of membership and financial stability, which detracted from focusing on the core mission.

While Paramita et al. focused on implementing a BI solution, other authors have employed similar methodologies to address different issues, such as data governance. For instance, Faezirada and Khoshnevisan developed policies to tackle the complex problem of data governance, rather than simply idealizing technological tools. In this project, active listening among volunteer leaders highlighted the need to reduce their workload. Flexibility in not being constrained to a pre-existing solution proved essential; for example, creating a website significantly improved their workflow. Only after developing a user-friendly tool, accessible to both legal guardians and association members, and maintainable by volunteers, was it feasible to consider implementing a BI solution. Otherwise, many details would have been overlooked, and the solution would likely have gone unused.

The solution presented and implemented pays careful attention to every detail, resulting in high satisfaction among association members, legal guardians, and especially volunteer leaders. This is evident through the frequent utilization of the solution, positive feedback in interviews/non-formal meets from users, and notably, the fact that two back-office roles previously managed by four different leaders can now be maintained by just two individuals under supervision. Furthermore, there remains potential for these roles to achieve full independence in utilizing the proposed solution, and that can be improved in the way of how to teach it, that can be more practical and dynamic.

5. CONCLUSIONS AND FUTURE WORKS

Given the benefits of employing data solutions to optimize both public and private entities, this study aimed to achieve such a solution for a non-profit association by applying the Soft Systems Methodology, despite constraints on implementation. NPAs, by nature, prioritize their mission and rely on dedicated volunteers for sustainability. Consequently, the lack of knowledge and limited investment in time and resources present additional challenges in finding a solution. However, while SSM may not be the obvious choice, it proves effective in this context by offering a different approach to problem-solving thanks to the iterative and cyclical methodology which allows revisiting and modifying previous phases as needed. Because of this approach, the final solution is highly consistent with real-world outcomes.

In this instance, the non-profit association was affiliated with the educational sector. However, their primary issue revolved around the excessive time dedicated to administrative tasks within the group, detracting from the effective utilization of volunteers for their core mission. This leads to fatigue and demotivation, as volunteers find themselves with diminishing personal time. The key areas identified for streamlining efforts were association membership and financial management. The proposed solution involved transitioning from the primary communication channel (email) to a website, which streamlined task management by eliminating many redundant processes. With this central platform established, the construction of a centralized database simplified organizational processes and consultations. Ultimately, to meet the need for a more visual and automated approach, the final solution—a interactive dashboard—was developed. Implementation occurred in several stages to ensure that changes were not overly abrupt and could be sustained independently. Although being focus on the educational area can be adapted to other associations due to the simplicity and low investment need.

In terms of association management, implementing processes and working autonomously proved relatively straightforward. However, the financial aspect presented challenges. Numerous restrictions were imposed, and volunteers struggled to adapt to the new rules and proposed changes in this area. This underscores the importance of investing more time and adopting a practical approach to ensure that all volunteers are receptive to change and willing to learn, thereby securing long-term sustainability.

Ultimately, the feedback and website indicators revealed promising results, requiring only 2 volunteer leaders instead of the previous 4 to manage operations effectively. However, it is difficult to demonstrate in numbers the time savings and satisfaction. In future work, more concrete and quantitative metrics should be implemented to assess the real impact of the methodology and the use of business intelligence solutions in NPAs. Metrics such as the number of emails, percentage of timely deliveries of financial reports to stakeholders, and hours spent on back-office tasks would provide quantitative evidence to demonstrate the effectiveness of implementing this.

In conclusion, providing business intelligence solutions to non-profit associations is crucial, as these tools offer benefits far beyond monetary profit. By facilitating operational efficiency and streamlining essential tasks, BI solutions empower individuals who generously volunteer their personal time to noble causes. These tools not only optimize resource allocation but also enhance organizational effectiveness, ultimately enabling non-profit associations to fulfill their missions more effectively and make a meaningful impact in their communities.

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