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Analysis of Monetary Transactions and Characterization of Consumption in the Oeste Region

Nuno Henrique Tavares de Carvalho e Silva

Project Work

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

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ANALYSIS OF MONETARY TRANSACTIONS AND CHARACTERIZATION OF CONSUMPTION IN THE OESTE REGION

By

Nuno Henrique Tavares de Carvalho e Silva

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

Co- Supervisor: Miguel de Castro Simões Ferreira Neto

Co-Supervisors*:* João Bruno Morais de Sousa Jardim

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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 acknowledge the Rules of Conduct and Code of Honor from the NOVA Information Management School.

Nuno Henrique Tavares de Carvalho e Silva

Lisbon, 29th November 2023

ABSTRACT

Information management is becoming crucial on a global scale. The benefits derived from this process are substantially important for analyzing and understanding past and current trends, providing valuable insights for future improvement. Through Business Intelligence tools, with the comprehensive or segmented analysis of provided and processed data, a final analytical solution can be derived. This solution offers valuable insights for decision-makers, guiding them in understanding the path forward. Currently, it plays a crucial role in management, underscored by the remarkable results achieved. Within the scope of this study, focused on the Intermunicipal Community of Oeste, the aim is to obtain crucial information about transactions and card usage to identify consumption patterns. The goal is to comprehend the regional dynamics and develop solutions to promote growth. This region aims to contribute to the promotion of sustainable development and the enhancement of the quality of life in its municipalities, aspiring to attain the status of a nationally recognized Intermunicipal Community. This project seeks to significantly contribute to the region's advancement by providing insights into its behavior over the analyzed period and supporting decision-making processes.

KEYWORDS

Big Data; Business Intelligence; OesteCIM; Power BI

Sustainable Development Goals (SGD):

INDEX

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LIST OF ABBREVIATIONS

ATM	Automated Teller Machine
BI	Business Intelligence
DS	Design Science
DSRM	Design Science Research Methodology
IS	Information System
OesteCIM	Comunidade InterMunicipal do Oeste
OLTP	Online Transaction Processing

1. INTRODUCTION

In today's era of technological advancement, information seems readily accessible to all due to its widespread presence. This accessibility, coupled with globalization fostering intensified competition, forces organizations to adapt continuously. Managing the substantial daily influx of data becomes crucial for informed decision-making. Recognizing that data serves as a vital resource for generating necessary information adds to the awareness of the competitive landscape among organizations (Duque et al., 2022).

Ensuring sustainable development and growth is a top priority for regional areas nowadays. It is not just a desire anymore, it is a necessity for enhancing the well-being of people and securing a future for the next generations. When it comes to regions heavily reliant on tourism for their economic foundation, the planning strategies adopted can have more significant effects compared to areas not solely dependent on tourism (Castanho et al., 2020). Businesses across all industries must stay ahead of the game to meet the expectations of modern consumers. Today's consumers, often referred to as the "new wave," crave personalized and customized experiences. The use of big data analysis simplifies the process of understanding consumer transaction patterns in a more detailed and individualized manner (Halim et al., 2019).

In the era of globalization, heightened competition makes organizations to adapt continually, primarily to handle the growing volume of generated data crucial for decision-making. Moreover, data serves as an essential resource for producing the information and knowledge necessary for effective operations. Organizations need to recognize that quality information management is crucial in the knowledge acquisition process for decision-making. This involves consciously organizing data systematically using adaptable patterns that can meet the dynamic demands of the market (Duque et al., 2023).

This study uses Business Intelligence tools by employing a data analysis solution focused on transactions within a specific region of Portugal, from March 2020 to November 2022. This region is called OesteCIM and comprises twelve municipalities, with a mission to promote sustainable development and improve the quality of life in its municipalities. Its vision is to become a nationally recognized Intermunicipal Community known for excellent public

management focused on quality, innovation, efficiency, and effectiveness, with a strong emphasis on partnerships and institutional network management while optimizing existing resources and structures. The analysis will be conducted to discern consumption patterns within this community and understand how transactions occur, aiming to formulate a tailored solution for this region.

2. LITERATURE REVIEW

Digitization essentially involves converting various actions and interactions in the physical world into numerical data for recording and analysis. In the past, data collection primarily relied on conventional methods such as taking notes and manual keyboard input. However, these methods often resulted in high costs and had limited scalability. In today's digital age, improvements in infrastructure and technologies like IoT sensors for data collection and mobile Internet for data transmission have significantly boosted our capacity to gather data (Cheng & Gu, 2022).

As reported by (Thomson et al., 2014) data management software becomes increasingly customized for deployment in public and private clouds or on a cluster of standard servers, emerging distributed storage systems are prioritizing improvements in data access speed through partitioning and replication strategies. However, to achieve greater scalability, contemporary systems typically sacrifice transactional support, preventing individual transactions from spanning across multiple partitions. Referring to the insights from the new institutional economics literature, transaction cost analysis could serve as a useful framework. This framework helps explain why firms exist, how they are structured, and the dynamics of vertical coordination within a supply chain (Jill E. Hobbs, 1996).

The integration of big data and analytics can be achieved smoothly. The necessary foundations for advancing big data analytics are already established. Firstly, we have tools and storage capabilities that can manage large volumes of data effectively. Moreover, the vast amount of big data available provides significant statistical samples and leads to improved experimental outcomes. Lastly, both companies and governments have acknowledged the benefits of utilizing big data for economic growth. Given the diverse nature of big data, especially in terms of variety, numerous techniques are employed for analytics (Kacfah Emani et al., 2015). The focus is on precisely understanding how to extract valuable information through the analysis of large and complex datasets. This process entails discovering valuable insights to mitigate risks, increase revenue, and improve competitiveness. However, various challenges emerge, including determining how to acquire, store, search, share, analyze, and visually present the data (Lu et al., 2013). The traditional tools are not able to deal with crucial challenges like scalability, adaptability, and usability. These challenges are critical for the success of big data

initiatives, as they significantly impact the development, management, and analysis of large datasets (Saggi & Jain, 2018).

As the number of transactions grows, it becomes crucial to examine their shared patterns. Grouping these transactions into clusters can assist in identifying common behaviors and detecting and tracking unusual transactions (M.K. Awan, 2017). On-Line Transaction Processing (OLTP) systems serve as the core of modern information systems, handling day-to-day operations. These systems record, monitor, and process all incoming requests, such as sales orders, customer and supplier information, incoming payments, and internal production processes (Bog et al., 2011). On-Line Transaction Processing (OLTP) systems are at the core of information systems, playing a vital role in supporting the day-to-day operations of businesses. They represent some of the most essential and critical applications for businesses (Vieira & Madeira, 2003). Gantz and Reinsel projected that the total volume of known data would increase significantly, from 0.8 zettabytes in 2009 to 35 zettabytes by 2020 according to the study of (Holt et al., 2015).

When businesses handle large volumes of data, they often face challenges related to the volume, accuracy, precision, and reliability of that data (Wang et al., 2018). Consequently, organizations have found it imperative to utilize analytical business intelligence tools as noted by (Muayad Younus et al., 2022), they do this because of the limitations of existing technological systems, the need to handle and analyze large datasets while uncovering new insights, and the complexity of processes required to enhance business performance.

Improving services in the public sector presents significant challenges. To overcome them, public officials need accurate, timely, and easily accessible information, both internally and externally, to make efficient decisions (Suziana binti Mohamad & bin Mohamed, 2012). However, public sector managers often prioritize budget decisions that result from negotiations with colleagues within their agency, rather than decisions grounded in thorough analysis. Additionally, many public organizations lack the resources to collect data on emerging trends in their services. Even when feasible, professionals may be hesitant to allocate resources to data collection instead of direct service delivery (Mezzanzanica et al., 2010).

In today's tech-driven world, the key to organizational success lies in making strategic decisions in real-time. BI serves as the intersection of business, management, and information technology, allowing organizations to extract meaningful insights from extensive data sources and various software solutions. It facilitates the development of real-time performance indicators and dashboards, improves customer understanding to enhance satisfaction, and empowers employees, including executives, managers, and analysts, to make informed decisions promptly and effectively. Investing in BI offers numerous benefits, replacing instinct-based management with efficiency and effectiveness. It allows organizations to comprehend customer behavior, analyze the past, monitor the present, predict future business trends, and stay ahead of the competition (Duque et al., 2022). In an open transaction environment, participants' transaction data is likely to be monitored by various parties, such as competitors, partners, investors, and others, for business intelligence purposes. In the age of knowledge discovery, big data, and analytics, the primary focus in open information transactions often revolves around using the data to gain insights into customers and competitors (O'Leary, 2018).

3. METHODOLOGY

This chapter outlines the approach used to conduct the study. It explains the research methodology, detailing the steps taken throughout the project. This includes information on the study area, how data was gathered, processed, and applied to develop a solution. Additionally, it covers the data modeling techniques employed for analyzing the problem and constructing the solution.

3.1. DESIGN SCIENCE RESEARCH METHODOLOGY

The Design Science Research Methodology (DSRM) outlined in this context encompasses the principles, practices, and procedures essential for conducting this type of research. The methodology serves three main purposes: aligning with existing literature, offering a basic process model for Design Science (DS) research, and providing a conceptual framework for presenting and assessing DS research in the field of Information Systems (IS). The DS process itself involves six key steps: problem identification and motivation, definition of the objectives for a solution, design and development, demonstration, evaluation, and communication (Peffers et al., 2007). Figure 1 illustrates this process.

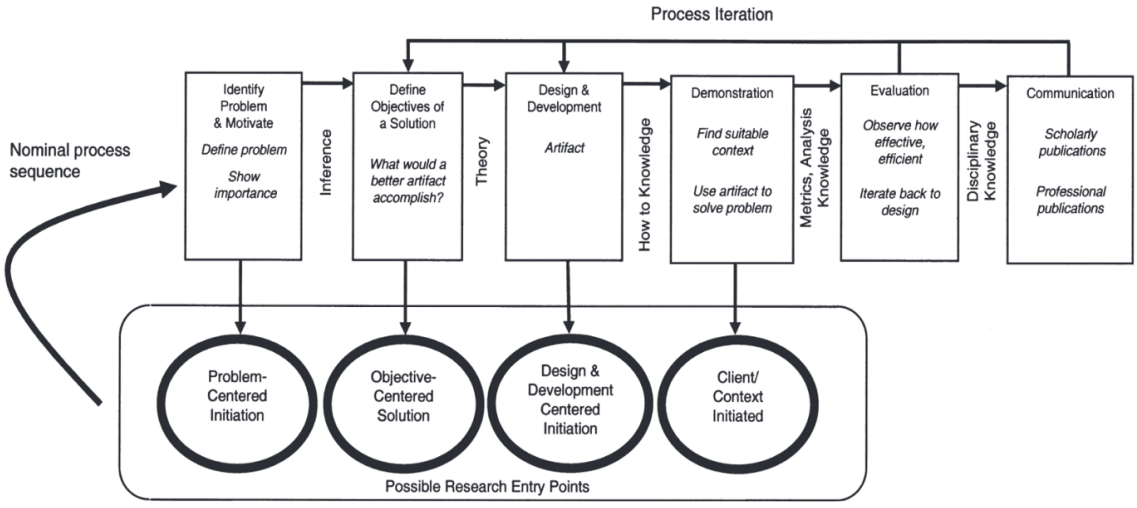


Figure 1 DSRM Process Model (Peffers et al., 2007)

3.1.1. Problem Identification

The problem presented for this project was to analyze monetary transactions and characterize consumption in this community. Considering that the location of each parish or municipality may have different reasons for the presented results, the challenge is to analyze the data to obtain feedback on how consumption is characterized in this community.

3.1.2. Objectives and Solutions

This work aims to involve processing and analyzing data from the operating systems of financial transactions through debit and ATM cards. The objective is to develop analytical models and visualization tools to characterize consumption patterns and consumer behavior in the OesteCIM region.

3.1.3. Design and Development

To achieve the objectives of the proposed solutions for this problem, we collected and extracted data for analysis in Power BI. The dataset comprises transaction data in the OesteCIM region from March 2020 to November 2022. Utilizing Power BI, we generated visualizations to conduct a more detailed and accurate descriptive analysis.

3.1.4. Demonstration

To demonstrate the functionality and operation of the artifact, a Power BI dashboard will be constructed. This dashboard will feature visualizations of the data to provide a clearer understanding of the problem, facilitating a more straightforward and accurate development of the solution. Successfully executing this step necessitates a thorough understanding of how to design dashboards to address the initial problem effectively.

3.1.5. Evaluation

In this phase, we will assess the effectiveness of the artifact in responding to the project solution through observation and measurement. To achieve this, it is imperative to conduct tests that evaluate the solution's relevance to the project. Once the conceptual model is finalized, we will evaluate how well the artifact aligns with the project's goals. This assessment will determine whether the dashboards effectively address all identified goals or if a redesign is necessary.

3.1.6. Communication

After completing the preceding steps, the final stage involves communicating the achieved findings and the methods and tools used to obtain them. This information will be presented to the relevant entities, along with outlining future work needed to enhance the study. The study necessitated organizations to provide data for thorough analysis, involving collaboration with relevant stakeholders to draw conclusions and propose solutions. At the very least, it aimed to aid others in reaching more effective solutions.

3.2. STUDY AREA

The study area will be the Intermunicipal Community of Oeste (OesteCIM), which is a public institution with the purpose of promoting sustainable development and enhancing the quality of life in its municipalities. Its goal is to become a nationally recognized Intermunicipal Community, excelling in public management focused on quality, innovation, efficiency, and effectiveness. The strategy involves fostering partnerships and efficiently managing Institutional Networks to optimize existing resources and structures.

The composition includes the municipalities of Alcobaça, Alenquer, Arruda dos Vinhos, Bombarral, Cadaval, Caldas da Rainha, Lourinhã, Nazaré, Óbidos, Peniche, Sobral de Monte Agraço, and Torres Vedras, identifying itself as the Intermunicipal Community of Oeste (OesteCIM). This entity corresponds to the Statistical Territorial Unit of Level III (NUT III) Oeste. The Oeste Region encompasses the mentioned municipalities, characterized by a population of over 350,000 inhabitants and a territorial extension close to 2500 km², with over 90 km of coastline.

While it has an ancient tourism legacy, the Oeste Region stands out as a destination oriented towards the future, combining innovation with the rich historical and cultural heritage present in this territory. Figure 2 illustrates the region and its 12 municipalities.

Figure 2 Oeste Community OesteCIM

3.3. DATA COLLECTION

To carry out the project and for analysis to be carried out, data was collected from SIBS - Sociedade Interbancária de Serviços. The data refers to monetary transactions via ATM card, detailed by parish and municipality, with values in relation to card numbers and respective values transacted and also with more detailed values such as average transaction and card values. All data refers to a time range, from March 2020 to November 2022. Figure 3 have the description of the SIBS Data.

Column Name	Description
Data	Day of the record
Semana	Week of the record
Mês	Month of the record
Ano	Year of the record
Freguesia	Parish
Setor ID	Identifier of the Sector
Setor	Name of the Sector
Tipo de Dia ID	Identifier of the Type of Day
N de Cartões	Nº of Cards used in the record
N de Operações	Nº of Operations in the record
Valor Médio por Cartão	Avg Value per Card
Valor Médio das Operações	Avg Value per Operation
N Médio Operações por Cartão	Avg of Operations per Card
Valor das Operações	Value of the Operation in the record

Figure 3 Column Description of SIBS Data

3.4. DATA PREPROCESSING

After all the data was collected, it was necessary to process it. There were a lot of problems with the data regarding the names of the parishes that had bad characters, the dates were also not all in the same format, which caused problems later when using this data for analysis. The weeks also had a small flaw, but it was resolved very quickly. Three new columns were also created, one for the Municipality, another for the District and another for the Activity Sector. All these changes were used to ensure that when transferring the data to Power BI, it was possible to carry out an analysis with the data all well processed to build dashboards with relevant and correct information.

3.5. DATA APPLICATION

Following the refinement and preparation of the dataset with essential adjustments, our next step involved the development of applications in Power BI. The primary objective behind these visualizations is to elevate interactivity and simplify data analysis, catering to both expert users and those without specialized knowledge.

Within Power BI, we took the initiative to establish surrogate and foreign keys for the dimension and fact table. Additionally, we refined data types and edited the names of tables and columns to make them more user-friendly, ensuring a clearer understanding for end users. This meticulous process aimed to enhance the overall accessibility and usability of the data within the Power BI environment.

3.6. DATA MODELLING

After gathering and preparing the data, a data model was created in Power BI. Figure 4 demonstrate the dimensional model used in the project. This model serves as the foundation for establishing connections between various dimensions and fact table within Power BI. The subsequent section provides visual representations that aid in comprehending the structure and content developed in Power BI.

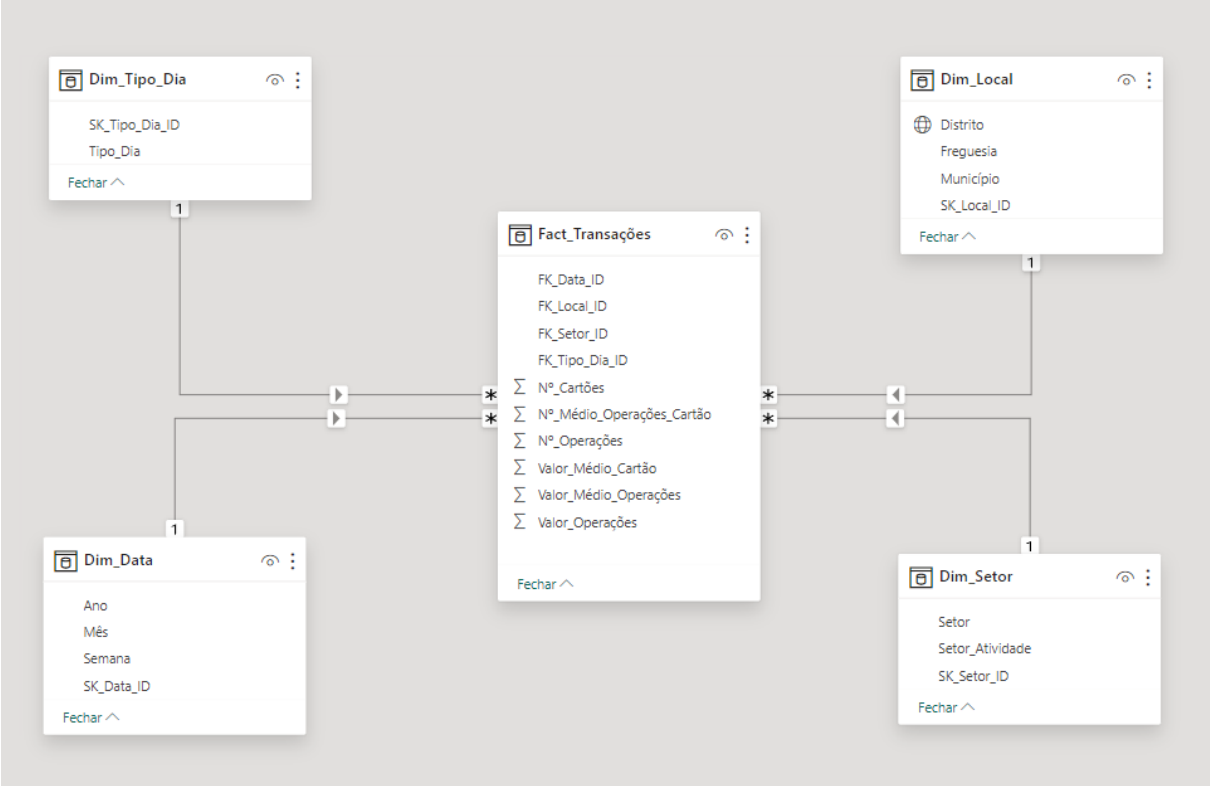


Figure 4 Dimensional Model

It was chosen the Snowflake Schema for this project, with a fact table, Fact_Transações and the dimensions Dim_Data, Dim_Local, Dim_Setor and Dim_Tipo_Dia.

This dimension, named Dim_Data, contains a surrogate key, named SK_Data_ID and parameters for Semana, Mês and Ano. It was necessary to create a surrogate key column so that, upon transitioning to Power BI, when analyzing the data, this column will prove instrumental in ensuring seamless table connections and mitigating potential issues of incongruity. In Figure 5 we see the structure of the dimension and in Figure 6 we can see some examples of rows that make part of this Dimension.

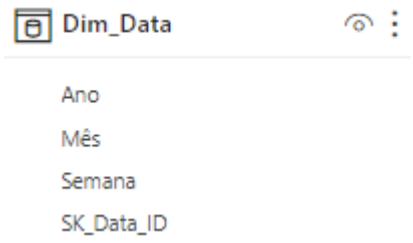


Figure 5 Dimension Data

SK_Data_ID	Ano	Semana	Mês
1	2020	Sem 13 - Abr	Abril
2	2020	Sem 27 - Abr	Abril
3	2020	Sem 18 - Mai	Maio
4	2020	Sem 16 - Mar	Março

Figure 6 Example of Dimension Data Rows

This dimension, named Dim_Local contains a surrogate key, named SK_Local_ID and parameters about Freguesia, Município and Distrito. The column Município and the column Distrito were created in order to complete all the information about the location of the parish. In figure 7 we see the structure of the dimension and in Figure 8 we have some examples of rows that form part of this Dimension.

Figure 7 Dimension Local

SK_Local_ID	Município	Freguesia	Distrito
111324	Torres Vedras	União das freguesias de Dois Portos e Runa	Lisboa
110814	Lourinhã	União das freguesias de São Bartolomeu dos Galegos e Moledo	Lisboa
101402	Peniche	Atouguia da Baleia	Leiria
111314	Torres Vedras	São Pedro da Cadeira	Lisboa

Figure 8 Example of Dimension Local Rows

This dimension, named Dim_Setor contains a surrogate key, named SK_Setor_ID and parameters for Setor and Setor Atividade. The column labeled "Setor Atividade" was created with the aim of significantly enhancing the existing information about the sector, enabling a more in-depth analysis of the data. In Figure 9 we can see the structure of the dimension. Figure 10 plays a crucial role in providing a more nuanced understanding of how data in this dimension can be interpreted.

Figure 9 Dimension Setor

SK_Setor_ID	Setor	Setor_Atividade
407	Restauração	Services
9999999	Levantamentos	Services
4071	Restaurantes	Services
4072	Bares, Cafés e Similares	Services

Figure 10 Example of Dimension Setor Rows

This dimension, named Dim_Tipo_Dia contains a surrogate key named SK_Tipo_Dia_ID and a Tipo de Dia parameter. The Figure 11 correspond to the structure of the dimension. This dimension serves to discern whether the record corresponds to a weekday or the weekend, as elucidated in Figure 12.

Figure 11 Dimension Tipo Dia

SK_Tipo_Dia_ID	Tipo_Dia
2	Fim de semana
1	Dia de Semana

Figure 12 Example of Dimension Tipo Dia Rows

This fact table, named Fact_Transações, contains five foreign keys, for the relationship with the Dim_Data, Dim_Local, Dim_Setor, and Dim_Tipo_Dia. Also contains six parameters Nº Cartões, Nº Médio Operações Cartão, Nº Operações, Valor Médio Cartão, Valor Médio Operações and Valor Operações. Without this table, creating informative visuals and dashboards would become significantly complex. In Figure 13 we can see the structure of the fact table and in the Figure 14 have examples of some rows with information in the fact table.

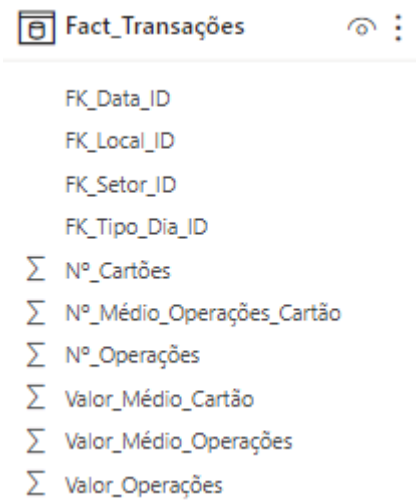


Figure 13 Fact Transações

FK_Data_ID	FK_Tipo_Dia_ID	FK_Local_ID	FK_Setor_ID	Nº_Cartões	Nº_Operações	Valor_Médio_Cartão	Valor_Médio_Operações	Nº_Médio_Operações_Cartão	Valor_Operações
6	1	111314	9999999	799	1072	123,89	92,34	1	98990
7	1	111314	9999999	786	1134	137,67	95,42	1	108210
8	1	111314	9999999	557	771	140,45	101,47	1	78230
9	1	111314	9999999	450	588	127,73	97,76	1	57480
10	1	111314	9999999	633	848	144,6	107,94	1	91530
11	1	111314	9999999	497	651	132,37	101,06	1	65790

Figure 14 Example of Fact Transações Rows

4. RESULTS AND DISCUSSION

After concluding the methodology phase, visualizations were constructed using PowerBI to enhance the comprehension of the data. This segment is dedicated to delving into the dashboards and individual visualizations, extracting insights derived from their analysis.

After this, an overview of the four dashboards is presented, encompassing a detailed examination of each visualization and a discussion of the results and insights gleaned from the undertaken work.

4.1. ANALYSIS OF TRANSACTION VALUE: MUNICIPAL LEVEL

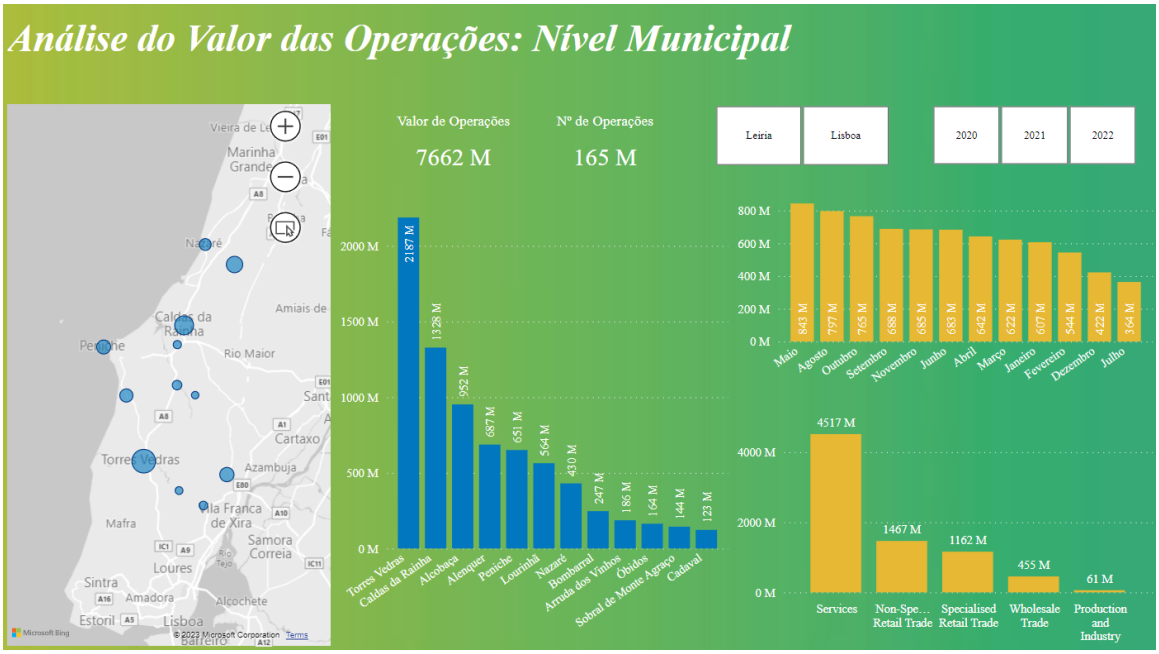


Figure 15 Analysis of Transaction Value: Municipal Level

The first dashboard - Analysis of Transaction Value: Municipal Level - illustrated in Figure 15, has two filters, one to select the year and another to select the location; however, it is possible to interact with any chart to select a preferred point.

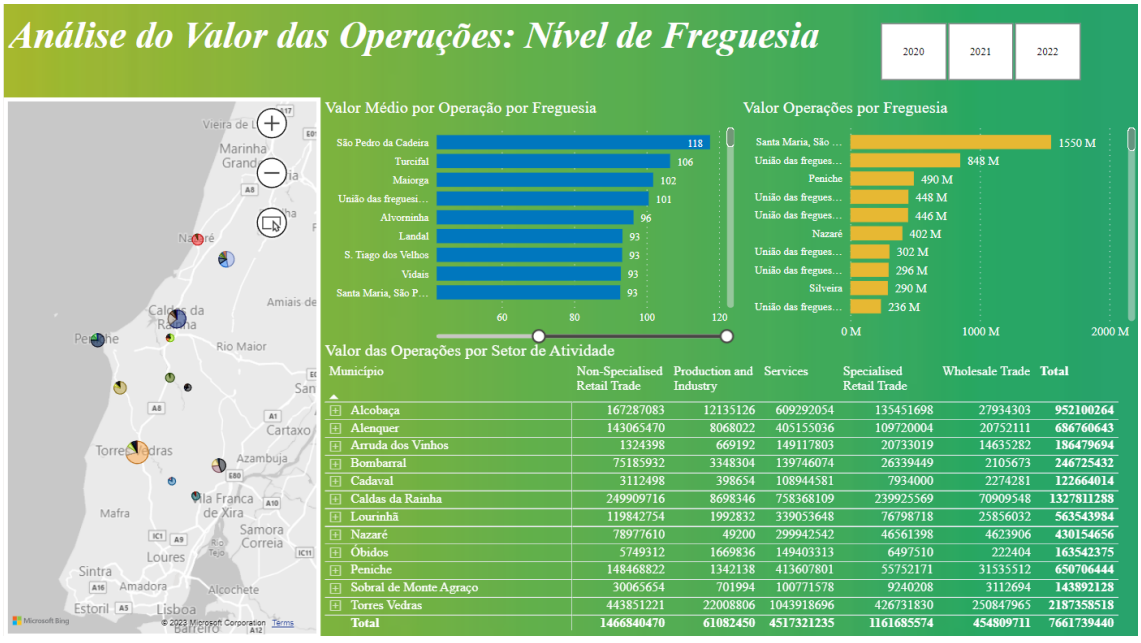
The visualizations in this dashboard pertain to the Value of Transactions that occurred in the West Community (OesteCIM) between March 2020 and November 2022. The map serves as a tool to provide the user with a spatial perspective of the analysis, indicating areas with higher

values. The remaining charts assist in obtaining feedback on how transactions are distributed by sector, month, and municipality.

Initially, it can be inferred that, by a significant margin, the municipality of Torres Vedras exhibits the highest transaction value, followed by Caldas da Rainha. The total amount transacted reaches 7662 million euros, distributed across 165 million transactions. Concerning the Sector of Activity, the Services sector stands out, surpassing the combined performance of the other sectors. This data suggests that the regional economy is strongly driven by this sector, an observation that remains consistent over the years, indicating a considerable dependence on tourism, as reflected in these figures.

Analyzing different months of the year, it can be concluded that May, August, and October recorded the highest volume of transactions, suggesting a potential seasonality in the region. It is essential to emphasize that during part of the analyzed period, Portugal experienced lockdowns, a factor that could influence some results. Consequently, it is imperative to consider these circumstances when interpreting the obtained data.

4.2. Analysis of Transaction Value: Parish Level



Município	Non-Specialised Retail Trade	Production and Industry	Services	Specialised Retail Trade	Wholesale Trade	Total
Alcobaça	167287083	12135126	609292054	135451698	27934303	**952100264**
Alenquer	143065470	8068022	405155036	109720004	20752111	**686760643**
Arruda dos Vinhos	1324398	669192	149117803	20733019	14635282	**186479694**
Bombarral	75185932	3348304	139746074	26339449	2105673	**246725432**
Cadaval	3112498	398654	108944581	7934000	2274281	**122664014**
Caldas da Rainha	249909716	8698346	758368109	239925569	70909548	**1327811288**
Lourinhã	119842754	1992832	339053648	76798718	25856032	**563543984**
Nazaré	78977610	49200	299942542	46561398	4623906	**430154656**
Óbidos	5749312	1669836	149403313	6497510	222404	**163542375**
Peniche	148468822	1342138	413607801	55752171	31535512	**650706444**
Sobral de Monte Agraço	30065654	701994	100771578	9240208	3112694	**143892128**
Torres Vedras	443851221	22008806	1043918696	426731830	250847965	**2187358518**
Total	**1466840470**	**61082450**	**4517321235**	**1161685574**	**454809711**	**7661739440**

Figure 16 Analysis of Transaction Value: Parish Level

The following dashboard - Analysis of Transaction Value: Parish Level - illustrated in Figure 16, has a filter to select the year, and it is again possible to interact with any chart to select a preferred data point.

In this dashboard, we provide an analysis at the parish level regarding transactions that occurred during the specified period. The reintroduction of a spatial perspective in the analysis aims to assist the user in grasping the precise spatial elements. The decision to employ two stacked bar charts was motivated by the intention to communicate, in a more elucidating manner, information regarding the average value per transaction and the total value of transactions per parish. This approach facilitates the understanding of the numbers and highlights disparities among the various parishes. Finally, the choice to incorporate a matrix aims to present data initially organized by municipality but with a special emphasis on segmentation by parish. This approach allows for a detailed analysis of the total value of transactions in different sectors of activity, providing a comprehensive and segmented view that enriches the understanding of the transactional landscape at the local level.

Upon analyzing this dashboard, it becomes evident that two parishes stand out, with indicators revealing values significantly higher than others. Notably, the parish of Santa Maria, São Pedro e Matacães records a total of transactions equivalent to 1550 million euros, with an average of 93 euros per transaction. Subsequently, the Union of parishes of Caldas da Rainha – Nossa Senhora do Pópulo, Coto e São Gregório exhibits a total transaction amount of 848 million euros, with an average of 73 euros per transaction. It is noteworthy that the prominent position of these two parishes remains unchanged compared to the previous years of 2021 and 2022. A noteworthy commonality is that both parishes predominantly concentrate the highest value of their transactions in the services sector, aligning with the insights derived from the previously analyzed dashboard.

This data provides valuable insights, highlighting the significant weight these two parishes hold in the West region. However, the concentration of economic activity in only two parishes in a geographically extensive region may raise concerns, indicating considerable dependence and an uneven distribution of resources and economic activity in the region.

4.3. ANALYSIS BY SECTOR: TRANSACTION VALUE AND NUMBER OF CARDS

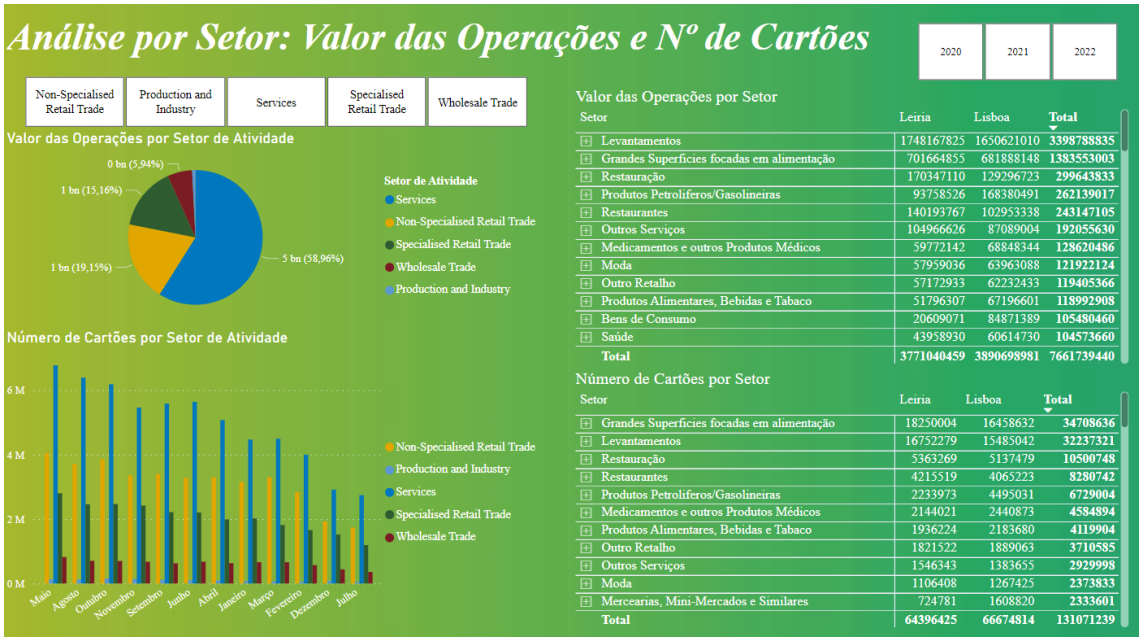


Figure 17 Analysis by Sector: Transaction Value and Number of Cards

This third dashboard – Analysis by Sector: Transaction Value and Number of Cards – illustrated in Figure 17, features two filters, one again for the year and a new one for activity sectors, allowing for results to be filtered by the specific sector under analysis. It is again possible to interact with any chart to select a preferred data point.

We opted to utilize the matrix again to present data related to transaction value and the number of cards per sector. Subsequently, we employed a circular chart to discern the percentages that each activity sector represents in the transactions conducted. Finally, the choice fell on a grouped column chart, aiming to provide a clear visualization of the months in which card usage was more intensive, also distinguishing the activity sector associated with these transactions.

Upon examining this dashboard, it becomes immediately apparent that the "Services" sector exhibits substantially higher values compared to other sectors. Upon closer analysis, prominent sectors emerge, namely, "Withdrawals" and "Large Surfaces Focused on Food," with transaction values of 3398 million euros and 1383 million euros, respectively. However, when considering the number of cards in circulation, an inversion of positions is observed, with 34.7 million for one and 32.2 million for the other. Additionally, concerning the months, the number of cards in the "Services" sector displays a more significant range of values

compared to other sectors. This more pronounced variation over the months suggests a greater fluctuation in transactions conducted via cards in this specific sector, contributing to a more detailed understanding of the temporal dynamics associated with this activity category.

A point of considerable significance is that intuitively one might anticipate both elements in question belonging to the "Services" sector; however, this expectation is not confirmed. It is observed that only "Withdrawals" belong to this specific sector. Large surfaces focused on food, on the other hand, fall within the "Non-Specialised Retail Trade" sector, representing virtually the entirety of this sector.

Other activity sectors exhibit lower but equally important figures. In "Production and Industry," it is noteworthy that the analyzed value is almost entirely attributable to manufacturing industries. In "Specialised Retail Trade," petroleum products and gas stations stand out as primary contributors. Lastly, within the "Wholesale Trade" scope, products related to food, beverages, and tobacco play a preeminent role in this specific sector.

4.4. Analysis of the Number of Cards by Type of Day

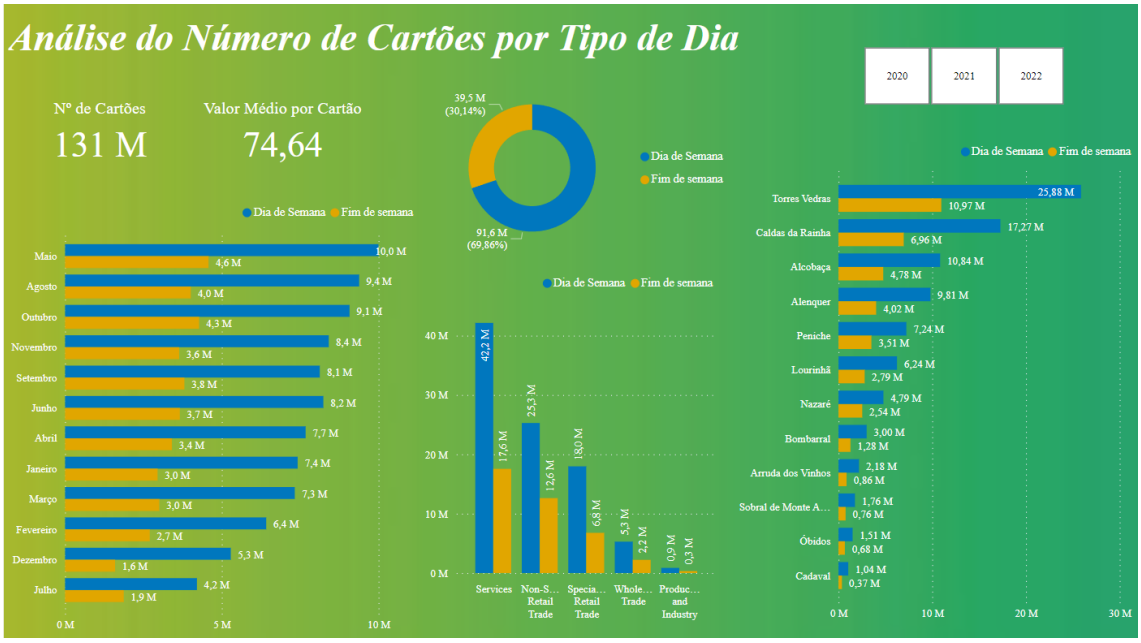


Figure 18 Analysis of the Number of Cards by Type of Day

Finally, we have the dashboard - Analysis of the Number of Cards by Type of Day - illustrated in Figure 18, featuring a filter for the year. It is once again possible to interact with any chart to select a preferred data point.

In this dashboard, two grouped bar charts were employed, one for months and another for municipalities. Additionally, a grouped column chart was chosen for the sector of activity. The last chart is a pie chart illustrating the percentages of each type of day. All these charts are annotated with the respective day type. Two cards were also utilized to display the number of cards and the average value per card.

Over the entire time period, it is evident that the municipality where cards were most frequently used was Torres Vedras, followed by Caldas da Rainha. This trend remains consistent irrespective of the chosen year. Regarding the months of the year, it is noticeable that the warmer months correspond to increased card usage. In terms of activity sectors, Services once again stand out with the highest numbers. The total number of cards used amounted to 131 million, with an average value per card of 74.64 euros.

The objective of this analysis by type of day is to discern whether card usage is significantly influenced by the time of year and if it varies notably between weekdays and weekends. Consequently, it can be concluded that the variation is not substantial, indicating a consistent level of activity both during the week and on weekends.

5. CONCLUSIONS, LIMITATIONS AND FUTURE WORK

Turning now to the conclusion, the purpose of this article is to develop and present a solution for a region in Portugal, specifically the Oeste region (OesteCIM). The entire development of this study is aimed at identifying patterns and anomalies within this region and understanding their underlying reasons. Through the presentation of meticulously processed data, the goal is to showcase, via Business Intelligence tools, how this region behaves.

Regarding the provided data, complications arose that necessitated addressing before proceeding to their analysis. Numerous data entries exhibited deficiencies, necessitating a more intensive effort to rectify this situation. In addition to the initially acquired data, new columns were also introduced with the aim of facilitating a more thorough analysis. Another aspect that significantly impacted this analysis was the temporal context of the data. Portugal experienced a global pandemic during the referenced period, which, in turn, markedly constrains the analysis. This situation poses considerable limitations as it hinders the extraction of the desired genuine results - an unencumbered timeframe devoid of constraints that could interfere with the obtained data.

Through the analysis of the data, it becomes evident that there is a pronounced dependence on services, serving as the primary source of transactions. This circumstance, however, imposes substantial limitations on the region in question, prompting the need for innovative solutions to diversify sectors and foster industrial growth. Such a strategic approach would directly impact regional development by creating employment opportunities and, consequently, attracting a larger population to the area. Continuing the analysis, it is noteworthy that a significant portion of transactions in this region is concentrated in only two municipalities, revealing a noteworthy disparity in values. This excessive concentration in specific locales does not align favorably with the analysis, suggesting the necessity for measures to more evenly balance the distribution of economic activities and transactions within the region.

This region urgently needs to explore innovative solutions to mitigate its heavy reliance, particularly on the tourism sector, and foster communal growth to elevate its standing. In terms of industries and agriculture, the region's geolocation provides a highly favorable

position for expansion, given its proximity to major cities with diverse needs. It is imperative to acknowledge the latent potential in this region as a strategic hub for growth, facilitating job creation and, consequently, advancing the holistic development of the community.

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