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Lisbon Participatory Budgeting Success

Assessing the Impact of Participatory Budgeting on Solving Citizens' Problem in Lisbon Parishes.

Pedro André Passos Carvalho da Silva

Dissertation

presented as partial requirements for obtaining the degree of Master of Science in Information Management

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação
Universidade Nova de Lisboa

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ASSESSING THE IMPACT OF PARTICIPATORY BUDGETING ON SOLVING CITIZENS' PROBLEM IN LISBON PARISHES.

by

Pedro André Passos Carvalho da Silva

The dissertation was presented as a partial requirement for obtaining the degree of Master of Information Management, with a specialization in Business Intelligence.

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DECLARATION OF INTEGRITY

I declare that I have carried out the present academic work with integrity. I confirm that I have not resorted to the practice of plagiarism or any other form of misuse of information or falsification of results during the preparation of this work. I also declare that I am aware of the Rules of Conduct and the Code of Honour of NOVA Information Management School.

Pedro André Passos Carvalho da SIlva

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ABSTRACT

This master's thesis explores the impact of participatory budgeting (PB) on problem-solving within Lisbon Parishes, specifically examining the relationship between implemented PB projects and citizen complaints. Despite the overarching goal of PB to address community issues, its efficacy in problem resolution has remained uncertain. The study categorizes parishes based on success rates, revealing varying levels of impact. Results indicate positive outcomes in 54% of parishes, with distinct success in specific topics and parishes. However, the study acknowledges limitations, including a limited number of complaints and an incomplete understanding of complainer archetypes. The research underscores the importance of increased complaints and a broader participant profile for enhanced effectiveness in participatory budgeting. Additionally, the study establishes predictability in identifying winning projects through critical variables such as value, votes, complaints, number of residents, and education. The inclusion of residents and educational indicators further refines predictive accuracy. Furthermore, the study introduces the innovative use of concentration curves, classifying parishes into four segments based on success rates, where the 1st have 4 parishes. This novel approach provides a nuanced understanding of the distribution of PB impact across different parishes. The comprehensive analysis contributes to a deeper understanding of Participatory Budgeting, civic engagement, and the local context in Lisbon. The research calls attention to the importance of comprehensive data, diverse participant profiles, and increased public engagement in PB processes to foster successful problem-solving initiatives.

KEYWORDS

Participatory budgeting, Lisboa Participa, City's decentralized meetings, Lisbon Parishes

Sustainable Development Goals (SDGs):

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LIST OF ACRONYMS AND ABBREVIATIONS

AM	**Topic: Administrative Modernisation**
C	**Topic: Culture**
E	**Topic: Education**
EI	**Topic: Economy And Innovation**
GSEE	**Topic: Green Structure, Environment and Energy**
HLD	**Topic: Housing and Local Development**
LL	**Topic: Lifelong Learning**
PB	**Participatory Budgeting**
RIMT	**Topic: Road Infrastructure, Mobility and Transport**
S	**Topic: Sport**
SCP	**Topic: Security And Civil Protection**
SR	**Topic: Social Rights**
SRT	**Success Rate**
UH	**Topic: Urban Hygiene**
URPS	**Topic: Urban Regeneration and Public Space**

1. INTRODUCTION

In recent years, participatory budgeting has become significant in public governance and local democracy. This approach empowers citizens by granting them direct influence over decisions about the allocation of public funds within their respective municipalities. The need to explore this alternative approach, aimed at empowering citizens and comprehending its success, arises from the potential to enhance the people's satisfaction. Specifically, it raises the pivotal question of whether participatory budgeting effectively addresses the grievances of Lisbon's residents. The origins of participatory budgeting can be traced back to Porto Alegre in 1989, where the initial forays into this innovative process were driven by financial constraints and the challenges posed by a disorganized bureaucracy. These early experiments ultimately laid the foundation for Participatory Budgeting as we know it today. Notably, in 2008, Lisbon became the first European capital to implement a municipality-scale participatory budgeting. This significant step allocated a portion of the city's budget to realize the requests of its citizens, following a meticulous selection process spanning multiple phases. After Lisbon's approach, many towns followed the same procedure to broaden decision-making to the population instead of only having limited people deciding - the elites (Frenkiel, 2021; Maravilla & Grayman, 2020).

We have multiple examples in different countries with different historical backgrounds, proving that mayors in charge longer are more likely to take this step (Klun & Benčina, 2021). Participatory budgeting positively influences civic participation (Kempa & Kozłowski, 2020), putting the population closer to what is happening in the council and with an active voice. Demographic diversity, economic development, and sound financial capacity are needed between the residents to promote better citizen engagement (Klun & Benčina, 2021) and participation to develop the city's problem resolution and satisfaction. With the adoption of participatory budgeting, people will stand up for the best of their community (El-Karmaoui, 2019). However, trends are not only influenced by the citizens but also depend on the influence of the city council (Falanga et al., 2021). To reach the confidence and interest of the population, some conditions must be met, such as credibility and regulation. These will help citizens believe that they are having a significant impact on the development of their city (Binda & Niedziela, 2021). Participatory budgeting policies also lead to more transparency and a stronger civil society (Braun & Marzec-Braun, 2021; Calabrese et al., 2020; Ewens & van der Voet, 2019).

This master's thesis seeks to delve into the core question of whether participatory budgeting in Lisbon effectively addresses the concerns and complaints of its residents. By examining the history, principles, and outcomes of participatory budgeting, this study aims to shed light on the research question:

Is participatory budgeting solving the complaints of people who live in Lisbon?

By having a combination of complaints made by people from different parishes during a period, despite not knowing whom complaints and probably some people's archetypes have not a representative participation, and has it happens for the participation of elites in PB (Frenkiel, 2021; Saguin, 2018) it might also exist on the decentralized meetings of city's council, but will be assumed as a representative sample to be treated as a community complaint, and therefore community problems. This method will guarantee an understanding of patterns between complaints and winning projects. The parish will do a quantitative

analysis of the individual needs and community goals, and the expected result is to understand if participatory budgeting is solving the needs and requests of Lisbon citizenry and under which conditions it has higher results. Citizens complain about urban services because of sometimes inefficient management of city council duties; alternatively, the city council offers the opportunity for citizens to choose which city projects they want to spend money on through participatory budgeting. Despite the council's behavior and assuming that people want the best for their community, we need to understand if the suggestions from participatory budgeting significantly impact the city. This project intends to understand if participatory budgeting solves the problems citizens complain about. For this, an analysis of all parishes in Lisbon will be taken to understand the level of improvement based on the adoption of participatory budgeting. Lisbon data will acknowledge precious information about the city's progress. The classification and analysis of the data will be developed in Python, combining three different sources: data from Lisboa Participa, the city council complaints from decentralized meetings in Lisbon, and socioeconomic data from Observatórios Lisboa.

First, data from different sources was extracted using web scrapping techniques for the Lisboa Participa website (https://lisboaparticipa.pt/pt) to get proposals and projects and then imported to Python the data for the Complaints from decentralized meetings and static data from Observatórios Lisboa (https://observatorio-lisboa.eapn.pt/). After that, data was treated to prevent data errors and, eventually, outliers that were not found. Before starting the analysis, an update to the data types was performed, followed by the creation of new features. With all data treated, datasets were used for correlation analysis to study which variables would be correlated. More visualization analysis was performed, and an algorithm was created to predict which project would win according to the input variables. Lastly, an analysis using concentration curves for the measurement success of Participatory budgeting on solving citizen problems while analyzing the winning projects on Lisbon Parishes by topic.

2. LITERATURE REVIEW

2.1. HISTORY AND CONCEPTUAL MODEL OF PARTICIPATORY BUDGETING

The origin of participatory budgeting (PB) goes back to 1989 in Porto Alegre, Brazil. The primary purpose of this innovation was to solve local problems more efficiently. The design's modification was adopted gradually in three macro-historical stages, being the first since the implementation until the mid-1990s, and that is when Porto Alegre was mentioned as a learning example, which would be referred to several times through the years (Falanga & Lüchmann, 2020). In the second phase, until the beginning of the 2000s, other countries in Latin America adopted it. This expansion's third and last stage began after the end of the last, spreading all over the countries under different conditions. The most similar case to the Brazilian city is Zaragoza, Spain, because it limited the participation to only choosing priorities and representatives since 2017, the year of PB's implementation (Manes-Rossi et al., 2021).

Participatory Budgeting is a democratic practice with a higher level of diffusion internationally. The citizens are the ones who have higher knowledge of what will benefit them individually. It is a matter of interest for the government to evaluate which programs will benefit the community in the future, bearing in mind the efficiency level of PB and decreasing corruption, especially in developing countries (Quispe et al., 2022). While paying attention to the citizens' voices, the government plays a vital role in improving the performance of PB (Sandi et al., 2021). PB enables the creation of an open public forum for discussion and debate, which can be favorable in long-term consequences on citizens' political commitment and the democratization of business administration (El-Karmaoui, 2019).

Using a benefits relationship with citizens in the long term benefits relationships with citizens, but citizens also identify more with their towns (Ślusarczyk & Herbuś, 2020). Many factors must be considered to measure the impact on the analyzed cities, but each city has particular characteristics. Hence, the conditions for PB have their specifications, and for the different analyses, it is shown that different communes applied different regulations for the same levels of participatory procedure (Binda & Niedziela, 2021). The amount spent on the PB also varies; for the different,t budgets is commonly calculated by a percentage of the municipal budget, as, for Krakow, on average is 0.5%, which is decided by 5 to 7 percent of residents (Zawadzka-Pąk, 2022), then the budget is divided into districts and other elections are taken (Peters et al., 2022). This is done differently depending on the PB agreement; for example, Paris splits the allocated budget into 20 districts, and then, after the voting, an algorithm is run to maximize social welfare (Hershkowitz et al., 2021).

Throughout the world, there are several differences in PB implementation. However, despite those, all have planning and participation as a focus to lead to citizen empowerment as finality, contributing to a better resource allocation and management of the municipality budget. The reasons for the implementation may vary, such as to decrease corruption in American Latin, decrease patronage in China, or disaffection in Europe (Quispe et al., 2022), or even to specific types of participation, such as for precarious housing in Algeria, working as a pilot to broaden to social environment and improvement of spaces (Yelles & Khalfallah, 2023). Spain has also, besides PB, used other tools to lead to citizen scrutiny

and answerability (Thompson, 2021). Although all of them may have different reasons, they should be solving the citizen complaints where the PB was applied. For that reason, the study will lead to an answer: Is participatory budgeting solving the complaints of people who live in Lisbon? – I will focus my study on Lisbon, so some results cannot be generalized worldwide but will precisely answer Portugal's capital question.

2.2. Participatory budgeting Implementations and success analysis

Across Europe, there are several cases where the mechanisms and procedures applied differ from the city and government, while all of them are trying to create their own unique PB (Binda & Niedziela, 2021). Some conditions are common, such as having a well-structured process with a pre-defined duration, processes run by neutral facilitators, the participants having complete and unrestricted access to information, and small groups being the primary setting for participant engagement (Bobbio, 2019). One of the most important sources of information is knowledge within the citizens because it will critically impact the decision-making process to complete public tasks (Zawadzka-Pąk, 2022). However, the knowledge must be complemented by the influence of the city council's substantial power to shape policies (Falanga et al., 2021). PB can work as a multi-stage procedure consisting of education campaigns, preparation of submissions, verification, final submission, examination, voting, implementation, and informing (Zawadzka-Pąk, 2022), or simpler, having a submission with discussion, followed by discussion, and at least the votation (Bednarska-Olejniczak et al., 2020). Generally, voting rules are created to maximize specific outcomes. The most common are social welfare or the total utility voters receive from the result. In PB, two projects are being voted on with opposite ideas; in those cases, to guarantee fairness in the election, a share of the voter is on the work put in to fulfill the voter's needs instead of winning the project with higher votes (Maly et al., 2022). In order to prevent the risk of crowdsourcing to the PB, the voting should be comparable to the local government election, or at least close to it, and for this, many more residents have to be involved (Zawadzka-Pąk, 2022).

2.3. Models Comparisons

One of the most significant limitations of PB is the risk of having a lower participation level - called 'stage zero' - which happens in the first years since the application (Binda & Niedziela, 2021). Another constraint is the rejection of projects regardless of their usefulness, which can be related to the lack of experience of candidates, poor argumentation, or even subjective evaluation of the committees. To improve the last constraint, the process could be divided into two parts: first, the evaluation should indicate errors or ambiguities, and second, after the corrections are made. The number of promising projects, such as awareness, would improve (Binda & Niedziela, 2021).

A method that has proved famous for maximizing the voters' utilities is NASH, whose purpose is to increase the product of utilities for the project selection (Rosenfeld & Talmon, 2021). Also, management dedication and budget integrity were positively related to Participatory Budgeting (Ayu Fatimatus Zahro

& Dinik Fitri Rahajeng Pengestuti, 2022). Both participations should be made Online or Presential (Institute of Governance and Policy Analysis, University of Canberra, Australia & Bhusal, 2020; Sroka et al., 2022; Zawadzka-Pąk, 2022; Zolotov et al., 2018). In the Lisbon case, in the last considered edition, more than 93% was made online, proving that it is the one that fits better than a citizen, although the possibility of having both is guaranteed. Poor citizen participation in the e-PB project correlated with low e-democracy outputs (Mærøe et al., 2021). One crucial matter of success is the promotion of this measure, and this can be guaranteed with a combination of factors such as the use of social media (posts and comments), interactive maps, and Webinars (Live and Broadcast), and at least having both traditional and electronic voting (Zawadzka-Pąk, 2022).

Different PB implementations showed that the expression of politics positively affects the citizens' participation, guaranteeing an influential path to citizens' participation (Legacy, 2017). Depending on the specific project and the amount of money needed, the stakeholders related become very important to complete the projects that can be higher than the limit imposed by the PB, so both the Public and Private Sectors work together in this type of large-scale infrastructure (Legacy, 2017). It has been proven that there is a correlation between the amount of money spent on civic projects and participation (Ślebocka & Kilanowski, 2021; Sroka et al., 2022).

The conclusion is that there are no mandatory combinations of participation types, meaning that a “pure” PB model does not exist. A hybrid PB is a hybrid PB because the most intriguing configurations are in between (Bobbio, 2019). The statement on the non-existing pure PB model happens because each city/country implementation is related to the current situation and purpose for implementation. Therefore, the dissemination will be different for the specifications. Portugal has been using both presential and online participation regarding proposals and votation and also has a strong involvement of teenagers in those processes, implemented directly in the schools. Another topic that differentiates the PB in Portugal is that three levels of government are involved with the voluntary adoption of this process: the Republic Government, two regional governments, and a considerable amount of local governments (*Atlas PT v2.0_compressed.Pdf*, n.d.).

2.4. Citizen Complaints

Citizen complaints drive proactive improvements, optimizing public funds by guiding strategic investments and ensuring emergency preparedness based on identified high-demand areas. The complaints’ source can be online, presential, by specific groups, or by a simple form.

This will lead to citizen reports analysis to understand the features of local community problems, suggesting that using data to solve regional problems can help analyze regional variations in local community issues by including data from other towns (Kano et al., 2019). Addressing a range of citizen complaints will encourage more locals to participate in the policy-making process and support locally managed, sustainable governments (Lee et al., 2019). Different local sociocultural factors, such as age, gender, economic standing, and percentage of immigrants living in different regions, influence policy needs, necessitating local governments' provision of specialized services (Lee et al., 2019).

All kinds of governments implement policies and measures that should be applied to the citizen complaints affecting them daily. The data on civil complaints might be used in policy recommendations to eliminate social concerns and customize local government policy goals (Lee et al., 2019). A natural-feeling approximation of local circumstances throughout the city might be helpful for legislators, business owners, and other social actors. These fundamental indexes could also provide valuable data to assist local decision-making (Kumar & Kaur, 2020). However, despite citizen engagement being essential to make cities sustainable and livable, citizen perspective is often ignored in the intelligent city discussion (Zhu & Alamsyah, 2022).

Applications and other tools, such as internet groups, could play an essential role in Citizen complaints; an excellent example for Portugal is ”nomeubairro,” where people can specify the location and category and if it is already solved. App’s exterior attributes, associability, communicability, addressability, and sensibility, are critical to citizen empowerment and contribute to increased political, social, and psychological empowerment. This last is associated with internal qualities, which increase citizens' sense of control through features like memorability, traceability, and programmability, typically leading to happier with the government and the App empowered residents (Zhu & Alamsyah, 2022).

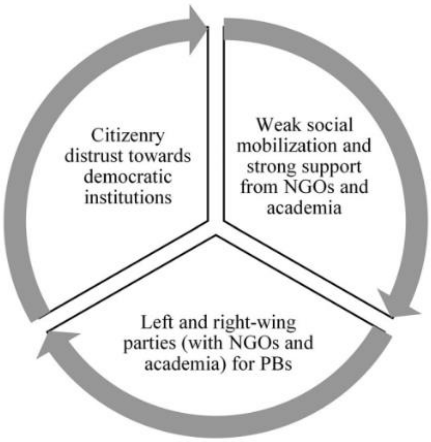
Using citizen-centered tactics can enable enterprises to increase service delivery rates, boost citizen use of public facilities, boost profitability, and raise living standards (Kumar & Kaur, 2020). Therefore, the citizen-report mechanism in local governments may help clarify the patterns of problem occurrence and provide quick solutions for specific field issues despite the problem classification not always being designed to represent real-world trends in occurrence(Kano et al., 2019).

Topics such as trash, parks and green spaces, building and construction, sports facilities, urban disturbance, cleaning, collection, and installation were alternated between primary and secondary needs regarding citizen complaints (Kumar & Kaur, 2020). The outcomes of the prioritization of the citizen problems process show how the public feels about various urban-related issues and determine which areas are most impacted; therefore, those complaints are assumed to be community problems that may be solved with the implementation of participatory budgeting.

3. THE CONTEXT OF LISBON AND PORTUGAL

In 2008, Portugal was affected by the financial crisis, which strongly affected the country's economy and caused structural modifications, starting with the global crisis and continuing strongly from 2012, which conducted restrictions. These restrictions led to innovation, and new mechanisms in that context appeared, such as PB in the same year, becoming the first PB implemented on a municipal scale by a European capital – this innovation had a significant impact on the dissemination of PB. Since it was one of the most affected countries, external help was needed, and it was applied by the International Monetary Fund and European Bank, which had a significant impact. Those also reached PB, which had to apply cuts to disposable value from 5 million to 2.5 million. Since the value change in 2012 until now, the value allocated has not suffered any change. Despite that, an award for "Best 2020 Participatory Practice" and "Sustainability 2021" has been given to Lisbon PB.

All the information on the PB of Lisbon is on the website https://op.lisboaparticipa.pt/pt/op, which has information on all the proposals, projects, and reports by year. The first European capital to experiment with Participatory Budgeting was Lisbon. As in many other countries, it was implemented by leftist parties and associated with a paternalistic approach to Participatory Budgeting. Before Lisbon, the first PB in the country was, in fact, in a small village near the capital, Palmela; in 2002, the communist party in the government implemented that. In Portugal, the primary context for dissemination, as we can analyze, bellow, on 1. Sociopolitical context of the dissemination of PBs on 2008, Portugal below, was the citizenry's distrust of democratic institutions, low social mobilization, and the availability of both left and right-wing parties to support it (Falanga & Lüchmann, 2020). In 2019, Portugal was the European country with the highest rate of local participatory budgeting implemented outside of a national legal framework (Falanga et al., 2021), and only the municipality can decide whether to implement it according to the political agenda. For this study, the location applied was, more precisely, Lisbon's parishes between 2014 and 2017. The leading information regarding those years and before analyzing the PB history in Lisbon Parishes shows the annual Lisbon PB analysis on Table 1.



1. Sociopolitical context of the dissemination of PBs on 2008, Portugal

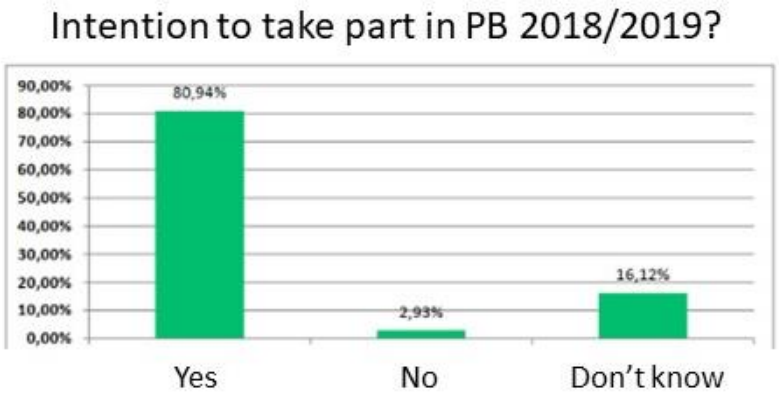
Table 1. Annual Analysis Lisbon Participatory Budgeting
Source: 2018 Participatory Budgeting Report

Edition	Proposals (Presential)	Presented Proposals	Votation Projects	Winning Projects	Votes	Value (€)
2008	0	580	89	5	1101	€ 5,130,176
2009	0	533	200	12	4719	€ 4,817,492
2010	492	927	291	7	11570	€ 4,500,000
2011	417	808	228	5	17887	€ 4,600,000
2012	288	659	231	15	29911	€ 2,375,000
2013	172	551	208	16	35922	€ 2,475,000
2014	298	669	211	13	36032	€ 2,428,000
2015	125	481	189	15	42130	€ 2,500,000
2016	210	562	182	17	51591	€ 2,480,000
2017	29	434	128	15	37673	€ 2,500,000

Despite winning awards in 2021, low participation suggests the city council's limited capacity to utilize past information or selective project acceptance policies (Falanga et al., 2021). It raises questions about whether participatory budgeting effectively addresses complaints from Lisbon residents.

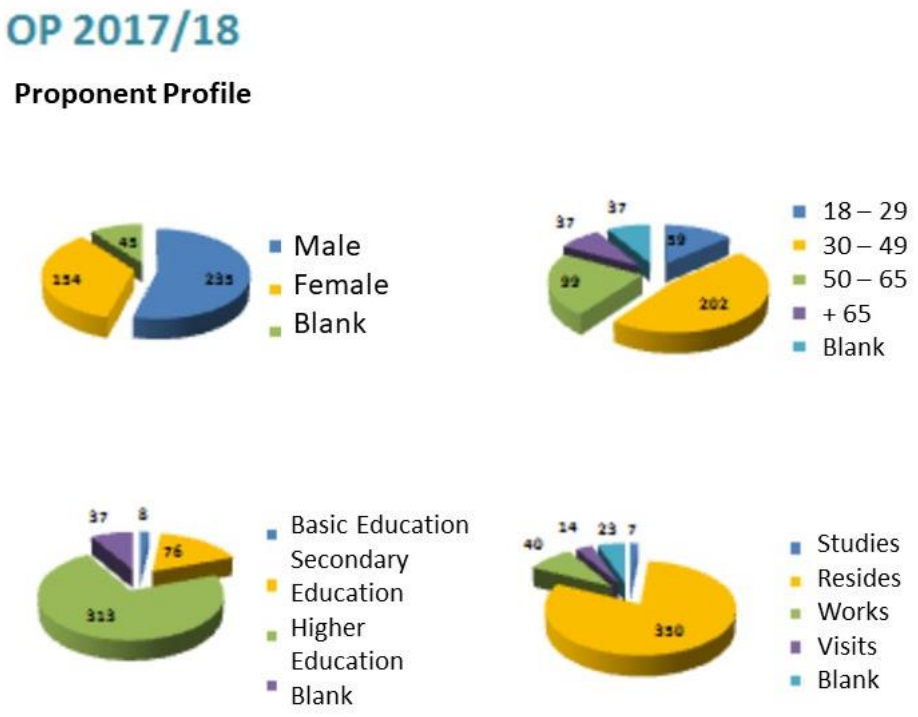
Between the analysis period from 2014 to 2017, 60 Projects won, guaranteeing 167.426 votes. Those are distributed in 11 topics: Green Structure, Environment and Energy; Culture; Road Infrastructure, Mobility and Transport; Economy and Innovation; Housing and Local Development; Education; Administrative Modernisation; Urban Regeneration and Public Space; Security and Civil Protection; Sport; Urban Hygiene; Social Rights; and Lifelong Learning. As stated before, Portugal appears as an example of democratic innovation, contrasting the theory that these advances are only standard in the north of Europe instead of the South (Goulart & Falanga, 2022).

While considering only online participation to guarantee a general overview of the citizen opinion, Competence, Impact, Meaning Self-Determination and Habit positively influence the intention to participate (Zolotov et al., 2018). As we can see below 2. Answers regarding future participation on 2018, the availability to participate in the PB in Lisbon for the following year is 80,94%, reflecting Habit's importance. The intention to not participate in PB for the following year was below 3%, and the remaining belongs to the people who do not know if they will participate, 16,12%. Participation, measured by the number of votes, reflects the increase in importance of PB (Lewandowska & Chodkowska-Miszczuk, 2022).



2. Answers regarding future participation on 2018

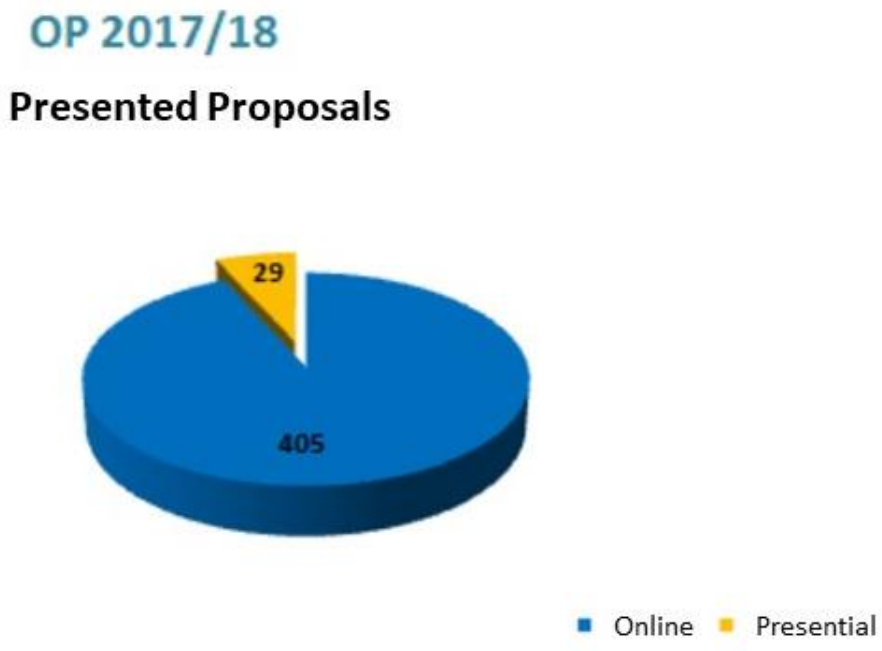
What would capture much attention and contribute to the credibility of PB are the criteria of project selection, why a specific project should be chosen over others, and who will benefit from that specific measure (Legacy, 2017). To guarantee citizen participation, information has to be available, residents must be kept up to date on the issues' development, and an evaluation of public institutions must be accessible for Channels, Outreach, Legal, and Organisational Frameworks (de Soysa, 2022). Another critical question stands for – Who are the participants? – This is relevant because it can be unrepresentative of the population and is, instead, controlled by specific groups, and if that happens, PB will serve those groups' interests (Godwin, 2018; Zawadzka-Pąk, 2022). PB is proven to have an empowerment responsibility for younger citizens engaging in decision-making (Augsberger et al., 2019).



3. Proponent Profile on 2017 from Lisboa Participa report

The above visualization, 3. Proponent Profile on 2017 from Lisboa Participa report, shows the proponent profile regarding Gender, Age, Education, and the current relations within the city. With this analysis, we can assume that most participants are males between 30 and 49 years old, with Higher Education, primarily residing in the city. The large numbers of participants do not represent most people's views, and the less fortunate people's participation is not steady over the long run, becoming less socially sustainable, indicating the power of groups – Elites (Frenkiel, 2021; Saguin, 2018).

The complaints from decentralized meetings lack personal information about participants, which is not the case for projects where the type of profile participating can play a crucial role in determining the level of satisfaction with the PB, thanks to the current distribution of the citizens through classes. This also holds for the Lisbon scenario, where the typical participant in the most recent year under consideration was a male living in Lisbon between the ages of 30 and 49 who held a university degree and where there is a wage correlation between educational attainment and salary (Ferreira et al., 2021). The presented proposals are mostly done online, with little presential despite their importance – this is shown on 4. Type of participation in 2017 from Lisboa Participa report 2017/2018, below and Table 1. Annual Analysis Lisbon Participatory Budgeting



4. Type of participation in 2017 from Lisboa Participa report 2017/2018

Source: 2018 Participatory Budgeting Report.

4. METHODOLOGY

4.1. RESEARCH METHODOLOGY AND ANALYTICAL FRAMEWORK

This structured analytical framework, present on Table 2. Analytical Framework and Methodology, combines quantitative analysis, data visualization techniques, and ethical considerations to understand Lisbon's participatory budgeting dynamics comprehensively; in the table below, the scheme is presented to facilitate the analysis intuitively. The sequential steps ensure a systematic examination of the relationship between project applications, complaints, and the factors influencing the success of PB initiatives.

Table 2. Analytical Framework and Methodology

Data Collection	Web scraping for proposals and projects.	
	I am gathering complaints data from Lisboa Participa and Observatórios Lisboa.	
Data Analysis Techniques	Quantitative Analysis:	Descriptive statistics, frequencies, and means.
		Algorithmic approach to assess the influence of proposal prices on winning projects.
	Visualization Methodology:	We use graphs, charts, maps, and summary tables to represent complex data relationships visually.
		Categorization of PB projects using a taxonomy for systematic analysis.
Relationship Analysis	We are examining the relationship between project applications and complaints in PB.	
	Consideration of participant complaints and proposals.	
Factors Influencing PB Success	Participant Type and Profile:	Analyzing the significance of diverse participant profiles.
		Correlation between participation levels and accurate representation of community issues.
Variable Importance Assessment	Analytical analysis supplemented by quantitative data analysis.	
	Algorithmic approach to identify crucial variables impacting winning projects.	
Research Design	Comprehensive case study approach.	
	Examination of themes, parishes, years, and winning projects.	
Participant Target	Inclusion of individuals residing in Lisbon participating in meetings or submitting proposals.	

Ethical Considerations	We are ensuring non-maleficence and fairness during the thesis development.
	Anonymization of confidential data obtained from decentralized meetings.
Data Confidentiality	Acknowledgment of confidential and sensitive data from city council meetings.
	Anonymization of data while adhering to the thesis's purpose.
Objective Assessment	Determine the effectiveness and challenges of PB initiatives.
	Evidence-based insights through statistical analyses and data visualization.
Limitation Recognition	Recognition of limitations in data, such as non-representative complaints or potential bias.
	Commitment to inclusivity in data analysis, avoiding exclusion of segments.

4.2. VARIABLES AND PROCESSING FRAMEWORK

Independent variables: Participation, Topic selection, and Votation on the participatory budgeting process.

Active citizen involvement is crucial for the success of participatory budgeting, and higher participation often leads to increased legitimacy and satisfaction with the budgeting process. Choosing topics influences the relevance of the participatory budgeting process; aligning topics with community concerns can enhance engagement and satisfaction. The voting process reflects community preferences, and understanding how the community votes provide insights into their priorities, potentially affecting the success of participatory budgeting.

Dependent variables: Success of participatory budgeting, match between the topic on complaints and winning projects (improved service delivery, increased civic engagement).

Measures the overall effectiveness of the participatory budgeting process. Success is defined by the winning projects for the topics on specific parishes with higher complaints, and assessing how well winning projects address community complaints helps determine the impact and relevance of the participatory budgeting outcomes. Successful PB should result in projects that improve public services, addressing specific community needs. If winning projects align with community concerns, it can boost civic engagement by fostering a sense of community ownership and responsibility.

Control variable: Number of citizens living by parish and socioeconomic status.

Community size can impact the dynamics of participatory budgeting. Larger communities may have different challenges and preferences compared to smaller ones. The community's economic background can influence participation levels and project priorities. Considering socioeconomic status as a control variable helps isolate its impact on the study variables.

4.3. RESEARCH DESIGN

This section outlines the research design for our study on Participatory Budgeting in Lisbon Parishes, and therefore, the research design with all the processes used are mentioned below Table 3. Study Overview - Participatory Budgeting in Lisbon Parishes. We focus on gathering and analyzing complaints from decentralized meetings and projects by Lisboa Participa. We meticulously select variables, including participation, topic selection, and voting, building on prior correlations like the relationship between money spent on civic projects and participation.

Table 3. Study Overview - Participatory Budgeting in Lisbon Parishes

Data Collection	Complaints gathered from decentralized meetings in Lisbon.	
	Projects from Lisboa Participa.	
Data Analysis	Quantitative Analysis	Classification analysis to explore factors impacting complaint resolutions.
	Supporting Analyses	Graphs and Data Visualization
		Correlation analysis for meaningful insights.
	Causality Exploration	Patterns detected are assumed to be causality.
	Variable Selection	Forward feature selection.
		Variables: Participation, topic selection, voting.
		Previous correlation: Money spent on civic projects and participation.
Dependent Variables	*Success of Participatory Budgeting - Match Between Complaint Topics and Winning Projects*	We have improved service delivery.
		It increased civic engagement.
Limitations	*Geographic Limitation*	Findings specific to Lisbon parishes.
	Contextual Limitation	It is not universally applicable due to diverse PB model implementations.
	Variable Limitation	Uncontrolled factors in complaint resolution.
	Temporal Limitation	Data static represents 2013 only.
	Topic Categorization Limitation	It is not exhaustive and may not cover all resident concerns.

4.4. Data Preprocessing

4.4.1. Lisboa Participa

Data web was scrapped from the website regarding all proposals (2014-2017).

This dataset, which comes from the Lisbon Participatory Budgeting website (https://op.lisboaparticipa.pt/edicoes-anteriores), has added the information for the remaining years until 2020/2021, where it has stopped because of Covid-19. Since then, no updates have been made. The Lisboa Participa website presents information regarding proposals and projects, where the projects are the winning proposals. So, in this situation, first, an application regarding a specific task is presented. If that particular one wins, it will become a project where a more intensive analysis is performed, and what was before a proposal can now be implemented if it wins the project selection. This data consists of the application of average citizens regarding a specific topic and parish. As stated, the years for the analysis are between 2014 and 2017, 4 years in total. As shown below, the Proposals dataset is more straightforward than the Projects, where more columns exist, such as the number of votes and the value. The columns are ID_proposal, ID, Title, Topic, Parish Group, Proposal, and Year. One particularity of this dataset was that an application could only have one topic but could be related to one or more parishes. However, some have no topic or parish, as stated below, on the Table 4. Missing Values, bellow.

Table 4. Missing Values

Dataset	No Topic	No Parish
Proposals	1657	1062
Projects	10	117

The Projects Dataset has multiple columns: ID, ID_unique, Year, Votes, Value, Text, Topic, Parish, and Winning_Projects. Despite analyzing the data, no errors were found; therefore, no correction was made. A period selection was applied for the analyzed years 2014 – 2017; all topics were binned. Since both proposals and projects could have one or more parishes by line, the proposal/project was duplicated by applying only one parish for each.

4.4.2. City Council complaints from decentralized meetings in Lisbon

Data regarding the citizen complaints between the years analyzed (2014-2017).

This dataset had real complaints from decentralized meetings, where the information on the Parish, topic, and date were the most exciting features to achieve results. While comparing with the Lisboa Participa dataset, the particularity was the opposite, where each topic could have more than one theme by complaints and only 1 Parish by complaint, although having one complaint without any topic.

The dataset has columns regarding the Parish, Date, Lives_Parish, Parish resident_No, Subject, Topic_A, Topic _B, Topic _C, Topic_D, Topic_E. This dataset had some errors, such as typos and duplications on topics that were corrected. A taxonomy association was used to categorize the data to match the topics on PB (Proposals and Projects) and Complaints. This approach can be tracked below on Table 5. Topic association for complaints - the association was done manually. When no rationale was detected, a deep dive into the topics was performed to match them, following the association below. Regarding the specification of this dataset, having one or more topics by each complaint, and as the proposals/projects dataset had already the topics binned, the same procedure was applied, and a variable Number_Topics was created.

Table 5. Topic association for complaints

ID	Topic PB EN	Topic PB PT	Topic Complaints
GSEE	Green Structure, Environment, and Energy	Estrutura Verde, Ambiente e Energia	Green Structure; Energy
C	Culture	Cultura	Culture
RIMT	Road Infrastructure, Mobility and Transport	Infraestruturas Viárias, Mobilidade e Transportes	Mobility and Traffic; Parking; Public Transport
EI	Economy and Innovation	Economia e Inovação	Supply and Markets; Planning
HLD	Housing and Local Development	Habitação e Desenvolvimento Local	Housing; Local Development; Urban Planning
E	Education	Educação	Education
AM	Administrative Modernisation	Modernização Administrativa	Municipal Companies; Human Resources; Information Systems; Proximity Structures
URPS	Urban Regeneration and Public Space	Reabilitação Urbana e Espaço Público	Urban Rehabilitation; Public Space; Municipal Works; Social Services; Heritage
SCP	Security and Civil Protection	Segurança e Proteção Civil	Security; Civil Protection; Civil Protection; Tourism
S	Sport	Desporto	Sports
UH	Urban Hygiene	Higiene Urbana	Urban Hygiene
SR	Social Rights	Direitos Sociais	Social Rights; Noise
LL	Lifelong Learning	Aprendizagem Ao Longo Da Vida	

4.4.3. OBSERVATÓRIOS LISBOA

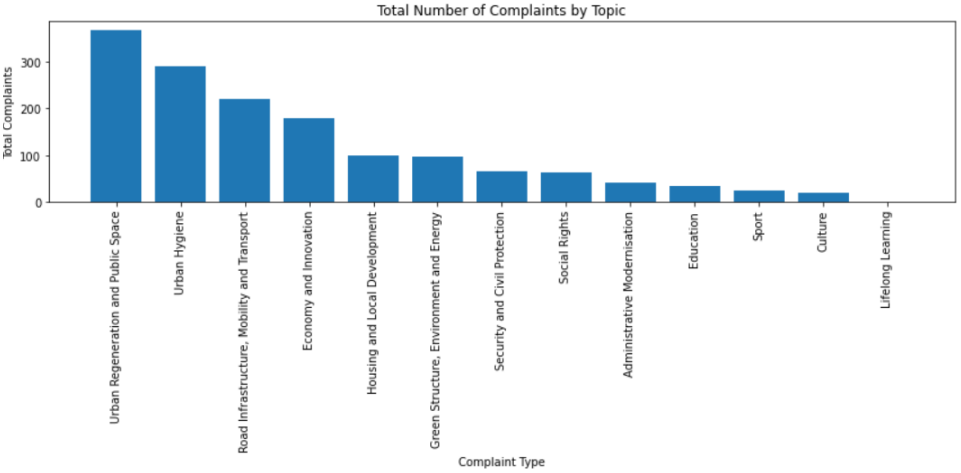
Socioeconomic data information on Lisbon's parishes between the years analyzed (2014-2017).

Quantitative data will enrich the modeling and socioeconomic information, showing the parishes' similarities. Variables are: Parish, Number_Residents, No_degree, Degree, Do not write and read, Write and Read, 1st Cycle, 2nd Cycle, 3rd Cycle, High School, Pos High School, Higher Education. After dataset analysis, a combination of data was performed to combine only one extensive dataset and different types of information on the different datasets. Complaints, instead of having 1 line for each complaint, were transformed into one line by each Parish, and the columns were the topics, where the sum of the combination of the parish and respective topic was the result. After that, a merger between the complaints and Observatórios Lisboa was performed by the parish, and after that, another merger, now between the projects, again by the parish. The overview of the topics for both Proposals and Projects is presented below Table 6. Overview of the topics.

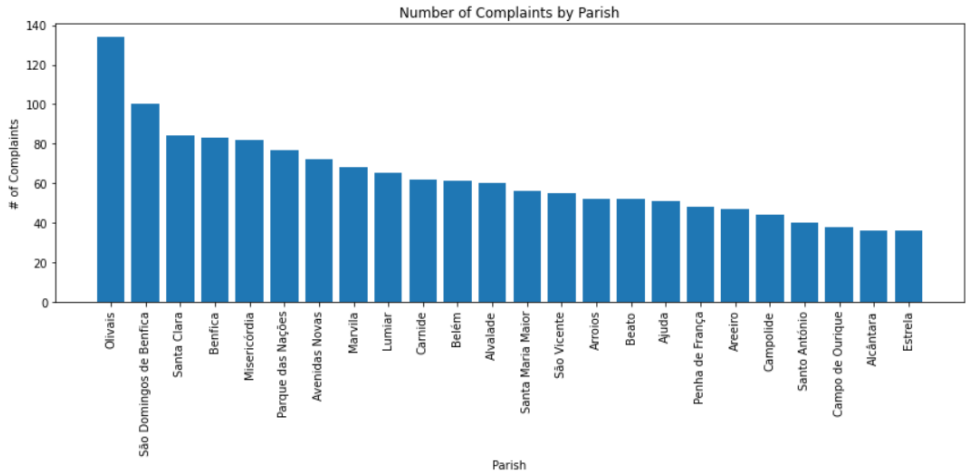
Table 6. Overview of the topics

	Proposals		**Projects**		
Topic	**T**	**W**	**T**	**W**	**Votes**
Green Structure, Environment, and Energy	399	318	232	15	66,279
Culture	153	60	53	10	19,521
Road Infrastructure, Mobility and Transport	346	178	141	9	25,343
Economy and Innovation	88	69	62	1	24,977
Housing and Local Development	43	24	17	1	2,927
Education	68	44	36	5	9,457
Administrative Modernisation	16	12	12	3	1,391
Urban Regeneration and Public Space	195	98	80	8	19,673
Security and Civil Protection	14	1	1	0	1,525
Sport	75	35	33	7	21,591
Urban Hygiene	63	37	18	1	1,715
Social Rights	59	22	12	1	1,713
Lifelong Learning	16	3	3	0	542
No Topic	616	28	10	0	0

Regarding the distribution of participation, the degree to which citizens are involved in the participatory budgeting process is measured by the number of citizens who send proposals. Level of the impact of votation: The degree to which citizens can vote on the final budget projects, measured by the number of citizens participating in the voting process. The standard variables for the categories with the higher resolution rate are Votes at 40% and Values at 11%. Urban Regeneration Public Space and Urban Hygiene are the categories with a higher percentage of complaints. The parishes with higher complaints are Olivais and São Domingos de Benfica. Lastly, the resolutions of complaints: The degree to which citizen complaints about local government services are resolved, measured by the number and topic of resolutions to complaints divided by the proposals. The analysis of the complaints of both Topic and Parish is presented below on both bar charts 5. Total Number of Complaints by Topic and 6. Number of complaints by Parish.



5. Total Number of Complaints by Topic

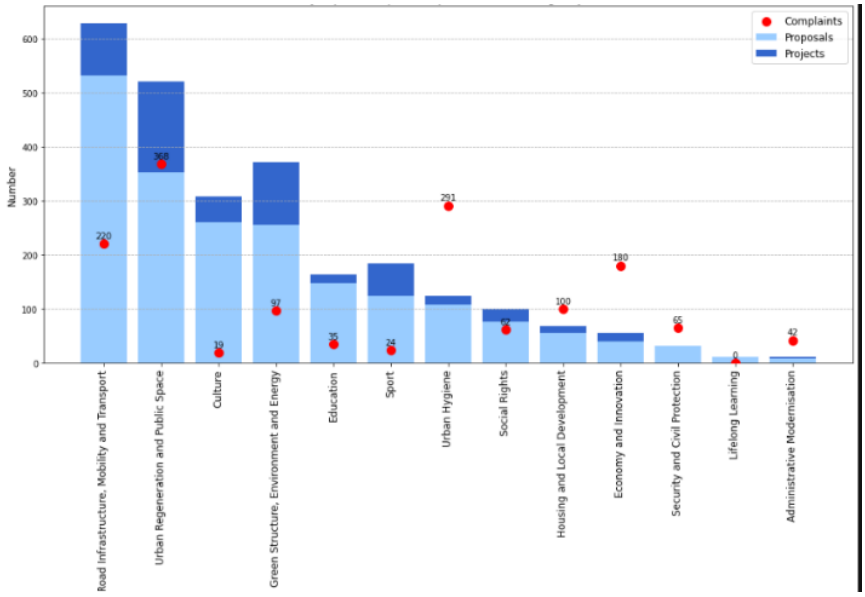


6. Number of complaints by Parish

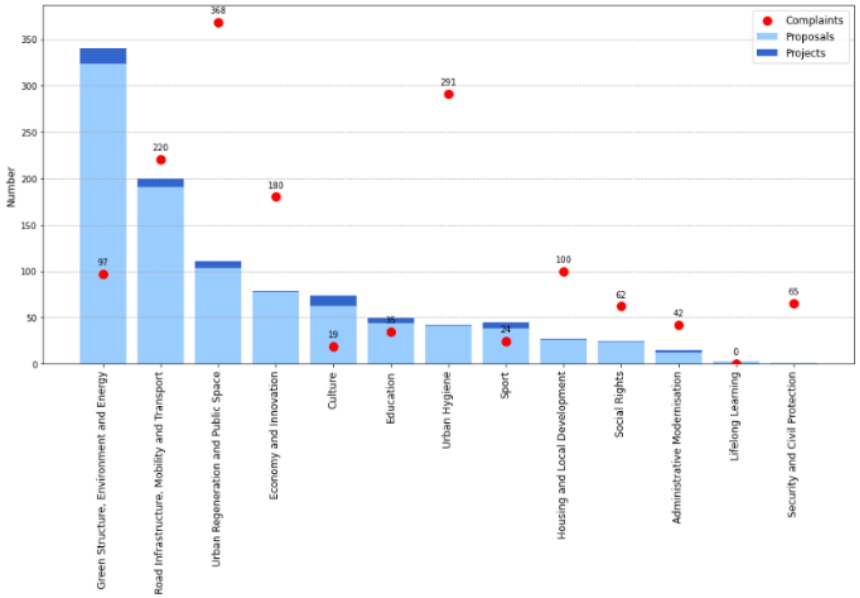
5. RESULTS

5.1. RESULTS AND FINDINGS

The years selected for the analysis are between 2014 and 2017 to match the years of the complaints of decentralized meetings, an approach for the last four years of the interval. This analysis of the number of complaints, proposals, and projects by topic is presented below. 8. Correlation Matrix between Lisbon Participa projects and Decentralized Meetings' number of complaints, merged by Parish Shows all complaints and proposals and 10. Correlation Matrix Lisbon Participa projects filters the accepted proposals and winning projects.



7. All Complaints, Proposals and Projects (2014 – 2017)



8. Accepted Proposals and Winning Projects Complaints (2014 – 2017)

To perform a quantitative study, first understand the variables, treat all data, create new features, put the dataset in the correct format, and run the first algorithm. The methodology chosen has appeared to be effective in analyzing the success of solving the rate of complaints within their relationship. The research was done systematically by crossing the winning projects of PB and the city council complaints based on the taxonomy model created by categorizing the different topics in different branches. By crossing the analysis by Parish between the topics the population was complaining about and the projects that were implemented, I have used a division between the number of complaints and the projects one by parish and then used a mean by the region to understand the results of the success of it.

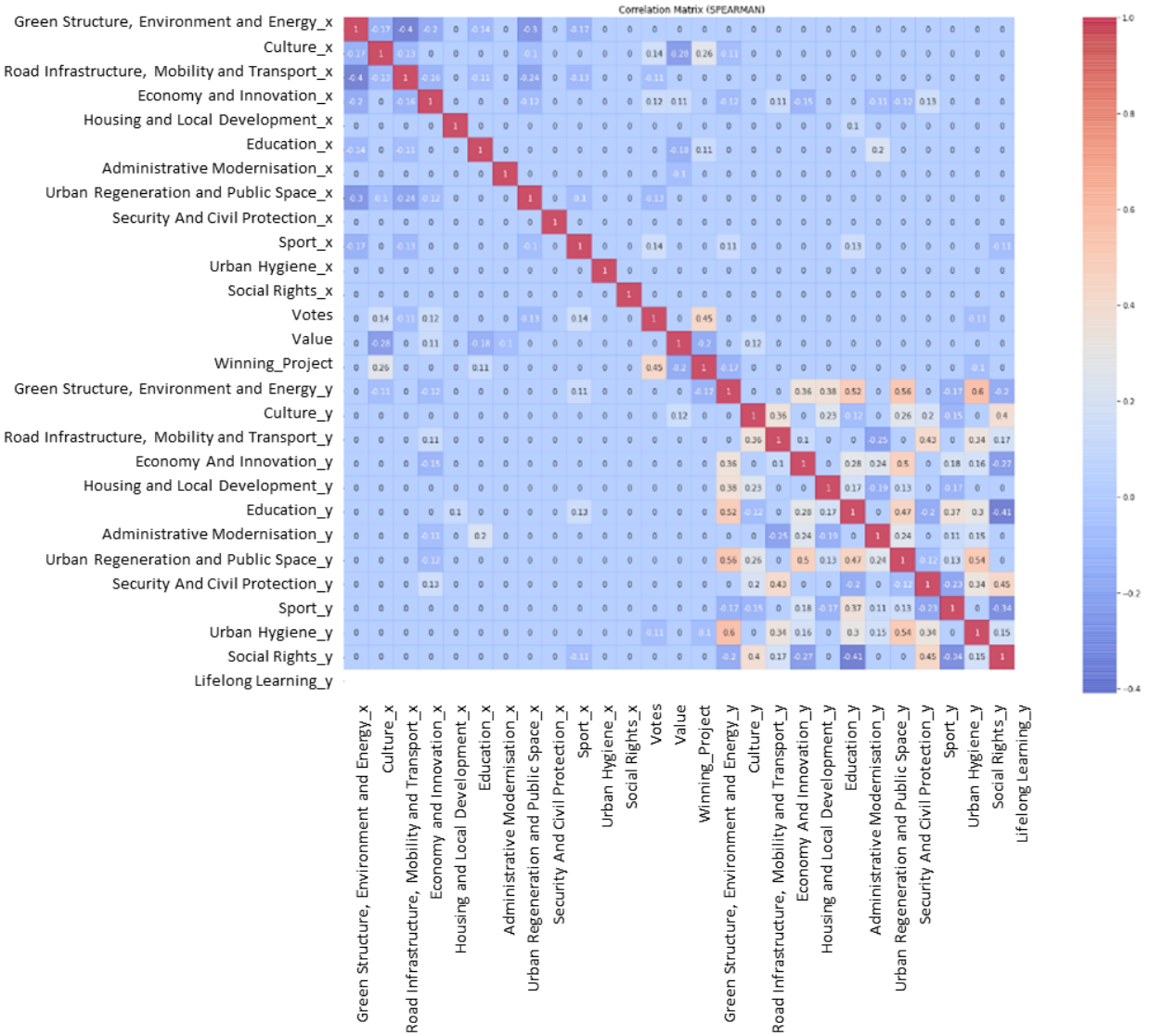
The citizen problem prioritization process results indicate the public's sentiments regarding different urban-related issues and identify the areas most affected. As a result, the complaints are presumed to be community issues that could be resolved by implementing participatory budgeting. As we can see above, with all the information regarding the winning proposals, winning projects, and the number of complaints by topic, it is clear that there is no direct relation. Urban Regeneration and Public Space are highlighted with the most significant complaints (community problems). However, the results do not directly relate to the winning proposals and projects, despite being in third place regarding winning proposals/projects. Another similar case is Urban Hygiene, highlighted as the second with a higher number of complaints but in seventh place regarding the number of winning proposals/projects. On the other hand, many winning proposals and projects are presented for Green Structure, Environment, and Energy, and a low level of complaints is presented. The topics with higher relations within the winning proposals and projects are road infrastructure, mobility, and transport.

Regarding the modeling, a random forest classifier was applied for both Proposals and Projects to predict the acceptance or winning for the analysis of the topics for the first, and the results achieved are below. The Table 7. Algorithm result**Error! Reference source not found.** below shows the result of the algorithm that performed better during the analysis – RFC. This was performed to enrich the knowledge about the relation between the topic selected and the results. The exact process was applied regarding the winning projects, but different results were achieved. Despite Carnide parish, there were different results for it. The relation between the winning project and the topics they were presented is low; only Culture and Education had a significant despite low correlation. Votation and value show a significant correlation with winning projects.

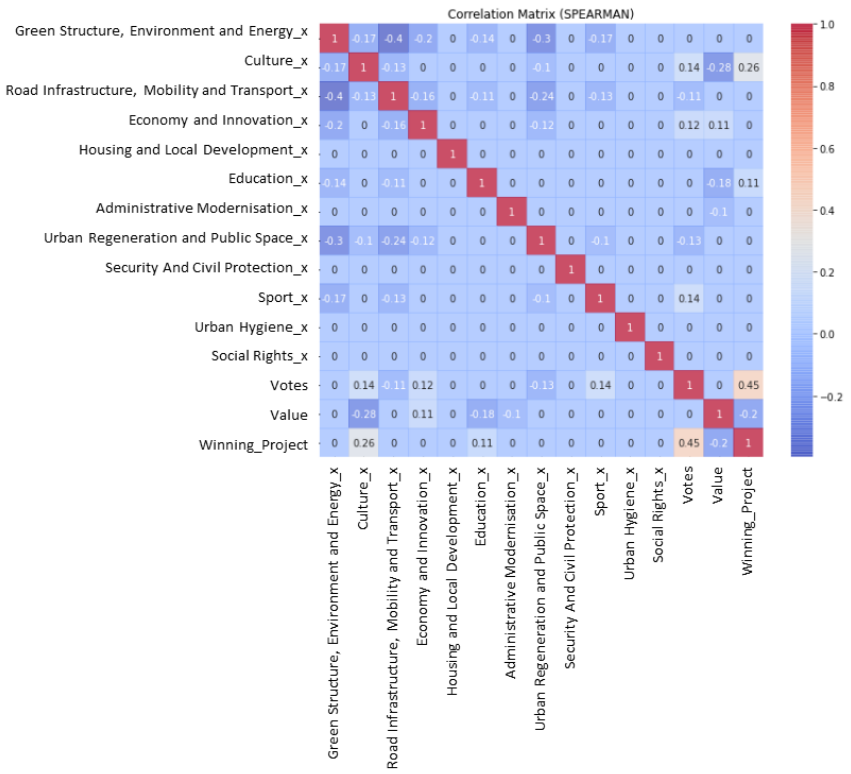
Table 7. Algorithm result

	0	**1**	**accuracy**	**macro avg**	**weighted avg**
precision	96%	100%	96%	98%	96%
recall	100%	67%	96%	83%	96%
f1-score	98%	80%	96%	89%	96%
support	92	12	0.961538	104	104

Below is the correlation between all variables, where a relation between the projects presented and the complaints was unclear and did not significantly impact it. Regarding the algorithm, the variables that impacted the most in achieving good results to predict whether a project would be a winning project were value, number_votes, number_complaints, number_residents, write, and read. Besides those, multiple variables were tried to be added, and all the combined dataset is presented in the annexes. While selecting the variables, a correlation was performed, which had the information on Projects and the number of complaints from decentralized meetings - 8. Correlation Matrix between Lisbon Participa projects and Decentralized Meetings' number of complaints, merged by Parish. To better analyze the variables only from Lisboa Participa, another correlation was performed - 10. Correlation Matrix Lisbon Participa projects - a simplified overview of the correlation matrix without considering the complaints from decentralized meetings.

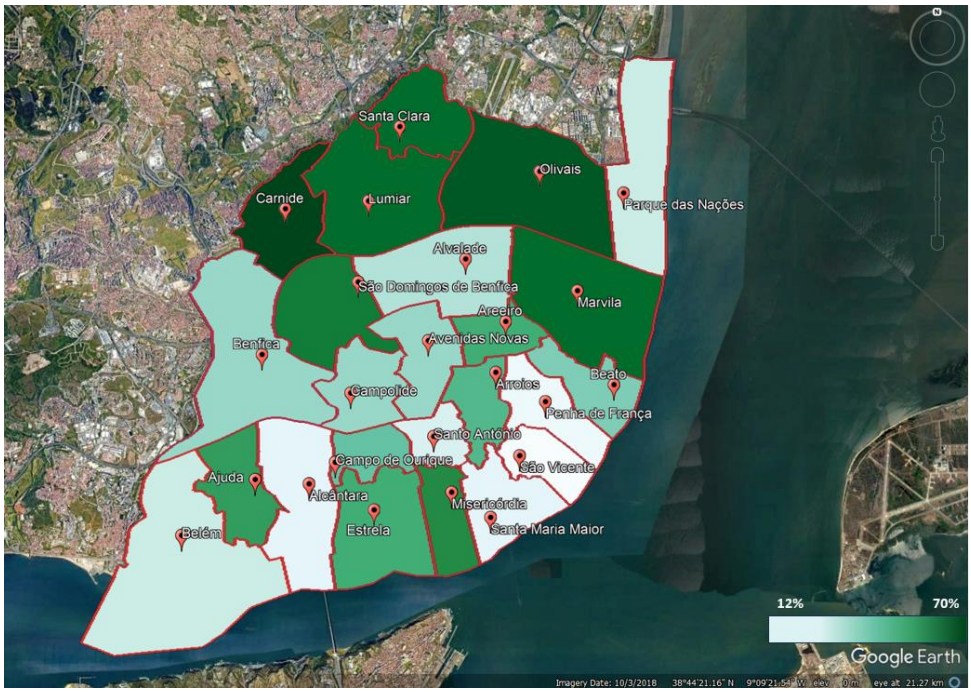


8. Correlation Matrix between Lisbon Participa projects and Decentralized Meetings' number of complaints, merged by Parish

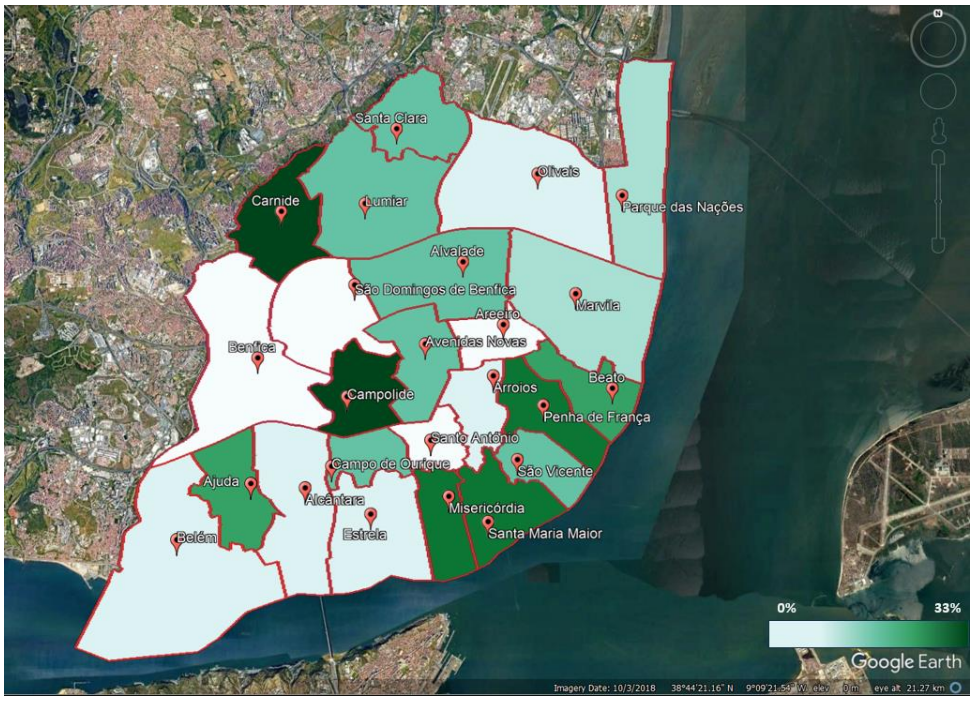


10. Correlation Matrix Lisbon Participa projects

The map below 9. Accepted Proposals (%) shows the performance of the accepted proposals for the different parishes where Carnide achieved the highest result - The percentage of Accepted Proposals is highlighted in the image below, where the higher value is darker.



9. Accepted Proposals (%)



11. Winning Projects (%)

The map above 11. Winning Projects (%) shows the Winning projects' performance, where Carnide and Campolide achieved the highest results. As stated before, one of the pretended analyses was to understand all the flow from a proposal that is applied until the project is implemented. The flowchart was analyzed according to the information in the annual reports. While analyzing the drill down between all proposals, the accepted ones are highlighted with meager results, those without a topic, followed by “Safety and civil protection” and” Lifelong learning.” All the remaining have an acceptance rate higher or equal to 37%. The top 3 with higher rates are “Green structure, environment and energy,” “Economy and innovation,” and “Administrative modernization,” all with higher than 70%.

Regarding the projects that were selected as winners, the proposals that ranked highest below also had the fewest winning projects—just one, with a 2% winning rate—while "Economy and Innovation" unexpectedly received one of the highest results. In contrast, the categories of "Culture," "Sports," and "Administrative Modernization" showed higher results, all of which had winning rates of at least 19%. With 20 projects, these categories account for nearly a third of all winning projects from the years under study. This is significant when considering the total number of topics available—13—plus the topic that was not included.

The topics with the highest complaints are “Road infrastructure, mobility, and transport”, “Economy and innovation”, “Urban regeneration and public space”, and “Urban hygiene.” While analyzing the topics with the most amount of proposals are “Green structure, environment and energy”, “Road infrastructure, mobility and transport”, and “Urban regeneration and public space”, having 2 out of 3 in common with the stated complaints before. Regarding the Projects, the results for the topics with higher relevance are “Green structure, environment and energy”, “Road infrastructure, mobility and transport”, and “Urban

regeneration and public space", being again 2 out of 3 in common. The analysis by topic for the different data sources is performed on Table 8. Comparison of 3 datasets with winning rates for Proposals and Projects, with additional information on the percentage achieved for both Accepted Proposals and Winning Projects.

Table 8. Comparison of 3 datasets with winning rates for Proposals and Projects

Topic	**Complaints**	**Proposals**	**Accepted Proposals**	**Projects**	**Winning Projects**
Green Structure, Environment, and Energy	97	399	80%	232	6%
Culture	19	153	39%	53	19%
Road Infrastructure, Mobility and Transport	327	346	51%	141	6%
Economy and Innovation	180	88	78%	62	2%
Housing and Local Development	100	43	56%	17	6%
Education	35	68	65%	36	14%
Administrative Modernisation	42	16	75%	12	25%
Urban Regeneration and Public Space	372	195	50%	80	10%
Security and Civil Protection	67	14	7%	1	0%
Sport	24	75	47%	33	21%
Urban Hygiene	183	63	59%	18	6%
Social Rights	62	59	37%	12	8%
Lifelong Learning	0	16	19%	3	0%
No Topic	0	616	5%	10	0%

While studying the relationship between the complaints and the votation by topic, the results showed a high relation for the parish Misericórdia, followed by Santa Clara, Olivais, Arroios São Vicente, and Penha de França. This analysis was performed as above to understand patterns between the votes to choose the projects to win and the complaints on the topics people think need to be improved. The topics with a higher percentage of complaints, "Urban regeneration and public space" and "Road infrastructure, mobility, and transport," are clearly distinguished by the following ones, but "Urban hygiene" and "Economy and innovation" are the complaints that follow. Those four combined represent 70% of total complaints, and these topics are the ones that are negatively impacting the citizens. While analyzing the proposals and complaints, the ones that represent the one's higher amount of it are "Green structure,

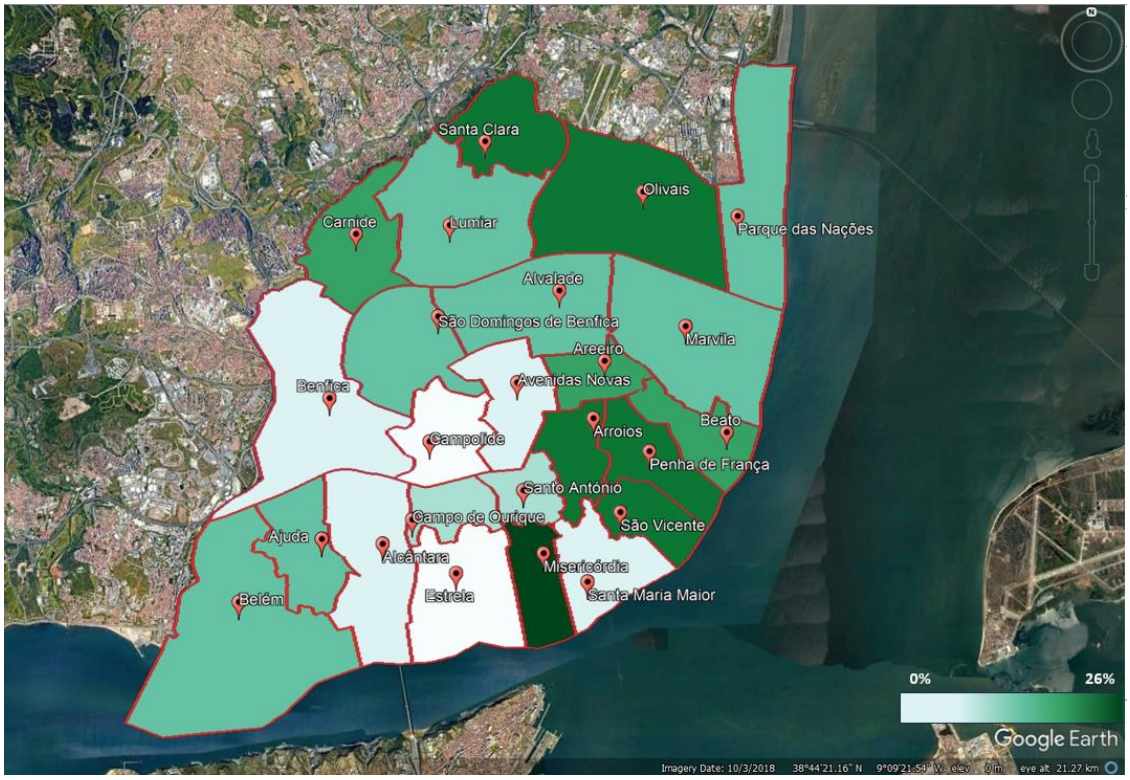
environment, and energy," and "Road infrastructure, mobility, and transport," matching 2 out of 3 of complaints and followed by "Urban regeneration and public space," "Culture," and "Economy and innovation." "Green structure, environment and energy" and "Culture," according to the winning projects, are the topics that are more surprising while analyzing the complaints from the citizens because they are not being mentioned as complaints from them, especially for "Culture." However, achieving 25% of winning projects only reflects the 1% of complaints. An analysis of the complaints, proposals (and winning proposals), and projects (and winning projects) is presented in the table below on Table 9. Complaints, Proposals and Projects by Winnings.

Table 9. Complaints, Proposals and Projects by Winnings

Source	**Complaints**	**Proposals**		**Projects**	
Topic	**% of Total**	**% of Total / All topics**	**% of Winning / All topics**	**% of Total / All topics**	**% of Winning / All topics**
Green Structure, Environment, and Energy	6%	19%	34%	33%	25%
Culture	1%	7%	6%	7%	16%
Road Infrastructure, Mobility and Transport	22%	16%	19%	20%	15%
Economy and Innovation	12%	4%	7%	9%	2%
Housing and Local Development	7%	2%	3%	2%	2%
Education	2%	3%	5%	5%	8%
Administrative Modernisation	3%	1%	1%	2%	5%
Urban Regeneration and Public Space	25%	9%	11%	11%	13%
Security and Civil Protection	4%	1%	0%	0%	0%
Sport	2%	3%	4%	5%	11%
Urban Hygiene	12%	3%	4%	3%	2%
Social Rights	4%	3%	2%	2%	2%
Lifelong Learning	0%	1%	0%	0%	0%
No Topic	0%	29%	3%	1%	0%

With the analysis of the relation between the number of complaints and the number of votes by topic and parish, a calculation was performed to create a rational, more accessible way to analyze the information by parish.

The method chosen was the number of complaints (by topic and parish) divided by the number of votes and then an average for all the topics, achieving only one score for each parish - this analysis is shown below on the map figure 12. Relation between complaints and votation by topic.

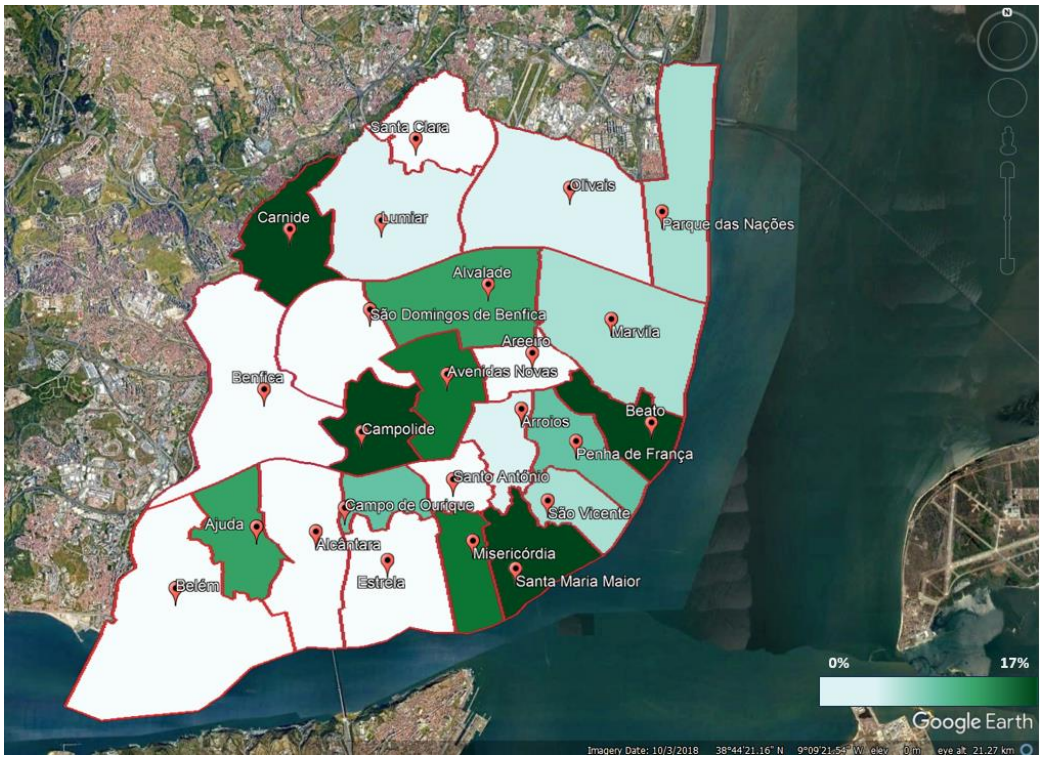


12. Relation between complaints and votation by topic

5.2. COMPARATIVE ANALYSIS

While analyzing by parish, the results vary; despite the existing complaints, no project was implemented, which happened for Areeiro, Benfica, Santo António, and São Domingos de Benfica. Other Parishes such as Ajuda, Alvalade, Campolide, Carnide, and Santa Maria Maior had a significant impact while matching the topics. However, Carnide had the highest relation with it, averaging 22%. The visualization bellow 14. Relation between complaints and winning projects by topic and Parish represents a calculation of the winning projects divided by complaints (by Parish) to analyze the success of participatory budgeting according to solving citizens' complaints.

As a result, the complaints are presumed to be community problems that could be resolved using participatory budgeting. The results of the citizen problems prioritization process reveal how the public feels about various urban-related issues and identify which areas are most impacted. While not all parishes responded to citizen complaints, the average output results by topic and parish show that Participatory Budgeting was solving problems for the people. Of the parishes that did respond, four had zero impact, seven had low results, and six had a significant positive impact - Ajuda, Alvalade, Avenidas Novos, Campo de Ourique, Misericórdia, and Penha de França. This analysis was presented on a map to distinguish the impact differences on the different parishes visually. To achieve the map visualization 13. Relation between complaints and winning projects by topic., a table was performed that is also presented below. 14. Relation between complaints and winning projects by topic and Parish



13. Relation between complaints and winning projects by topic.

Parish	GSEE	C	RIMT	EI	HLD	E	AM	URPS	SCP	S	UH	SR	LL	TOTAL
Ajuda	75%	-	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	9%
Alcântara	0%	0%	0%	0%	0%	0%	-	0%	-	-	0%	0%	-	0%
Alvalade	0%	-	0%	13%	0%	0%	-	8%	0%	67%	0%	-	-	10%
Areeiro	0%	-	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%
Arroios	33%	0%	0%	0%	0%	0%	-	0%	0%	-	0%	0%	-	3%
Avenidas Novas	0%	100%	0%	0%	0%	-	0%	6%	0%	-	0%	0%	-	11%
Beato	0%	100%	0%	0%	50%	0%	0%	0%	-	-	0%	-	-	17%
Belém	0%	-	0%	0%	0%	0%	-	6%	0%	0%	0%	-	-	1%
Benfica	0%	0%	0%	0%	0%	0%	-	0%	0%	-	0%	0%	-	0%
Campo de Ourique	0%	-	8%	0%	0%	-	50%	0%	-	-	0%	-	-	8%
Campolide	100%	-	33%	0%	0%	-	-	0%	-	0%	0%	0%	-	17%
Carnide	-	100%	18%	0%	0%	0%	0%	13%	0%	20%	0%	0%	-	14%
Estrela	0%	-	0%	0%	0%	-	0%	0%	0%	-	0%	0%	-	0%
Lumiar	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	2%
Marvila	0%	-	0%	0%	0%	50%	0%	7%	0%	-	0%	-	-	6%
Misericórdia	100%	-	0%	0%	0%	-	0%	0%	0%	-	0%	0%	-	11%
Olivais	0%	0%	0%	0%	0%	33%	0%	0%	0%	0%	0%	0%	-	3%
Parque das Nações	0%	-	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	-	5%
Penha de França	50%	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	-	8%
Santa Clara	0%	0%	0%	0%	0%	-	0%	0%	0%	-	0%	0%	-	0%
Santa Maria Maior	-	100%	0%	0%	0%	-	-	8%	0%	-	0%	0%	-	14%
Santo António	0%	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%
São Domingos de Benfica	0%	0%	0%	0%	0%	0%	-	0%	0%	-	0%	0%	-	0%
São Vicente	50%	-	0%	0%	0%	0%	-	0%	0%	-	0%	0%	-	6%
Total	16%	63%	3%	1%	1%	14%	7%	2%	0%	29%	1%	2%	-	-

14. Relation between complaints and winning projects by topic and Parish

The graphical representation is a compelling visual tool, succinctly communicating the impact distribution across various parishes in Lisbon. By focusing on the importance and names of each parish, this visual medium enables viewers to quickly grasp the notable success achieved in specific areas through Participatory Budgeting (PB) initiatives. This 15. Parishes success' Ratefacilitates a swift understanding of PB's overall effectiveness and provides a nuanced perspective on the diversity of outcomes within the framework. Through this simplified yet insightful approach, stakeholders, policymakers, and the community can readily identify areas of excellence, potential challenges, and opportunities for targeted interventions. The graphical presentation transforms complex data into an accessible format, fostering a comprehensive understanding of the nuanced success landscape in citizen problem-solving through participatory budgeting in Lisbon. Principal Finding: The Influence of Participatory Budgeting on Citizen Issues in Lisbon for certain parishes that exhibit successful problem resolution, parishes show efficacy in resolving citizen concerns, and the success rate of the different parishes is presented below.

15. Parishes success' Rate

6. DISCUSSION AND CONCLUSIONS

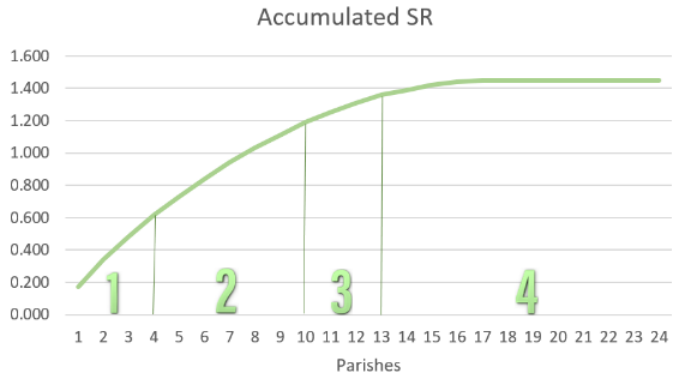
6.1. DISCUSSION AND IMPLICATIONS

The impact of PB, although helping people's problems, is not clear that it is solving them. A relation between the winning/implemented projects undoubtedly exists for the parishes of Beato and Campolide, which had an average success rate of 17% while analyzing the winning/implemented project by topic and parish according to the number of complaints in the same conditions. This Success Rate was achieved by crossing all the complaints for the different topics and parishes with all winning projects in the same condition – The higher the value, the higher the resolution rate for the complaints. The average of 17% was achieved thanks to the topics "Culture" and "Housing and local development" for Beato and "Green structure, environment and energy" and "Road infrastructure, mobility, and transport." Carnide and Santa Maria Maior had a similar success rate of 14%. For both, the "Culture" topic was the main reason for a high SR, followed by "Urban regeneration and public space" and, regarding Carnide, "Sports" and "Road infrastructure, mobility, and transport." With an SR of 11%, Both Avenidas Novas and Misericórdia are followed by Alvalade with a score of 10%. All the remaining except for Alcântara, Areeiro, Benfica, Estrela, Santa Clara, Santo António, and São Domingos de Benfica got no impact, 0%, and the remaining achieved an SR between 1% and 9%. This information was put together in a simple Table 10. Parish Success Rate: Relation between complaints, winning projects by topicpresented below.

Table 10. Parish Success Rate: Relation between complaints, winning projects by topic

#	Parish	%
1	Beato	17%
2	Campolide	17%
3	Carbide	14%
4	Santa Maria Maior	14%
5	Avenidas Novas	11%
6	Misericórdia	11%
7	Alvalade	10%
8	Ajuda	9%
9	Campo de Ourique	8%
10	Penha de França	8%
11	Marvila	6%
12	São Vicente	6%
13	Parque das Nações	5%
14	Arroios	3%
15	Olivais	3%
16	Lumiar	2%
17	Belém	1%
18	Alcântara	0%
19	Areeiro	0%
20	Benfica	0%
21	Estrela	0%
22	Santa Clara	0%
23	Santo António	0%
24	São Domingos de Benfica	0%

To facilitate the analysis, a 16. Concentration Curve of Accumulated SR for the accumulated SR was performed to group the parishes by similar levels of success. Four groups were classified as 1, 2, 3, and 4, presented on the image's Concentration Curve of accumulated Success Rate below. Considering this, it is assumable that PB had significant effects for the 1st group, which has the four parishes stated before while analyzing the winning/implemented projects and the complaints on the same topic selections.



16. Concentration Curve of Accumulated SR

A concentration curve was performed, as we can see above, where the success of participatory budgeting was analyzed by topic of complaints (by parish) and topic of winning projects (by parish) where the data regarding the table above was used in order to divide the different parishes into four different segments. Besides the parishes in the first segment, 2nd group was composed of the following six parishes, which had some effects on the analysis but not as significant as the 1st group. Regarding the 3rd and the smallest, composed of only three parishes, the success rate was low, but the last group is assumable to have some relation despite the low value. Lastly, the 4th group is proven to have 0% or almost no relation between the winning projects and the complaints on the topic's resolution. This group is the largest and composed of 11 parishes out of 24, meaning that this group has almost as many parishes as the other three groups above. Considering that 11 parishes have no significant level of relation, it is hard to prove that PB is solving the people's problems for Lisbon Parishes although improving some of them.

The comprehensive analysis of Participatory Budgeting (PB) outcomes in Lisbon reveals encouraging results across a substantial portion of the city's parishes. When evaluating success based on the number of parishes, 54% demonstrate positive results attributed to PB initiatives. This percentage highlights the widespread effectiveness of the participatory budgeting approach, showcasing its positive impact on local communities. Furthermore, a parallel examination based on the number of residents in each parish underscores the noteworthy influence of PB, with a commendable success rate of 48%. This dual perspective emphasizes PB's overall success and sheds light on its ability to engage and benefit a considerable portion of the population across diverse parishes in Lisbon. These percentages provide a quantitative measure of the positive outcomes associated with participatory budgeting, affirming its efficacy in fostering community involvement and addressing the unique needs of different areas within the city. Despite the number of papers and reports on PB, there is still a research gap on the theme because of limitations such as low data or insufficient information. The focus on one city, comparing different international cities, and the lack of investigation of urban sustainability limit the study's results

(Falanga et al., 2021). By using accurate data, it has planned to achieve essential results that will be used further, especially in cities in similar conditions such as Lisbon, because as it will be applied only regarding Portuguese capital data, it is another limitation in this document for a comparative study. Although it has restrictions (date and time), this work is planned to be critical to the PB state of the art since the match between what citizens are complaining about and the projects implemented, using accurate data, is an indicative approach to understanding the real success and solving the rate of the complaints and was not done before, considering all the prior research on the topic. This will enrich the knowledge on several themes, such as Participatory Budgeting, Civic Engagement, the current situation in Lisbon, and different types of PB models. However, future work can still be done by managing the study's limitations.

6.2. CONCLUSIONS AND LIMITATIONS

An analysis of the patterns of those parishes that were highlighted: Beato, Campolide, Carnide, Santa Maria Maior, Avenidas Novas, Misericórdia, Alvalade, Ajuda, Campo de Ourique, Penha de França, Marvila, São Vicente and Parque das Nações was performed, to understand if there were any hidden information that could lead to these results. Many factors can impact the results, such as citizen engagement, decision-making processes, resource allocation, and the role of local governance. After the clinical analysis, no pattern was remarkably related, so one of the limitations regarding the low relation between the topics of complaints and the topics of winning projects can be the number of complaints available that lack quantity and diversity.

The collection of complaints from various parishes over a specific period introduces a complexity in representation, as the identities of the complainants remain unknown, potentially leading to a non-representative sample. While the amalgamation of grievances provides a comprehensive overview, it is crucial to acknowledge that certain archetypes may not be proportionally represented.

This challenge persists even in decentralized meetings within the city's council. Despite this, for analytical purposes, these complaints are often treated as representative samples, representing broader community issues. An essential consideration arises concerning the participants in these meetings, as their composition may not accurately mirror the demographic diversity of the overall population. This lack of representativeness can be exacerbated if specific interest groups exert control over participation, potentially steering Participatory Budgeting (PB) outcomes toward serving the interests of these particular groups. Addressing the question of participant demographics is pivotal in ensuring the equitable and inclusive nature of PB processes, preventing the undue influence of specific segments of the population.

While analyzing the study workflow, starting from the data sources, handling the data, and getting the results, there is a high opportunity to make this paper reliable despite not proving a relation between Participatory Budgeting for all the Parishes. This happens because all data imported to the model is accurate and was gathered directly from the sources apart from the static data regarding the Lisbon Parishes information such as the number of citizens and the education level. By crossing the internal and external data, a better understanding of whether PB is solving Lisbon citizenry's needs and requests will be guaranteed to highlight this study compared to others.

Further work can still be done on the topic since a specific analysis has been done for the Portuguese capital, which can differ from other capitals or municipalities. This takes place regarding each city's complexity and particular specifications, so it can be more trustworthy while studying cities in conditions similar to Lisbon's.

Besides the location, other limitations exist, such as the low amount of complaints and not knowing the archetypes of people who signed the complaints in the first place, which were considered as the main limitations of the study: both sample size and the archetypes of complainers, which affected the most the results. The need for more complaints is evident because, with more complaints, a close relationship could be formed with the static information on parishes.

The categorization of the complaints topics was also another limitation. Sometimes, it was done manually to match the project topics because they were written similarly. However, others were done through an association and a deep dive analysis of the complaints to have the same topics over the three datasets (Proposals, Projects, and Complaints). Also, on the Projects, many had locations in all city parishes, which were disregarded, although some work was done on it during the process, affecting the results achieved.

One more difficulty was that there were complaints with more than one topic on the complaint dataset, and regarding the proposals/projects, there were some with more than one parish. To surpass this difficulty, I have applied binary columns for the topics and applied calculation to the proposals and projects because each can have more than one topic (for the calculation proposal/project with more than one Parish being counted in the same amount of time. Regarding the complaints, some had more than one topic by complaints, and for that reason, they were counted more than once and others did not have a matching topic, so they counted and measured.

Since the study is a longitudinal analysis, the static data imported to the model is another limitation since I have chosen to load data from 2013. The decision to use this data instead of similar ones such as the Census is that Portugal and precisely Lisbon's situation has changed a lot in recent years, regarding the number of citizens and even the origins of the theme, meaning that there were a lot of migratory movements in Lisbon and the cities surrounding the. Lastly, the time available to perform this study was not much, which can also lead to a limitation regarding the disposal time to work on it and deep dive into it.

Despite all the limitations said above and bearing in mind that future work can still be done by managing the limitations of the study, this one will contribute to the Participatory Budgeting state-of-the-art enriching knowledge on the themes: Participatory Budgeting, Civic Engagement, the current situation in Lisbon, and different types of PB's models and successes. Since the availability of the complaints, the method, whether to go for a systematic review or comparison, with these accurate results, could be achieved by applying good aggregations in terms of winning proposals and complaints to guarantee a meaningful connection. As stated above, there was no clear conclusion that would be applicable directly to all Lisbon Parishes, keeping in mind that the goal was to have a clear output of the success of PB in Lisbon Parishes. So, despite participatory budgeting helping to improve citizens' complaints, it is not solving them for all Parishes, only achieving significant results in 11 out of 24 parishes. Considering all the

states above, future work must be done with higher complaints to justify the hypothesis and with higher participant profiles.

The results of prioritizing citizen problems indicate how the public feels about urban-related issues and identify the most affected areas. As a result, those complaints are presumed to be community issues that could be resolved by implementing participatory budgeting. Despite not achieving the expected results regarding the thesis question of participatory budgeting solving citizen problems, apparent predictability was achieved to know which projects were expected to win. The variables that made it possible were Value, Number_Votes, Number_Complaints, Number_Residents, and Write and Read.

The reasons for these results are clear: the value is highly correlated with the winning projects due to the limitation of 2.5 million each year, and the vote is also because this was one of the steps for selecting winning projects. The Number_Complaints, which also positively impacted the model's accuracy, showed that it could be justified by the city's existing problems on specific topics or by the number of citizens; therefore, the inclusion variables, the number of residents, were included, and the accuracy increased again. Lastly, educational KPIs showed a high correlation between education and winning projects.

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ANNEXES

Table 11. Data Dictionary Combined Dataset

Column	Data Type	Unique Values	Null Values
ID	int64	194	0
ID_unique	object	460	0
Year	int64	4	0
Votes	int64	195	0
Value	float64	50	0
Text	object	456	0
Topic	object	13	0
Parish	object	24	0
Winning_Project	int64	2	0
Green Structure, Environment and Energy_x	int64	2	0
Culture_x	int64	2	0
Road Infrastructure, Mobility and Transport_x	int64	2	0
Economy and Innovation_x	int64	2	0
Housing and Local Development_x	int64	2	0
Education_x	int64	2	0
Administrative Modernisation_x	int64	2	0
Urban Regeneration and Public Space_x	int64	2	0
Security and Civil Protection_x	int64	2	0
Sport_x	int64	2	0
Urban Hygiene_x	int64	2	0
Social Rights_x	int64	2	0
Lifelong Learning_x	int64	1	0
Number_Parishes	int64	7	0
Green Structure, Environment and Energy_y	int32	9	0

Culture_y	int32	4	0
Road Infrastructure, Mobility and Transport_y	int32	11	0
Economy and Innovation_y	int32	12	0
Housing and Local Development_y	int32	9	0
Education_y	int32	5	0
Administrative Modernisation_y	int32	8	0
Urban Regeneration and Public Space_y	int32	14	0
Security and Civil Protection_y	int32	8	0
Sport_y	int32	5	0
Urban Hygiene_y	int32	18	0
Social Rights_y	int32	8	0
Lifelong Learning_y	int32	1	0
Number_complaints	int64	22	0
Number_Residents	int64	24	0
No_degree	int64	24	0
Degree	int64	24	0
Don’t write and read	int64	23	0
Write and Read	int64	24	0
1st Cycle	int64	24	0
2nd Cycle	int64	24	0
3rd Cycle	int64	22	0
High School	int64	24	0
Pós High School	int64	22	0
Higher Education	Int64	24	0