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Immigration in Portugal

Migratory movements and economic impact through a
Business Intelligence approach

Inês Alexandra Durão Martins

Project Work

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

NOVA Information Management School
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IMMIGRATION IN PORTUGAL

Migratory movements and economic impact through a Business Intelligence approach

By

Inês Alexandra Durão Martins

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

Supervisor: Professora Doutora Teresa Ferreira Rodrigues

Co-Supervisors: Professor Doutor Miguel de Castro Neto

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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.

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ABSTRACT

Due to the fast growth in the number of immigrants in Portugal, there is an increasing need to examine data and values related to the subject, particularly in understanding the relation on the country's economy and the local community. Therefore, it is essential to visualize the official data in a more accessible manner to facilitate decision-making regarding immigration.

In line with the global trend of increasing reliance on Business Intelligence (BI) solutions, this project proposes the implementation of a BI solution using Power BI.

The initial step involved creating a conceptual model. Followed by an extensive data collection process from multiple sources. Subsequently, various transformations were applied to the collected data to prepare it for further analysis and usage. Finally, a data visualization report was developed, aiming to provide a clear overview of the immigration trends, the geographical distribution of immigrants, their countries of origin, demographic characteristics, and its connection with economy. The objective is to enhance the decision-making process by providing accurate and visually appealing representations of the data.

The results obtained from the implementation of the Business Intelligence solution indicated that, overall, it has the potential to be useful for decision-making and supporting studies related to immigration in Portugal. The system offers valuable insights into immigration patterns, enabling to make informed decisions and better understand the implications of immigration on various aspects of society and the economy.

KEYWORDS

Business Intelligence; Dashboard; Microsoft Power BI; Immigration

Sustainable Development Goals (SGD):

INDEX

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LIST OF ABBREVIATIONS AND ACRONYMS

DW   Data Warehouse

BI   Business intelligence

KPI   Key performance indicators

GDP   Gross domestic product

INE   *Instituto Nacional de Estatística*

PBI   Microsoft Power BI

SEF   *Serviço de Estrangeiros e Fronteiras*

PIB   *Produto Interno Bruto*

DAX   Data Analysis Expressions

NUTS   *Nomenclatura das Unidades Territoriais para Fins Estatísticos*

1. INTRODUCTION

1.1. BACKGROUND AND CONTEXTUALIZATION

Immigration has an impact on every sector of all countries, including the demographics, economy, labor market, fiscal system, health, crime, and politics, among others (Ben-Gad, 2004; P. Smith & Edmonston, n.d.).

The importance of immigration in Portugal is known and proven by several studies (Dias & Gonçalves, 2007; Peixoto et al., 2017; T. Rodrigues & Chorincas, 2022), and it is becoming more important to study these impacts since the number of foreign population resident in Portugal continues to increase. In 2021, the number of registered immigrants in Portugal was recorded as 698.889, and since 2001 over 90% of the population growth can be attributed to a positive migratory balance, which represents the difference between the annual volumes of emigration and immigration (T. Rodrigues, 2021; Estrela et al., 2022).

The use of business intelligence software, allows the design of various reports in different formats using the official available data. Being able to access data from a database permit to generate various reports that meet various requirements. If we can collect a large amount of data and produce reports, the quality and efficiency of decisions will increase. As mentioned in the previous study, dashboards for visualization of demographic data has shown great result making all the information easily understandable (Homsuwan et al., 2018).

According to (Guedes, 2018), the importance of business intelligence is being a reality that is transversal to several sectors. The technological solutions and offerings to be used must always be appropriate for each sector, and the solution must be customized, so that it becomes possible to provide the right information at the right time, in formats that are suitable for the target audience, to ensure that the objectives are met.

In the Portuguese case, it is necessary to better understand the experiences of immigrants living in the country and their impact on the national economy. There are specific challenges faced by immigrants in terms of access to employment, education, and social integration different from individuals of Portuguese citizenship. These challenges can have negative or positive effects on the economic and social integration, which in turn can have an impact on the overall economic performance of the country.

1.2. STUDY OBJECTIVES

Based on the literature critical review we pretend to emphasize and explore the importance of a business intelligence solution today. We will also explore studies concerning immigration in Portugal that we consider relevant to estimate the impact of the evolution of immigration on a country's economy.

The main objective is to develop a business intelligence solution to facilitate the analysis of the immigration numbers evolution in Portugal from 1980 to 2021, and connect that information to socioeconomic data, in order to explore the relationship between economy and immigration.

A dashboard will be elaborated to support the analysis of the several data available regarding different immigration subjects in a clear, succinct, and engaging way as well as connect to the impact on the economy through KPIs.

Users will be able to evaluate and interpret more effectively and make decisions more quickly. It can be consulted by different entities, such as government entities and political parties to help make decisions that might be associated with immigration. Additionally, academic users can utilize the dashboard to increase the quality of their research on the subject, benefiting from its comprehensive data and analytical capabilities.

The following actions need to be taken first in order to accomplish this goal:

1. Creation of the Conceptual Model: Where we will include a data model proposal, selection of the appropriate performance indicators and a dashboard proposal.
2. Development of the Proof of Concept: Implementation and data processing, creation of dashboards for the visualization and deployment of KPI's previously selected.
3. Analysis of the obtained results.

Research Questions:

1. What is the dimension of recent growth in the number of immigrants in Portugal?
2. How do unemployment rates and GDP influence the influx of immigrants in Portugal and vice versa?
3. What are the major countries of origin for immigrants in the global scenario?
4. How have immigration distribution patterns evolved over time for specific countries of origin?
5. How does the geographical distribution of immigrants vary based on gender and country of origin, and what are the concentration patterns of the immigrant population across different districts in Portugal?
6. What is the professional landscape and entrepreneurial activity among immigrant populations in Portugal?
7. What are the employment and activity statuses of immigrants based on country of origin?
8. What are the dominant job sectors among immigrants in Portugal, and how do they vary by country of origin?
9. What is the age composition of immigrants in Portugal, and how does it differ by country of origin?
10. What is the educational background of immigrants in Portugal, and how does it vary by country of origin?

These research questions encompass various dimensions of immigration in Portugal, including growth trends, economic influences, global origins, distribution patterns, professional landscape, employment status, age composition, and educational background. By addressing these questions, the business intelligence solution will provide valuable insights into immigration dynamics and their socioeconomic implications in Portugal.

1.3. STUDY RELEVANCE AND IMPORTANCE

Immigration is a major global issue. In recent years, immigration has become a highly debated topic worldwide. The movement of people across borders has implications for economic growth, social cohesion, and cultural diversity.

In recent years, Portugal has witnessed a substantial surge in immigration, with a notable influx of immigrants originating from both European Union member states and non-EU countries. This study focuses on comprehensively analyzing the migratory patterns of these immigrants and their consequential effects on the Portuguese economy, employing Business Intelligence (BI) techniques.

This study holds significant importance as it provides valuable insights into the experiences of immigrants in Portugal. It enables a comprehensive examination of factors such as their countries of origin, educational backgrounds, and employment statuses, among others. By gaining a deeper understanding of these aspects, policymakers can effectively address pertinent issues, particularly in the realm of public policy formulation and implementation.

Although there is an abundance of statistical data and static tables available, there are relatively few academic resources that consolidate qualitative information, such as a report or a Power BI dashboard, into a single tool. The immigrant population numbers continue to increase, as well as their socioeconomic profiles. So it is becoming more and more important to have tools to support the visualization of the evolution of immigration in different fields, and estimate its influence on the economy. These tools can help decision-making regarding immigration challenges and associated risks.

1.4. PROJECT RESEARCH DESIGN AND STRUCTURE

1.4.1. Research Methodology

The Design Science Research Methodology (DSRM) Process Model, a systematic and iterative strategy for resolving real-world issues via the creation, application, and assessment of creative objects, is used in this master's thesis. The DSRM Process Model involves six stages and aims to produce an innovative artifact that addresses the identified problem and contributes to the advancement of knowledge in the field. The model presented in Figure 1 shows the different steps (Peffers et al., 2007).
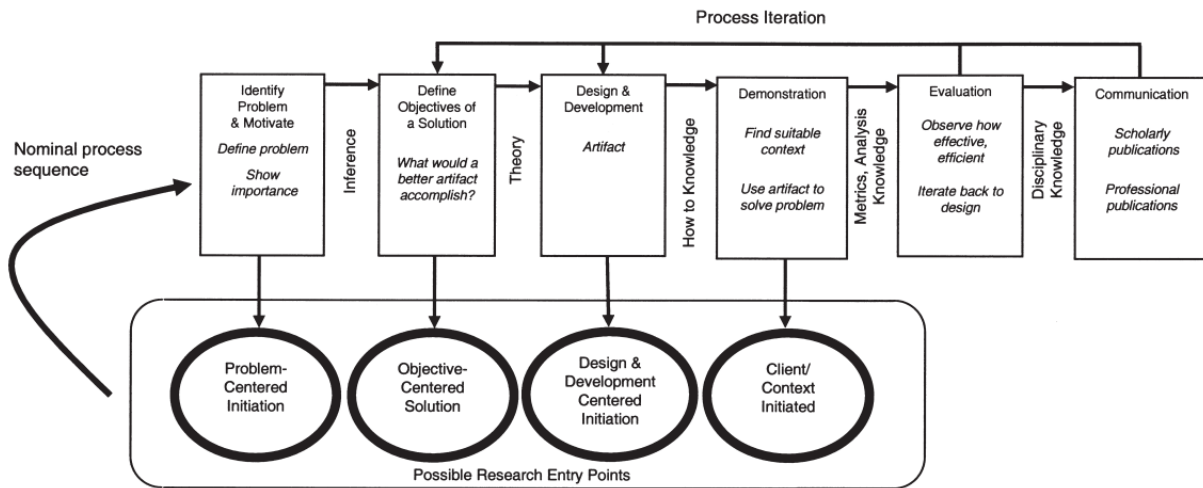
Figure 1. DSRM Process Model (Peffers et al., 2007)

The Design Science Research Methodology outlined here comprises essential principles, practices, and procedures for conducting an investigation (Peffers et al., 2007). To create successful artifacts, Design Science Research is important in a guided discipline and consists of six steps, which can be performed according to the needs of a given project (van der Merwe et al., 2019).

To implement the Design Science research process, it is essential to undertake six sequential steps.

1. **Identify Problem and Motivation**
   As mentioned earlier, the number of immigrants in Portugal is increasing, which means that it is becoming more important to have a tool where we can easily search through the available data to find patterns and relationships with the economy. This will support further studies on the topic and decision-making related to the topic.

2. **Define the objectives of a Solution**
   The main goal is to develop a Business Intelligence solution that processes the available data, cross-correlates the data, and presents it through visualizations for people who have a subject-related job, future studies, and public sector decision-making.

3. **Design and Development**
   The entire process that will lead to the creation of dashboards will be developed, namely the extract, transformation, and loading of the data, the creation of metrics, and the choice of how to visualize them.

4. **Demonstration**
   As the project is developed, we will evaluate the results to understand if the objectives and results are being met and what adjustments need to be done.

5. **Evaluation**
   After the concept model has been completed, an assessment of how well the artifact supports the solution to the goals, confirming whether the dashboards address all the identified goals or whether it is required to redesign them.

6. **Communication**
   This document will serve as a disclosure.

1.4.2. Project Structure

This dissertation is divided into seven chapters each of them structured into various sections and subsections to ensure a coherent and comprehensive exploration of the research topic.

Chapter 1 contains the introduction, providing an in-depth presentation of the research background, clearly defined objectives, detailed document structure, and research methodology.

In chapter 2, for the literature review, we chose the main topics to develop our research, mainly related to immigration in Portugal and business intelligence, including relevant information and citations.

Chapter 3 is focused on the development of a conceptual model for the project, encompassing the creation of metrics, formulas, data model and draft dashboards.

Chapter 4 includes the ETL process and the practical application of the conceptual model design.

Chapter 5 is dedicated to the comprehensive presentation and evaluation of the research results. The obtained findings are effectively displayed through appropriate data visualization to derive meaningful insights.

In Chapter 6, the final section of this master thesis, limitations encountered during the research are meticulously addressed, and valuable suggestions for future work are provided.

Lastly, Chapter 7 presents a concise yet comprehensive summary of the entire master thesis, encapsulating the key accomplishments, findings, and conclusions drawn from the research.

2. LITERATURE REVIEW

2.1. IMMIGRATION IN PORTUGAL

There is no uniformity in the way different countries operationalize statistically the concept of immigrant. In conceptual terms, the notion of immigrant corresponds to the universe of people who have a border movement and/or entry and settlement for a period of more than a year in a country other than their country of origin. In Portugal, the immigrant population is counted through the nationality of the people (Oliveira, 2021).

2.1.1. Immigration and economy

With a total of 698,889 immigrants in Portugal recorded in 2021, it is clear that immigration holds significant relevance in the country. These values testify the impact of migration flows in national terms, both economically, socially, and culturally. Currently, Portugal is the 5th most aged country in the World, with a ratio of 189 individuals aged 65 or older for every 100 individuals aged 0 to 14, with a total dependency on migratory movements to mitigate the negative effects of the aging process. The phenomenon of immigration contributes to a slowdown of the aging process and has positive repercussions in several sectors, such as contributive population numbers, productivity levels, volume and impact of remittances and consumption (T. Rodrigues, 2021).

Since 2010, 92% of population increase rates was supported by a favorable migration balance. Even so Portugal lost population between 2010 and 2019. The recovery observed can be attributed entirely to the positive changes in migratory balances, related to a clear decrease in the number of people leaving the country (emigration) and a significant increase in the number of people entering the country (immigration). In fact, the positive recovery observed since 2019 was totally due to positive migration balances (Coelho, 2021).

In the last years the regularization of immigrants in Portugal had also a positive impact on social security and public accounts. Therefore, immigration plays a key role both in rejuvenating and increasing the active population and in the sustainability of social security in Portugal (Coelho, 2021). The exceptional regularization of migrants living in Portugal when COVID-19 forced to close the borders had a positive impact on the rise of migratory community (Ferreira & Rodrigues, 2021)(Stanford et al., 2021).

The immigration process and the challenges faced by immigrants has to be discussed, particularly in the context of precarious agricultural work in southern Portugal. The factors that drive illegal migration, such as poverty, wars, economic crises, and religious persecution. Immigrants often face discrimination and negative stereotypes, which marginalize them and deny them the rights and benefits of citizenship. Yet despite the difficulties they face, immigrants play a crucial role in the economy, especially in jobs that local workers refuse to do. The paper of (Campos, 2021) emphasizes the need to recognize the importance of immigrants' contributions and their integration into society for social harmony and the overall development of the country.

As 60% of the immigrant population is active age, their integration into the labor market generates social security contributions, mitigating the difficulties of the public budget (T. F. Rodrigues & Henriques, 2017).

We can understand social security as a system of collective, autonomous, and state guarantees, based on the organized solidarity of a community, which aims to prevent and address social risks. There are three main objectives of the system: A) The objective is to guarantee the fulfillment of the entitlement to social security. B) The goal is to encourage consistent enhancements in the quality and extent of social protection, along with its equitable distribution. C) The aim is to enhance the effectiveness and efficiency of the system's management. (Peixoto et al., 2011).

The obligation to contribute to social security arises from the fact that there is a remuneration and is constituted in the month of the beginning of the working activity. Accordingly, foreigners who legally work and reside in Portugal are subject to the same rights and duties as nationals.

Also, in the study of (Peixoto et al., 2011), it was concluded that between the years 2002 and 2010, in net financial statements, immigrants are large contributors to the system. Comparing values of contributions on one hand, with the set of social benefits and pensions on the other.

According to (Peixoto et al., 2017), the estimations presented to show that the expected population evolution, in a scenario without immigration, cannot ensure the human resources necessary for the economy. Concerning the aging of the population it is expected that the percentage of the population with 65 years or older will continue to increase, however, even with the projected growth in the migration balance, the challenges associated with population aging cannot be solved through migration strategies only.

The same study also shows that, in a scenario in which there is no replacement migration, economic developments will penalize the financial balance of the old-age pension system. It is then projected that without the immigration scenario, a financial imbalance tends to increase. The consideration of replacement migrations allows us to foresee a more positive evolution between receipts and expenditures related to old age, which contributes to the global balance of the Social Security system.

The age composition of a population significantly impacts regional economic development. A higher proportion of older individuals and increased dependency on the working-age population negatively affect per capita income and labor productivity. This relationship varies across regions, with growing urban areas benefitting from a younger population, while declining rural regions face challenges due to aging demographics. Younger age groups positively influence economic indicators, particularly in growing regions, while older age groups have a negative association, especially in rural areas. Immigrants have a significant impact on the average age of the regions where they reside. Due to their typically younger age profile, immigrants contribute to lowering the average age of the population in those areas (Goujon et al., 2021).

Tracking the countries of origin of immigrants to Portugal is valuable for understanding immigration patterns and identifying trends, challenges, and opportunities related to specific immigrant groups. By monitoring the countries from which immigrants predominantly come, policymakers, researchers, and organizations can gather important data to develop targeted policies, allocate resources effectively, and provide appropriate support and integration programs for specific immigrant communities. Additionally, tracking changes in the countries of origin over time can help identify emerging migration trends and potential shifts in immigration patterns to Portugal (Kunczer et al., 2019).

This study highlights the concentration of immigrants in cities and regions, compared to native populations, and emphasize the importance of understanding and measuring the local adjustments resulting from immigration. The authors discuss the different skills possessed by immigrants and how they affect the local economy. They also explore the empirical literature on the causal impact of immigrants on local economies, including the response of native workers and firms. Concluding that it is relevant to analyze the geographical distribution of immigrants (Lewis & Peri, 2015).

Understanding the job status and activity of immigrants is vital for comprehending their impact on Portugal's economy. Over the past two decades, immigration patterns in the country have closely followed economic cycles. Immigrants fill positions in both modern and traditional sectors, but ineffective policies have limited their professional mobility and led to low wages and insecure working conditions. The coexistence of immigration and emigration, influenced by free labor circulation and low-skilled wages, is a unique aspect of migration to Portugal. Despite economic challenges, there is a lack of significant social tensions or anti-immigration attitudes, partly due to integration policies and the dissipating effect of emigration. Studies have highlighted immigrants' positive contributions to economic growth and population dynamics in Portugal (Fonseca & Mcgarrigle, 2014).

Portugal is acknowledged for its business-friendly legal framework and efficient procedures when it comes to establishing companies. Nevertheless, the country encounters obstacles in terms of accessing credit, obtaining construction permits, managing tax payments, and ensuring investor protection. During the economic and financial crisis, Portugal witnessed a decline in entrepreneurial activity, primarily due to inadequate profits and challenges in securing financing. Government initiatives and subsidies are viewed positively as they contribute to the promotion of entrepreneurship. However, the overall evaluation of government policies concerning business taxes and regulations is unfavorable (de Reis Oliveira, 2019).

The fact that immigrants are employed or unemployed is an important factor in estimating the fiscal impact. Immigrants' age is considered to be the most important factor that can justify the differences in contributions between the immigrant population and the natives. In the short term, the skill level of the immigrant is seen as an important factor in the fiscal impact (Vargas-Silva et al., 2022).

The impact of immigration on unemployment can vary depending on the level of substitution or complementarity between native and migrant workers, as well as the flexibility of labor markets. Research conducted at the micro-level indicates that immigration initially has slight negative effects on employment and wages for native workers without a high school education, but these effects become slightly positive in the long term. On a macroeconomic scale, studies utilizing both individual-level and macro-level data demonstrate a positive complementarity effect between native and foreign workers, resulting in job creation and increased job complexity. Furthermore, literature indicates that skilled labor migration contributes positively to the differences in relative Total Factor Productivity (TFP) in advanced economies, thereby stimulating job creation. To assess the relationship between immigration, unemployment, and growth, a panel Granger causality approach was employed in 22 OECD countries. Ultimately, the impact of immigration on unemployment hinges on whether substitution or complementarity effects take precedence. (Esposito et al., 2020).

One commonly used metric to measure the economic impact of immigration is Gross Domestic Product (GDP) per capita. GDP per capita measures the economic output of a country per person and can provide an indication of overall economic performance. There is a method for assessing the effect of

immigration on the public sector's economy. This technique calculates the increase in the country's Gross Domestic Product (GDP) that is brought about by the growth in the labor force due to immigration, expressed as a percentage (Kerr & Kerr, 2011).

Considering that the concentration of immigrants is generally associated with attitudes towards immigrants, we can infer that areas with higher unemployment rates and lower GDP might experience different patterns of immigrant influx compared to areas with lower unemployment rates and higher GDP. In regions with better economic conditions, where unemployment rates are low and GDP is high, a positive relationship between these factors and the influx of immigrants may be expected. This could be due to perceived opportunities and favorable living conditions attracting immigrants to these regions. Therefore, by examining the interplay between unemployment rates, GDP, and immigration patterns in Portugal, we can gain insights into how economic factors shape the inflow of immigrants and potentially influence public perceptions of immigration in different regions of the country (Boateng et al., 2021).

There are different forms of how immigration impacts the economy of the host country, be it through fiscal effects, house prices, creation of new jobs, wages, or employment effects on native workers and GDP (Dustmann et al., 2006).

2.1.2. History of immigration in Portugal

Portugal is historically an emigration country. From a historical perspective, the migratory movements in Portugal were characterized by a peak of the emigration movement, which took place between the end of the 60s and the beginning of the 70s of the 20th century, therefore, it was characterized as a country with a predominantly migratory nature. The immigration trend in Portugal is a phenomenon considered recent since it began to gain visibility and expression after the revolutionary process of 1974. Between the 1970s and the 1990s, where there was a predominance of immigrants from African Portuguese speaking countries (PALOP) and a stable contingent of Brazilians (Peixoto, 2004; T. F. Rodrigues, 2009).

Until the year 2000, the immigrant population in Portugal was predominantly from Lusophone countries, corresponding to 77%. This migratory scenario, which had been dominant since the 1980s, began to change in the 90's by the arrival of tens of thousands of immigrants from Eastern European countries, due to the need of intensive non-skilled work for civil construction of roads, *Expo 98* and *Ponte Vasco da Gama* (Baganha et al., 2004).

According to data provided by the Annual Statistical Reports made available by the Foreigners and Borders Service (SEF), between 2005 and 2010, the sustained growth of foreign residents in Portugal was broken. In 2010, there was a decrease in the number of immigrants in the national territory in comparison to the previous year. The economic crisis that the country was going through in this period is pointed out as the main cause for the lower attraction of the immigrant population to the country (Bento et al., 2011).

2.1.3. Description of the immigrant population in Portugal

In 2021, the resident foreign population experienced a continued growth for the sixth year in a row. The number of foreign citizens holding residence authorization increased by 5.6% compared to the previous year, reaching a total of 698,887 individuals. This marked the highest value recorded by SEF (Serviço de Estrangeiros e Fronteiras) since its establishment in 1976 (Estrela et al., 2022a).

Is possible to identify three profiles of foreigners living in Portugal: those coming from developed countries such as the European Union, the United States, Canada, and Northern Europe, with medium or high qualifications, who essentially occupy positions in areas such as education, health, and administration. The second profile comes from South America and other European countries, usually with high school education and medium qualifications, working in the service sector, for example in retail, restaurants, and tourism. Finally, we have a profile from Africa and Asia, with low qualifications, working in service sectors such as cleaning, civil construction, and agriculture (T. F. Rodrigues & Henriques, 2017).

The Brazilian community represents the largest percentage of the foreign resident population, signifying in 2021 29.3% of the total, followed by citizens from the United Kingdom with 6%, and in third place Cape Verde with 4.9%. Some new communities are having a significant increase, such as Nepal, Bangladesh, and India which stands out with a 23.2% increase over the previous year, moving four positions to fifth place (Estrela et al., 2022b).

Regarding the distribution by age group, among the resident foreign citizens, a significant proportion of 76.4% constitutes the potentially active population, with a notable prevalence of the 25-44 age group (young adults in active age). Migrants are on average 8 years younger than nationals (Oliveira, 2021).

Most of the immigrant population has secondary school education. Portuguese-speaking countries have the lowest qualifications and Spanish, British, and Ukrainian citizens have the highest qualifications (T. F. Rodrigues & Henriques, 2017).

Concerning activity sectors, the most prominent are services and civil construction. The Chinese community is highlighted in retail trade and restaurants, the Brazilian community in restaurants, and the Spanish community in education, health, and medicine (T. F. Rodrigues & Henriques, 2017).

Foreigners choose to reside in large urban centers and more dynamic areas in terms of less skilled employment, industry, and tourism. Over the years, there has been a consistent pattern in the geographical distribution of the foreign population, with a notable concentration along the coastal regions. Approximately 66.8% of the registered foreign population is primarily located in the districts of Lisbon, Faro, and Setúbal. (Oliveira, 2021).

Globalization has changed the type of migrants, and today it is possible to observe worldwide a set of qualified and potentially qualified professionals (Góis, 2022).

2.2. BUSINESS INTELLIGENCE

The term "Business Intelligence" (BI) was coined by Howard Dressner in 1989. It refers to a system that facilitates decision-making by leveraging data-driven insights. BI involves the integration of data collection, data warehousing, knowledge management, and analysis to provide valuable insights that contribute to the decision-making process. (Negash & Gray, 2008).

The term intelligence has been in use since the 1950s, especially when scientists talked about artificial intelligence (Chen et al., 2012). The term business intelligence only starts to be used in the 1990s, in the business and IT panorama according to (Magaireah et al., 2019), although there are studies that diverge, (Luhn, 1958) claims that the term BI has been used since the 1950s.

As time went by, new needs emerged, mainly on the behalf of companies, which needed more predictive and well-informed decisions. The complexity of information requirements, as well as the increase in computational capacity, meant that BI has continued to develop and gain importance until nowadays (Magaireah et al., 2019).

The implementation of a Business intelligence system in any project has become the key strategic tool, that will impact success. For decision-making and control, BI is now required to be more competitive and flexible when sharing information and data. (Nofal & Yusof, 2013).

Aside from vital technological factors like data quality, user access, and the integration of BI with other systems, the decision-making environment significantly influences the success and capabilities of BI. (Işik et al., 2013).

According to (Merhi, 2021), the successful implementation of data intelligence in the public sector is influenced by three critical categories: organization, process, and technology. Notably, project management, information system & data, and data quality emerge as the key drivers of success in terms of analysis. Among these categories, technology holds the highest level of significance.

2.2.1. Business Intelligence System Architecture

Mentioned (Rahman, 2011), the architecture of a BI system is composed of several components, such as the one mentioned next.

The data sources consist in identifying the various heterogeneous data sources that will be the basis of the solution to be developed.

ETL (Extract, Transform and Load) consists of data extraction, transformation, and loading. In the first phase, the data are extracted from various data sources and go through the transformation and the cleansing process, for example, standardizing the data, correcting errors, eliminating unnecessary fields or duplications, calculating metrics, and so forth; finally, they are ready to be loaded back into the Data Warehouse for analysis.

Data Warehouse is a repository of well-structured data to enable analysis to aid decision-making; serves as a central repository of information from one or more data sources; serves as the source for decision support systems.

Reporting is the phase of DW analysis through the creation of reports and dashboards. They provide a visualization of the most relevant information, in a consolidated and organized way on a single screen, so that it can be analyzed.

2.2.2. Data Visualization

In recent years, data visualization has been increasing quickly in the industry of analytics and Business Intelligence. Data visualization is considered an interdisciplinary field with the purpose of delivering the final stretch of the complete BI and analytics capability to users. Visualization can be defined as the process of creating a visible, direct, concrete image in the human brain, through visual elements and variables such as color, positions, etc. (Zheng, 2017).

Data storytelling can be considered a form of persuasion. The way you set up the narrative through visuals will make the audience think about something new and make decisions according to the conclusions drawn (Dykes, 2019).

According to (Sisense, 2019), building an efficient dashboard is the culmination of a BI process that includes defining KPIs and creating a data model. The design of a dashboard should not be underestimated, as a poor design will ruin all the work done previously, and will make the information difficult to read, spoiling the purpose.

From the (Cotgreave, n.d.) article, six best practices must be followed to improve dashboards, and these are: "Connect to All of Your Data; Blend Your Data Together; Choose Metrics that Matter; Utilize Better Visualizations; Use your Data in the Field and Share for Collaboration".

In recent years, the prevalence of digital dashboards has significantly increased, establishing them as indispensable communication tools. These dashboards play a crucial role in providing viewers with an up-to-date understanding of the information's current implications and its potential future significance. While the presence of effective dashboards can minimize unwanted interference from stakeholders and executives, they can also make a decisive impact on winning or losing a contract in competitive bidding scenarios. It is vital to recognize that information visualization is a scientific discipline rather than an artistic endeavor, and as such, there are specialized seminars and webinars available to address the gaps in traditional education when it comes to dashboard design (Kerzner, 2023).

When presenting quantitative data such as temperature, speed, or income, color can be used as a visual representation. A sequential color scale is a good option, using a range of colors to indicate which values are smaller or larger than others. These scales can be based on a single tone or multiple tones. When showing data on a map, color scale can be used to indicate variations in data values. Diverging color scales are also useful for data containing both positive and negative numbers. They stitch two sequential scales together to provide a balanced progression from light to dark colors. Color can also be used as an accent to emphasize specific data elements (Wilke, 2019).

(Wilke, 2019) shares a guide for the best ways to visualize different types of data. Recommending for numerical data, bars, dots, and heatmaps. Histograms and density plots provide intuitive visualizations of distributions, while boxplots, violin plots, and strip charts are effective for visualizing multiple

distributions. For proportions, pie charts, side-by-side bars, and stacked bars are suitable. Scatterplots are the recommended visualization for x-y relationships. Line graphs are commonly used for temporal data, while maps are used for geospatial data.

2.2.3. Key Performance Indicators and Metrics

Key performance indicators (KPIs), in a corporate setting are crucial quantitative measures that illustrate a company processes and structures. To support decision makers in planning and controlling, KPIs provide critical information. KPIs are a collection of indicators that concentrate on crucial elements of an organization's performance that are essential for achieving success. (Badawy et al., 2016) .

KPIs possess specific characteristics, including being sparse, drillable, simple, actionable, owned, referenced, correlated, balanced, aligned, validated, regulated, and distributed. Business monitoring is supported by an information system that provides information on several KPIs. It is a crucial activity that identifies problems in business performance and enables decision-makers to take corrective action in a timely manner (Badawy et al., 2016).

Customizing KPI reports to meet the specific needs of each decision-maker is essential to ensure that they are utilized effectively. It is important for those responsible for creating the reports to consider the target audience and ask themselves five key questions: "Who will be reading this report?", "What is their understanding of the report's topics?", "What are their expectations for the report?", "What information do they seek?", and "What actions will they take based on the information provided?"(Marr, 2015).

The customization of KPI reports should be guided by the answers to the five questions posed earlier. Best practice reports establish context, prevent data hijacking, and offer strategically relevant insights through visual displays and written narratives. A five-step process should be followed to ensure engaging and useful KPI reports, including the use of a strategy map, framing with a key performance question, supporting with graphs and charts, capturing salient points with headings, and providing context through explanatory text (Marr, 2015).

Different types of metrics include observations, data tables, statistics, and human judgment. Metrics must be measurable to meet stakeholders expectations, and they improve performance and decision-making. The time frames and life expectancies of different metrics impact their frequency of measurement. Using metrics management has various benefits, including improved performance and informed decision-making (Kerzner, 2023).

Metrics and Key Performance Indicators (KPIs) are essential elements of dashboard visualizations, informing users about their progress towards their goals. Metrics refer to numerical measurements that represent business data. Multidimensional analysis refers to examining a measure across more than one dimension, while a KPI is usually linked to a goal. Key Performance Indicators (KPIs) are typically used to assess improvement toward achieving objectives. These KPIs are often expressed as a ratio of the actual value to the target value, providing users with an easy-to-understand indication of whether they are meeting their goals (Kerzner, 2023).

3. CONCEPTUAL MODEL PROPOSAL

In this chapter, following our design science research methodology, it will be designed a conceptual model proposal, based on the literature review. Aiming to design a dashboard that will facilitate the computation of the relationship between immigration and the country's economy and provide comprehensive insights.

As previously mentioned in the Introduction, this chapter will provide an in-depth explanation of the data flow from source to data visualization. The suggested data model architecture will be presented, taking into account the main goals and needs of the report. In addition, the most relevant metrics and indicators will be identified in order to enhance the quality of information that the future dashboards will provide. Finally, the conceptual model for the dashboard is designed ensuring the end results produces appropriate conclusions.

To maintain consistency in the model, the dimensional model, comprising dimension and fact tables, and dashboards will be constructed in Portuguese due to the fact that all the data sources to be used are in Portuguese.

3.1. DATA FLOW

The following model aims to show the steps through the creation of the Business Intelligence solution to answer the needs. It will be use as data source excel files from INE, Pordata and SEF.

Once the data sources have been identified, the next step is to establish a connection between the data and the Power BI Desktop. The process of transforming, cleaning, formatting, and modeling the data will begin, for this purpose, the Power Query module will be used. The Power Query module is an intuitive tool that provides a user-friendly interface for performing data transformations.

During the transformation process, a multidimensional model will be created in Constellation schema format. This model will contain all the logically structured information required for the analysis. This will facilitate the creation of data visualization.

The final step in the data flow process is to create a dashboard that presents the data in an easily readable format. This dashboard will be built according to the recommendations studied in the literature review and will display metrics and indicators defined.
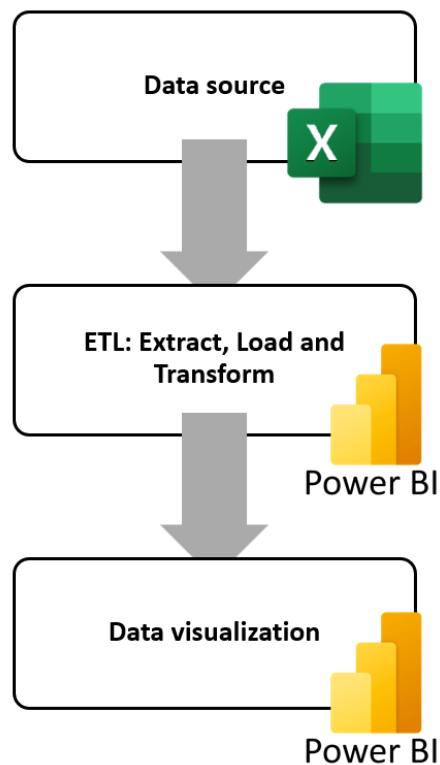
Figure 2. Data Flow

3.2. DATA MODEL ARCHITETURE PROPOSAL

In this section, will be propose a Data Model Architecture that has been designed to support the conceptual model proposal. The goal of this architecture is to ensure efficient data storage, processing, and retrieval, thereby enabling effective implementation of our Business Intelligence solution. A detailed description of the structure and components of the proposed architecture will be provided.

The proposed data model comprises nine fact tables and two dimension tables. The dimension tables includes Dim Ano and Dim País de Origem. Each of these dimension tables has been carefully selected to ensure that all important data is recorded, allowing for more effective decision making.

Once the business process and its granularity have been defined, the proposed model consists of two dimension tables and nine fact tables to facilitate the analysis.

Dimension Tables:

Year Dimension (DIM_Ano): This dimension captures the year. It enables time-based analysis and provides insights into trends and patterns over different years.

Country of Origin Dimension (DIM_PaísdeOrigem): This dimension captures information about the nationality or country of origin of immigrants. It allows for analysis based on different countries.

Fact Tables:

Education Fact Table (FACT_Educação): This fact table captures data related to the education levels of immigrants. It includes attributes such as education level and nationality, providing insights into the educational background of immigrants and its relationship with other variables.

Professional Status Fact Table (FACT_EstatutoProfissional): This fact table captures data related to the employment status of immigrants. Allowing for the analysis of labor market dynamics and the integration of immigrants into the workforce.

Gender Fact Table (FACT_Género): This fact table captures data related to the gender distribution of immigrants. It includes attributes such as gender, country of origin, and year, enabling the analysis of gender disparities and their impact on various socioeconomic aspects.

Age Group Fact Table (FACT_GrupoEtário): This fact table captures data related to the age distribution of immigrants. It includes attributes such as age group and country of origin providing insights into the age demographics of immigrants and their implications on different dimensions.

Immigration Fact Table (FACT_Imigração): This fact table captures data related to immigration patterns. It includes attributes such as country of origin, number of immigrants, and year, allowing for the analysis of immigration trends and their impact on the country's population composition.

Indicator Fact Table (FACT_Indicadores): This fact table captures significant metrics and indicators related to the country's economy. It includes attributes such as *PIB*, unemployment rate, and year, providing insights into the relationship between immigration and economic factors.

Residence Location Fact Table (FACT_LocaldeResidência): This fact table captures data related to the demographic distribution of immigrants by district. It includes attributes such as country of origin, gender, district location and immigration count, enabling the analysis of population distribution and immigration patterns across different regions.

Job Fact Table (FACT_Profissão): This fact table captures data related to the professions or occupations of immigrants. It includes attributes such as job and country of origin, facilitating the analysis of the employment sector and the contributions of immigrants in various fields.

Activity Status Fact Table (FACT_SituaçãoLaboral): This fact table captures data related to the labor market status of immigrants. It includes attributes such as activity status and country of origin, providing insights into the dynamics of the labor market and the employment situation of immigrants.
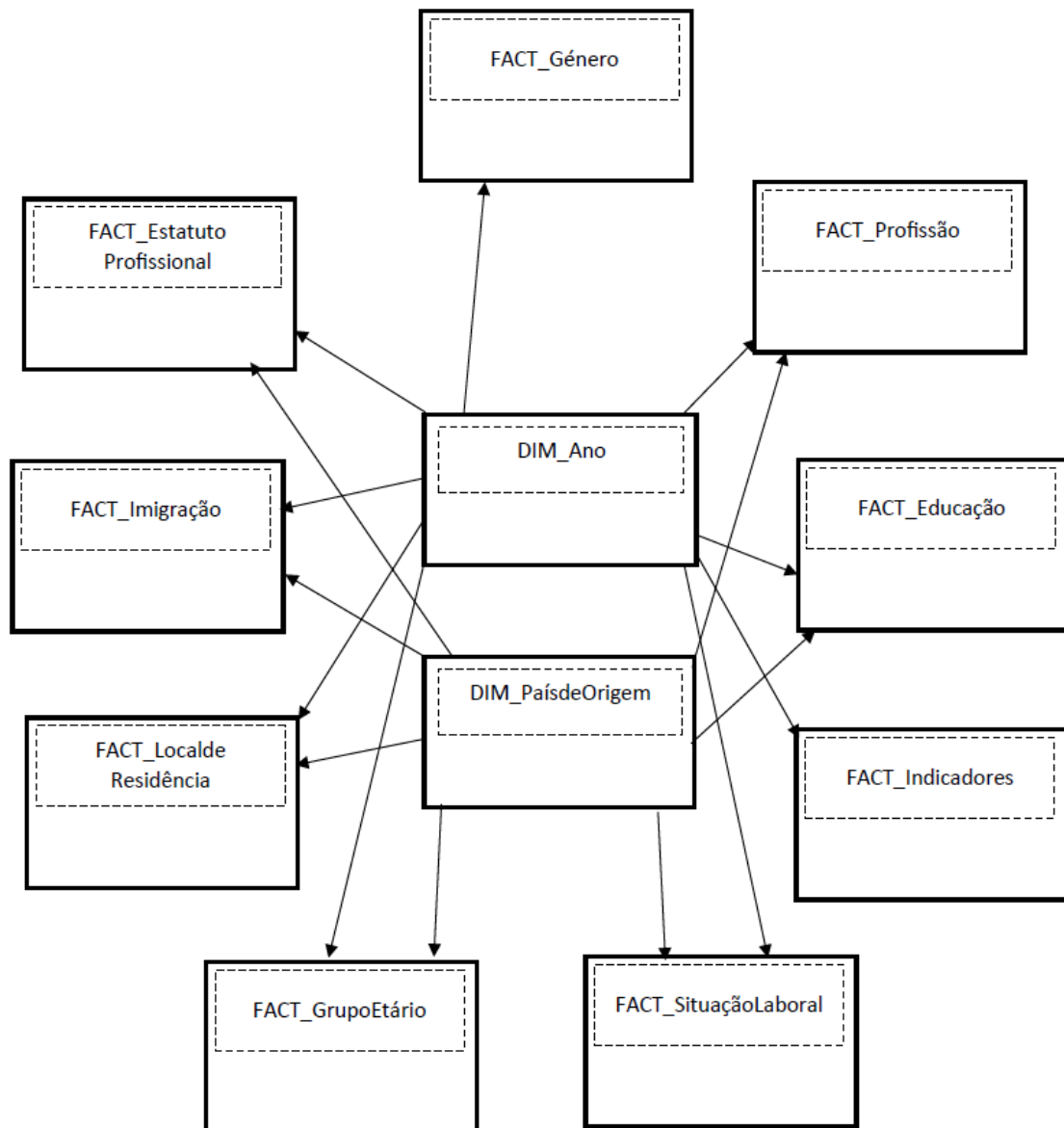
Figure 3. Conceptual data model diagram

3.3. METRICS AND INDICATORS

Effective monitoring and assessment of any project or effort depends on the selection of the right KPIs and metrics. In this section the metrics and indicators that are most relevant will be listed.

The list will be compiled by rigorously examining existing literature, reports, and other relevant sources of information. The list of metrics and indicators identified through this process will serve as a basis for developing an effective monitoring and evaluation framework. This framework will help ensure that the project or effort meets its objectives and is on track towards achieving its goals.

- Immigrant population share: This metric measures the proportion of the total population in Portugal that is made up of immigrants. This can give an indication of the overall impact of immigration on the country (Edo, 2019).
- Country of origin: It can be useful to track the countries of origin of immigrants to Portugal. This can help to identify any trends or changes in immigration patterns, as well as any potential challenges or opportunities related to specific immigrant groups (Edo, 2019).
- Age distribution: Immigrants can have an impact on the age distribution of the population in a receiving country (Fairlie & Lofstrom, 2015) .
- Gender Distribution: Gender distribution is the proportion of males and females in a population, which can provide insight into patterns of immigration and economic disparities related to gender (Fitzsimmons et al., 2020).
- Geographic Distribution: Immigrants may be concentrated in certain regions or cities in a receiving country (Borjas, 2019).
- Education level: Measuring the education level of immigrants in Portugal can provide insight into the potential contribution that immigrants can make to the country's economy and society (Borjas, 2019).
- Employment status: Tracking the employment status of immigrants in Portugal can provide information about their integration into the labor market, as well as any potential challenges they may face in finding work (Ahmad, 2020).
- Labor force participation rate: This measure calculates the percentage of individuals who are of working age and are either employed or actively looking for work. Immigrants can have a positive impact on the labor force participation rate, as they are often motivated to work and can fill labor market gaps (Docquier et al., 2014).
- Unemployment rate: This metric measures the proportion of the labor force that is unemployed. Immigrants can potentially increase the unemployment rate if they face discrimination in the job market or lack the necessary skills to find work (Tani, 2020).
- Employment Rate: This KPI measures the percentage of immigrants who are employed in Portugal (Tani, 2020).
- Entrepreneurship rate: This metric measures the proportion of the population that owns or manages a business. Immigrants can contribute to the entrepreneurship rate in Portugal by starting new businesses or bringing skills and experience to existing businesses (Fairlie & Lofstrom, 2015).
- Tax revenue: This metric measures the amount of revenue generated by taxes. Immigrants can contribute to tax revenue through income taxes, value-added taxes, and other taxes (OECD, 2021).
- *Produto interno bruto(PIB)* Growth: This metric measures the overall economic growth of Portugal. Immigrants can contribute to the PIB through increased consumption, increased productivity, and entrepreneurship (OECD, 2021).

3.4. PROPOSED MOCK-UPS

Below will be presented a lay out of a conceptual model that will guide the creation of the final dashboard. The conceptual model will define the structure, organization, and functionality of the dashboard, as well as outline the goals and objectives of the project. This model will serve as a

blueprint for the development stage, ensuring that the final product aligns with the intended design and meets.

The dashboard will feature several distinct pages, each with its own set of data visualizations and informational displays.

The first page will serve as the cover, featuring a title and intuitive buttons that provide easy navigation to the subsequent pages.

The second page will provide a comprehensive overview of immigration trends between the years 1980 and 2021. Through a combination of charts and tables, users will gain a clear understanding of the total number of immigrants, as well as their correlation with key indicators such as GDP and employment rates. This page aims to highlight the interplay between immigration patterns and broader economic trends, enabling users to discern meaningful relationships.

The third page of the dashboard will show a world map visualizing the main nationalities of immigrants in Portugal. By using a map-based visualization, users can quickly identify the countries from which the highest number of immigrants originate and gain insights. The map will utilize color-coding to represent the density of the immigrant population in each country and accompanied by tables and charts

The fourth page will offer a detailed map of Portugal that will highlight the distribution of the immigrant population across the country's various districts. Through color-coded representation, users will be able to identify areas with higher concentrations of immigrants. This page aims to provide a more granular understanding of the geographic distribution of the immigrant population, enhancing insights into regional disparities and clustering patterns. Also supported with filters, charts and tables.

The subsequent four pages will delve into socioeconomic indicators related to labor activity, employment, education, and age groups. Through the use of filters, visual cards, charts, and tables, these pages will serve as a comprehensive data hub, offering detailed insights into the socioeconomic characteristics of the immigrant population in Portugal. Users will be able to explore various dimensions and gain valuable insights into the labor market dynamics, educational levels, and age composition of immigrants.

Overall, the dashboard will be designed to present a wide range of information in a professional and user-friendly manner. By combining visualizations, data tables, and filtering options, users will have the opportunity to explore and analyze immigration-related data from different perspectives, empowering them to draw meaningful conclusions and inform decision-making processes.
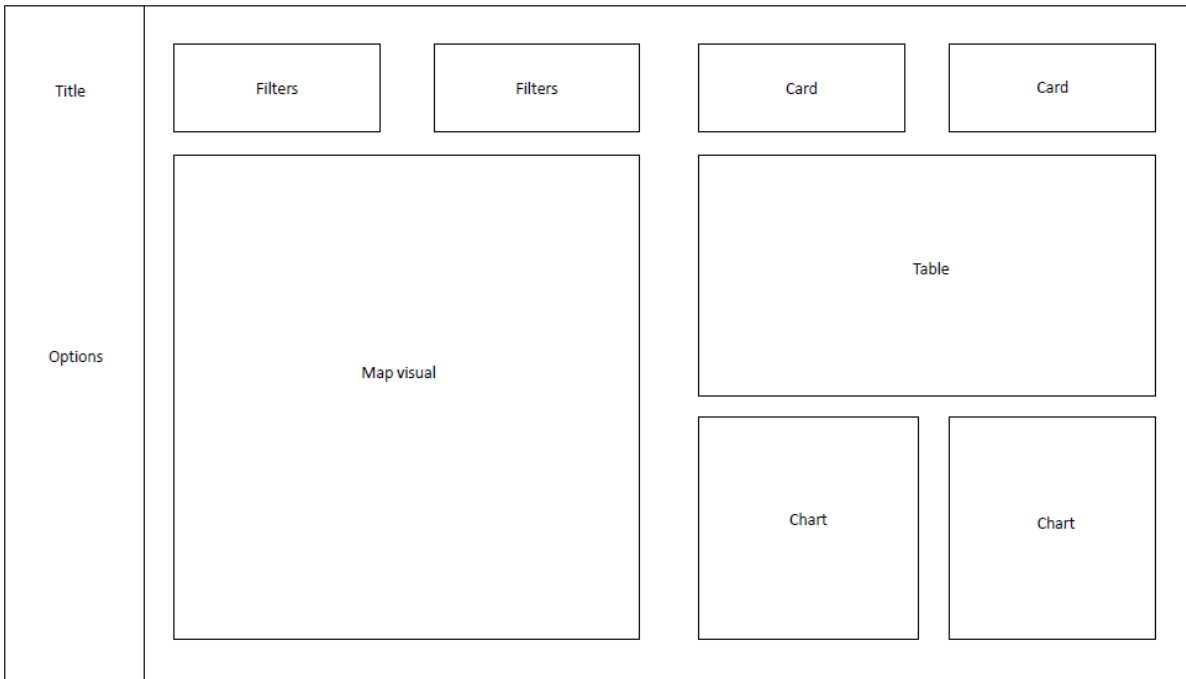
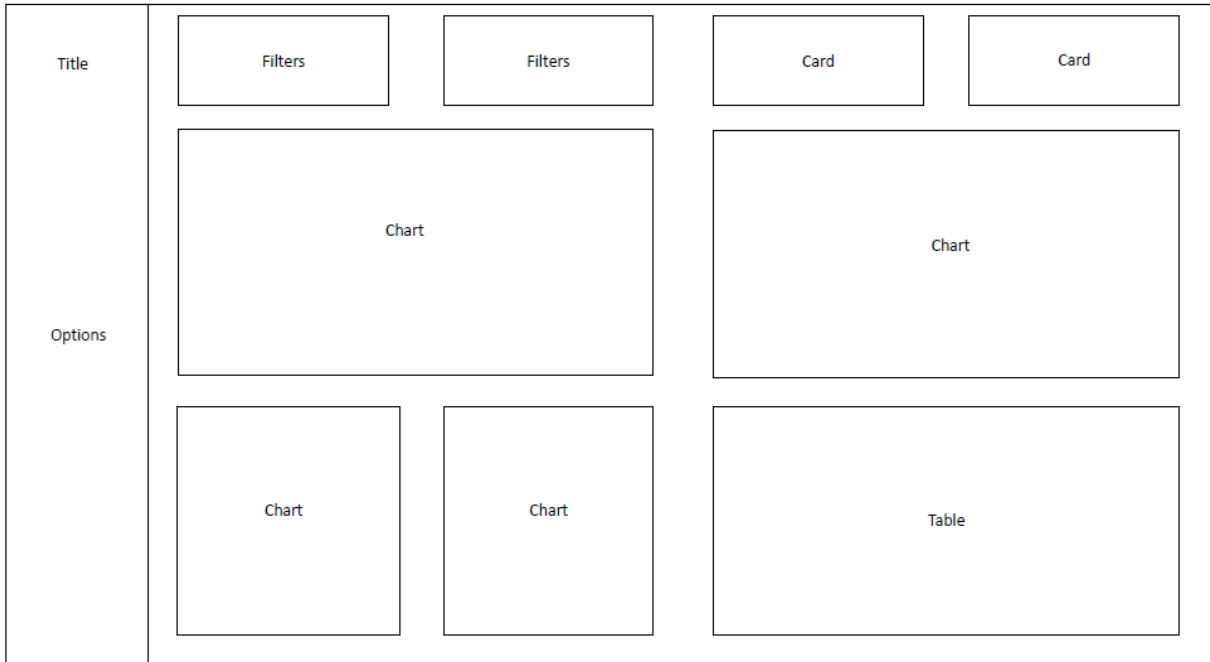Figure 4. World nationalities/distribution in Portugal mock-up proposal

Figure 5. Socioeconomic indicators mock-up proposal

4. PROOF OF CONCEPT

In this chapter, the conceptual model is brought to life through the implementation of the proposed solution from the previous chapter. Firstly, the data sources used to gather the necessary information for analysis. Next, the process of integrating and processing the data to ensure its reliability and consistency is delved into. Subsequently, the developed dimensional model is presented, which effectively structures and organizes the data. Then, the steps taken to construct the essential indicators that drive the analysis are detailed. The final section showcases the developed dashboard and its main functionalities.

It proceeds with a proof of concept, translating the conceptual model proposal into tangible results. Subsequently, more technical procedures are undertaken to address data integration and processing. This encompasses establishing relationships between different databases and designing metrics to calculate specific indicators. The focus lies on creating meaningful connections between datasets and devising appropriate metrics to facilitate accurate calculations for the desired indicators.

Ultimately, it reaches the culmination of the work as the final dashboard prototype is presented, accompanied by a detailed explanation of its structure. Through a comprehensive analysis, it determines whether the initial goal has been successfully achieved, providing a conclusive assessment of the implemented solution.

4.1. DATA SOURCES

A selection of diverse data sources that contribute to the comprehensive analysis of the foreign population. The following sources have been distinguished, each offering unique insights and attributes:

Excel report extracted from the INE Portal, containing data from the 2021 census on the foreign population. This report includes information on the number of immigrants and their nationality across various fields, such as:

- Age group
- Level of education
- Activity status
- Occupation
- Professional status

Excel report extracted from Pordata, providing attributes such as:

- Year
- Country of origin
- Number of immigrants.

Excel report extracted from Sefstat, including attributes such as:

- Year
- Gender

- Country of origin
- District of residence
- Number of immigrants.

Excel report, extracted from Pordata, including attributes such as:

- Year
- Gender
- Number of immigrants.

Additionally, it was extracted three separate Excel reports from Pordata. These reports include the Year attribute, along with:

- Percentage of immigrants,
- GDP value
- Unemployment rate.

4.2. DATA INTEGRATION AND PROCESSING

Data integration and processing play a crucial role in the construction of the artifact during the practical phase. In this chapter, will be discussed the steps involved in the ETL (Extract, Transform, Load) process and highlight the significance of ensuring data consistency and quality.

The ETL process serves as the foundation for the creation of the dashboard. Its primary objective is to load the data described in section 4.1 into the system and cleanse it to enhance its consistency and reliability. By adhering to formatting standards, removing errors and unnecessary information, and renaming data categories for improved cross-referencing, the dataset becomes more robust and cohesive.

Power Query, a feature of Power BI, was utilized to transform and prepare the data. This tool was used to connect to various sources, perform data transformations, and ensure data cleanliness before loading it into the data model.

The transformations involved tasks such as cleaning and standardizing data, merging data from different sources, unpivoted tables, combining columns, and applying filters or transformations to ensure data quality and consistency.

Throughout the ETL process, a range of techniques and operations were applied to ensure the accuracy and integrity of the integrated data. The data preparation was conducted entirely within Power BI's Query Editor.

4.3. DIMENSIONAL MODEL

For the dimensional model composed of 9 fact tables and 2 dimension tables, forming a constellation schema, several transformations were performed using Power Query in Power BI to achieve the final model.

The constellation schema is a design approach in dimensional modeling where multiple fact tables are associated with multiple dimension tables. In this case, there are 9 fact tables, which represent different types of data collected, and 2 dimension tables.

Despite having several common attributes among the fact tables, they could not be joined together due to the data arrangement and structure. Therefore, each fact table had to be kept separate based on how the data was collected.

By applying these transformations, the data from the different fact tables and dimension tables were prepared and structured in a way that they could be loaded into the final dimensional model. The resulting model represents the relationships between the facts and dimensions and enables efficient analysis and reporting in Power BI.
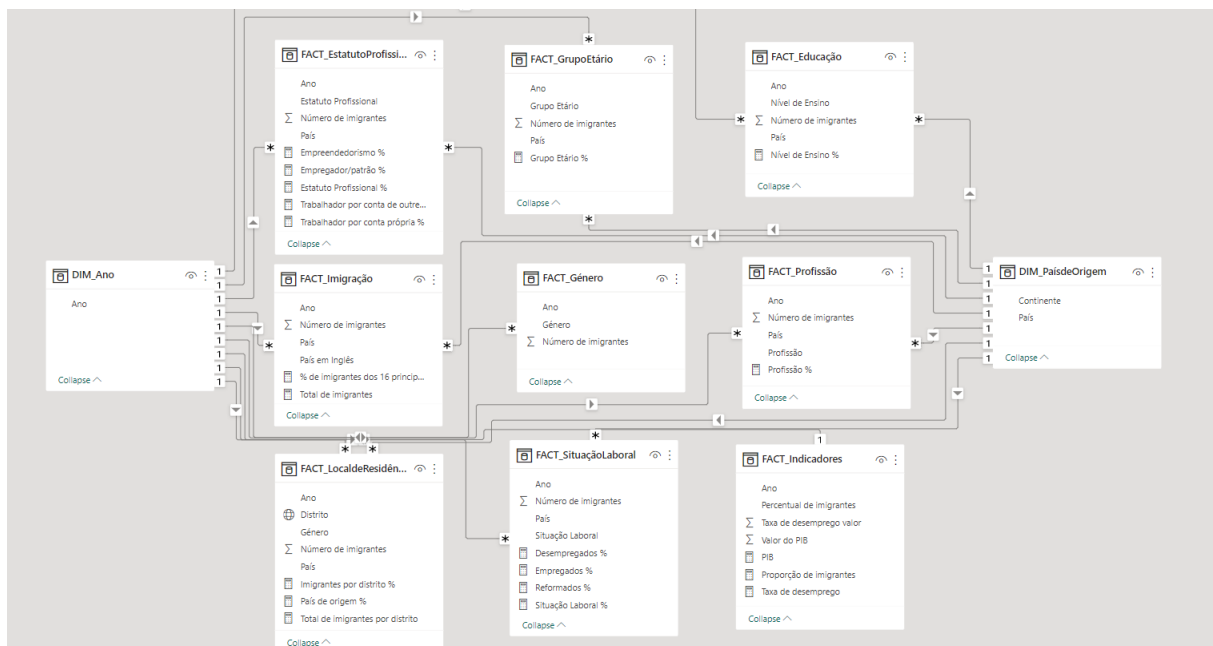

Figure 6. Dimensional model

4.4. INDICATORS CONSTRUCTION

A key aspect of the dashboard's interactivity lies in the creation of measures. These measures serve as valuable analytical tools and are built using Data Analysis Expressions (DAX) , a programming language designed specifically for data analysis tasks. With DAX, it becomes possible to perform in-depth data analysis by generating new columns and measures that encapsulate important calculations and metrics.

The following measures were established:
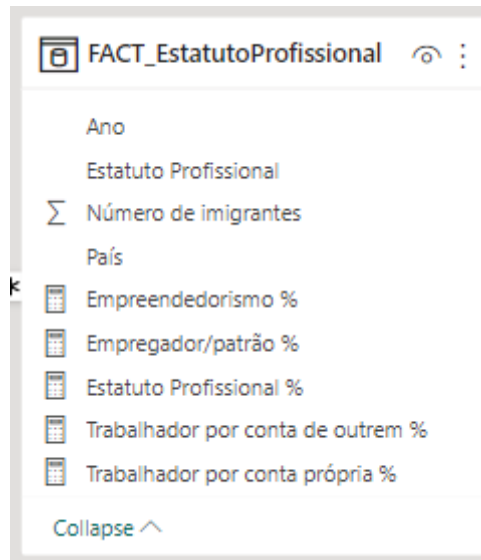
- **Professional status**

Figure 7. Fact Estatuto profissional

Percentage of entrepreneurship

Empreendedorismo % = CALCULATE([Estatuto Profissional %],
'FACT_EstatutoProfissional'[Estatuto Profissional] = "patrão" ||
'FACT_EstatutoProfissional'[Estatuto Profissional] = "trabalhador por conta própria")

Percentage of population who are Employer/Boss

Empregador/patrão % = CALCULATE('FACT_EstatutoProfissional'[Estatuto Profissional %],
'FACT_EstatutoProfissional'[Estatuto Profissional]= "Empregador/Patrão")

Percentage of population in each category of Professional status by country of origin

Estatuto Profissional % = DIVIDE(SUM('FACT_EstatutoProfissional'[Número de
imigrantes]),CALCULATE(SUM('FACT_EstatutoProfissional'[Número de imigrantes]),
ALL('FACT_EstatutoProfissional'[Estatuto Profissional]),
CALCULATETABLE(VALUES('FACT_EstatutoProfissional'[País]))))

Percentage of population who are employees

Trabalhador por conta de outrem % = CALCULATE('FACT_EstatutoProfissional'[Estatuto
Profissional %],'FACT_EstatutoProfissional'[Estatuto Profissional]= "Trabalhador por conta de
outrem")

Percentage of population who are Self-employed

Trabalhador por conta própria % = CALCULATE('FACT_EstatutoProfissional'[Estatuto   Profissional %], 'FACT_EstatutoProfissional'[Estatuto Profissional]= "Trabalhador por conta própria")
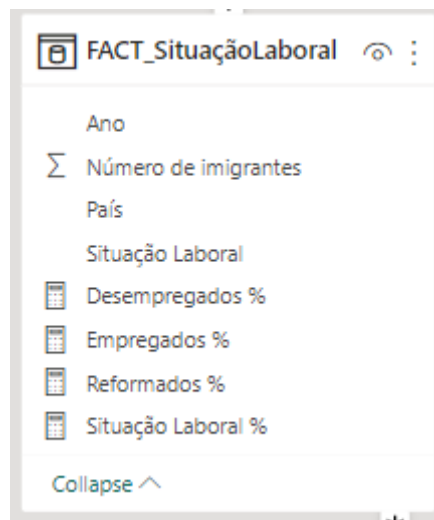
- **Activity status**

Figure 8. Fact Situação Laboral

Percentage of population who are unemployed

Desempregados % = CALCULATE([Situação Laboral %],'FACT_SituaçãoLaboral'[Situação Laboral] = "Desempregada")

Percentage of population who are employed

Empregados % = CALCULATE([Situação Laboral %], 'FACT_SituaçãoLaboral'[Situação Laboral] = "Empregada")

Percentage of population who are retired

Reformados % = CALCULATE([Situação Laboral %],'FACT_SituaçãoLaboral'[Situação Laboral] = "Reformados")

Percentage of population in each category of activity status by country of origin

Situação Laboral % = DIVIDE(SUM('FACT_SituaçãoLaboral'[Número de imigrantes]),
CALCULATE(SUM('FACT_SituaçãoLaboral'[Número de
imigrantes]),ALL('FACT_SituaçãoLaboral'[Situação Laboral]),
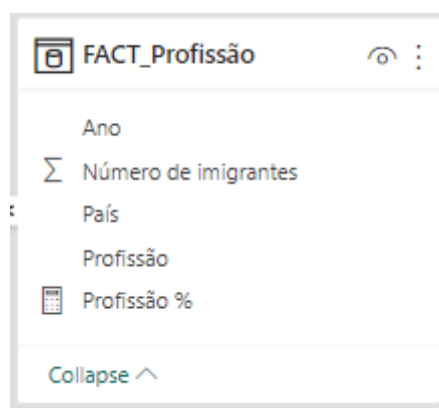CALCULATETABLE(VALUES('FACT_SituaçãoLaboral'[País]))))

- **Job**

Figure 9. Fact Profissão

Percentage of population in each category of job by country of origin

Profissão % = DIVIDE(SUM('FACT_Profissão'[Número de
imigrantes]),CALCULATE(SUM('FACT_Profissão'[Número de imigrantes]),
ALL('FACT_Profissão'[Profissão]), CALCULATETABLE(VALUES('FACT_Profissão'[País]))))

- **Immigration**
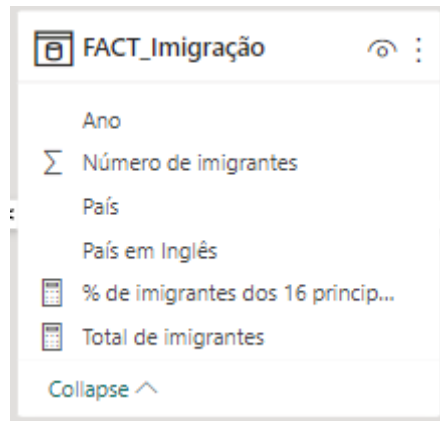
Figure 10. Fact imigração

Percentage of immigrants in the top 16 countries

% de imigrantes dos 16 principais países = DIVIDE(SUM('FACT_Imigração'[Número de imigrantes]), CALCULATE(SUM('FACT_Imigração'[Número de imigrantes]),ALL('FACT_Imigração'[País])))

Total number of immigrants

Total de imigrantes = SUM ('FACT_Género'[Número de imigrantes])

- **Education**
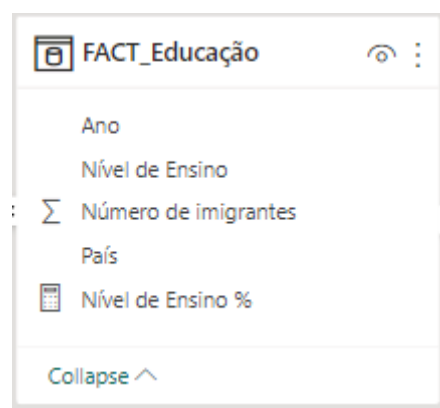
Figure 11. Fact Educação

Percentage of population with each level of education by country of origin

Nível de Ensino % = DIVIDE(SUM('FACT_Educação'[Número de imigrantes]),CALCULATE(
SUM('FACT_Educação'[Número de imigrantes]),ALL('FACT_Educação'[Nível de Ensino]),
CALCULATETABLE(VALUES('FACT_Educação'[País]))))

- **Place of residence**
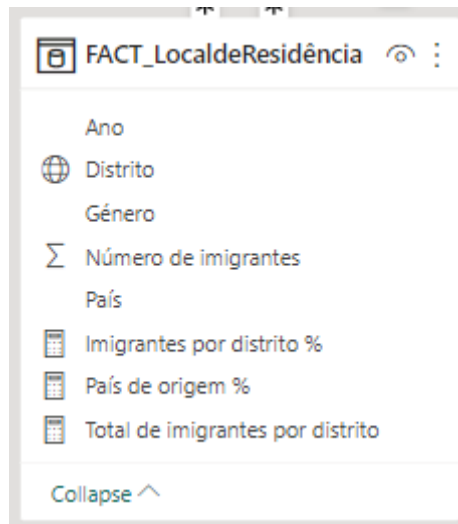
Figure 12 . Fact Local de residência

Percentage of immigrants in each district

Imigrantes por distrito % = DIVIDE(SUM('FACT_LocaldeResidência'[Número de imigrantes]),
CALCULATE(SUM('FACT_LocaldeResidência'[Número de
imigrantes]),ALL('FACT_LocaldeResidência'[Distrito))

Percentage of immigrants in each district by country of origin

País de origem % = DIVIDE(SUM('FACT_LocaldeResidência'[Número de
imigrantes]),CALCULATE(SUM('FACT_LocaldeResidência'[Número de imigrantes]),
ALL('FACT_LocaldeResidência'[País])))

Total number of immigrants by district

Total de imigrantes por distrito = SUMX(VALUES('FACT_LocaldeResidência'[Distrito]),
CALCULATE(SUM('FACT_LocaldeResidência'[Número de imigrantes])))

- **Age group**

Figure 13. Fact Grupo etário

Percentage of population in each age group by country of origin

Grupo Etário % = DIVIDE(SUM('FACT_GrupoEtário'[Número de imigrantes]),CALCULATE(
SUM('FACT_GrupoEtário'[Número de imigrantes]), ALL('FACT_GrupoEtário'[Grupo Etário]),
CALCULATETABLE(VALUES('FACT_GrupoEtário'[País]))))

- **Indicators**
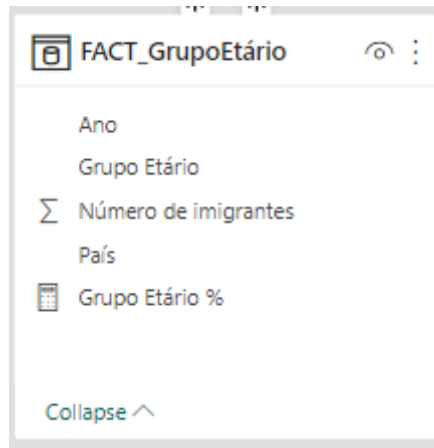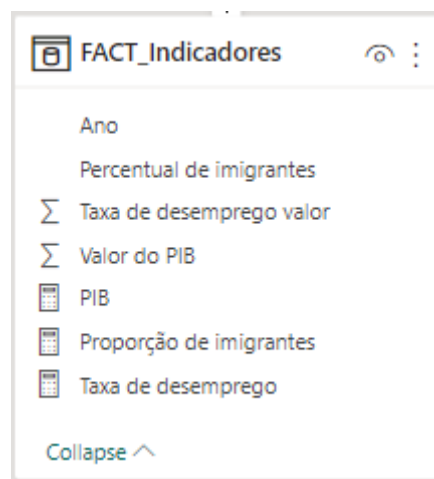

Figure 14. Fact Indicadores

Total value of PIB

PIB = SUM ('FACT_Indicadores'[Valor do PIB])

Percentage of immigrants of total population

Proporção de imigrantes = SUM('FACT_Indicadores'[Percentual de imigrantes])/100

Unemployment rate

Taxa de desemprego = SUM ('FACT_Indicadores'[Taxa de desemprego valor])

4.5. DASHBOARD

The dashboard presented below represents the culmination of our project, providing an all-encompassing platform to monitor and analyze immigration data in Portugal and its correlation with the economy. The dashboard comprises a total of eight pages. These pages are thoughtfully organized to offer users a seamless and intuitive experience while navigating through the wealth of information available.

Figure 15. Dashboard cover page

The first page of the report, depicted in Figure 15, consists of a Cover page comprising seven buttons that direct the user to different pages corresponding to each specific theme.

Figure 16 . Dashboard Overview

On the second page of the report, depicted in Figure 16, the Overview dashboard is showcased, providing an overview of immigration in Portugal from 1980 to 2021. The dashboard displays key information and insights related to immigration trends over the specified period.
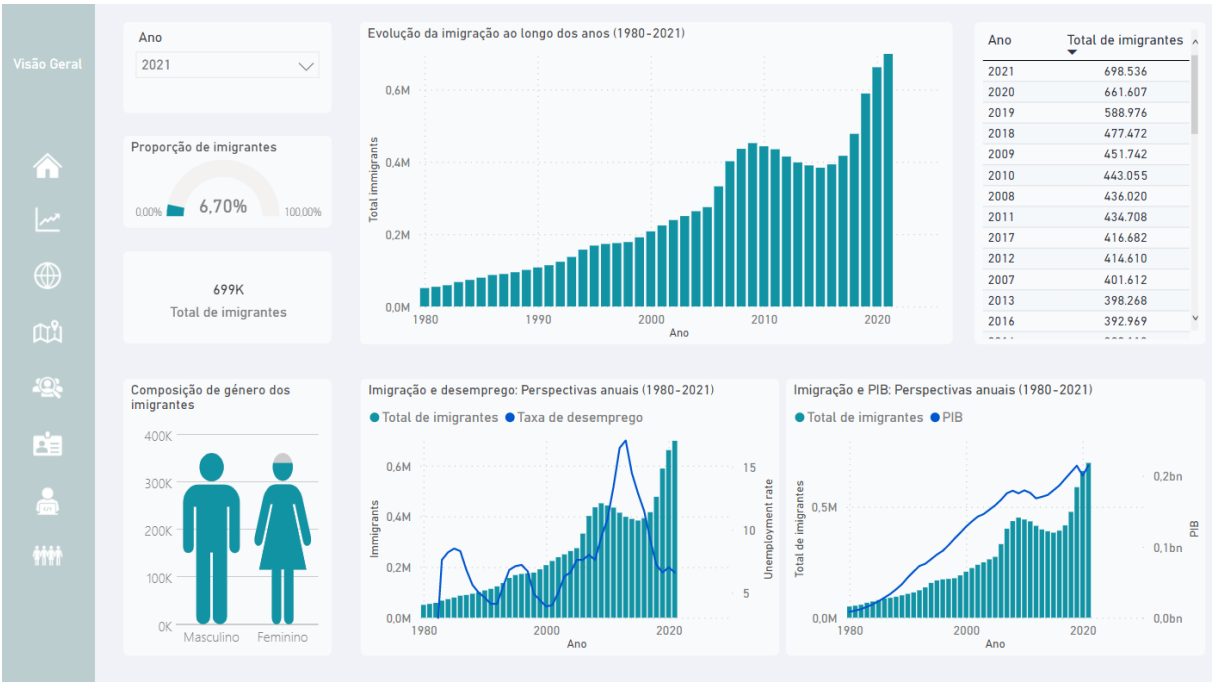
Located in the upper left corner of the dashboard is the dashboard's name, followed by eight buttons that direct users to different pages, each corresponding to a specific theme. This consistent structure is maintained throughout the remaining pages of the report, ensuring a coherent and user-friendly experience.

A slicer is available on the dashboard, allowing users to select a specific year for analysis. Upon selecting a year, the dashboard dynamically updates to display relevant information for the chosen timeframe. Users can observe the immigration share, as well as the total number of immigrants and their gender distribution for the selected year.

To visualize the immigration share by year, a gauge visual was employed, providing a concise representation of the proportion of immigrants, and a card visual was utilized to display the total number of immigrants, offering a clear numerical value.

For the analysis of the gender composition of immigrants a visual infographic is used with female and male symbols, with these symbols being filled according to the respective total values for each gender.

At the center, a bar chart provides a visual representation of the evolution of immigration from 1980 to 2021. This is followed by a table displaying the total immigrant values for each year.

At the bottom section, two bar charts, similar to the one described earlier, are featured, with the inclusion of an additional line representing the unemployment rate in the first chart and the GDP value in the second chart. These charts provide insights into the relationship between the number of immigrants and both the unemployment rate and GDP.

The first chart illustrates the immigration trends over the specified period, while the line displaying the unemployment rate enables a comparison between the influx of immigrants and the prevailing employment conditions. In the second chart, the line representing the GDP value complements the understanding of immigration patterns by showcasing the economic context.
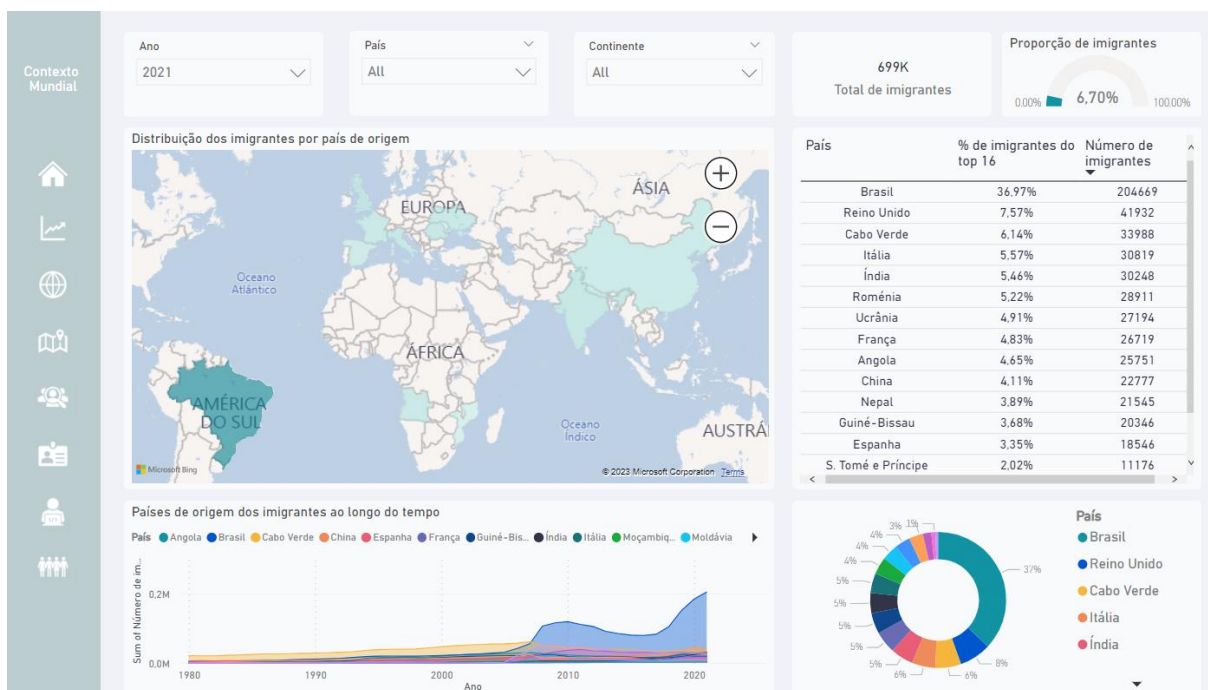
Figure 17. Dashboard world scenario

The third page of the report, image 17, the world scenario dashboard is showcased, providing an overview of immigration in Portugal from 1980 to 2021 with a worldwide visualization. This dashboard offers an overview of immigration patterns and helps understand the geographic distribution of immigrants to Portugal.

Located in the upper left corner of the dashboard is the dashboard's name, followed by eight buttons that direct users to different pages, each corresponding to a specific theme.

Moreover, users have the option to utilize three filters, allowing for a more detailed examination of the information. The first filter pertains to the year and impacts all the visuals, enabling users to focus on specific timeframes. The second filter enables filtering by country, while the third filter allows users to narrow down the data by continent.

At the center of the dashboard, a world map is displayed, featuring gradual color shading. Darker shades of blue represent countries with higher numbers of immigrants, while lighter shades indicate countries with lower numbers of immigrants. The colors vary dynamically based on the selected year

and the other applied filters, providing a comprehensive visualization of immigration patterns across different regions.

To visualize the immigration share by year, a gauge visual was employed, providing a concise representation of the proportion of immigrants, and a card visual was utilized to display the total number of immigrants, offering a clear numerical value.

Below, a table presents country-specific data, including the percentage of immigrants among the top 16 countries and the corresponding total number of immigrants.

Towards the bottom of the page, an area chart depicts the evolution of immigration for each country from 1980 to 2021. When applying the country filter, users can observe the specific trends in immigrants originating from that selected country.

Finally, a donut chart showcases the percentages of immigrants within the top 16 countries, providing a visual representation of the distribution among these key countries.
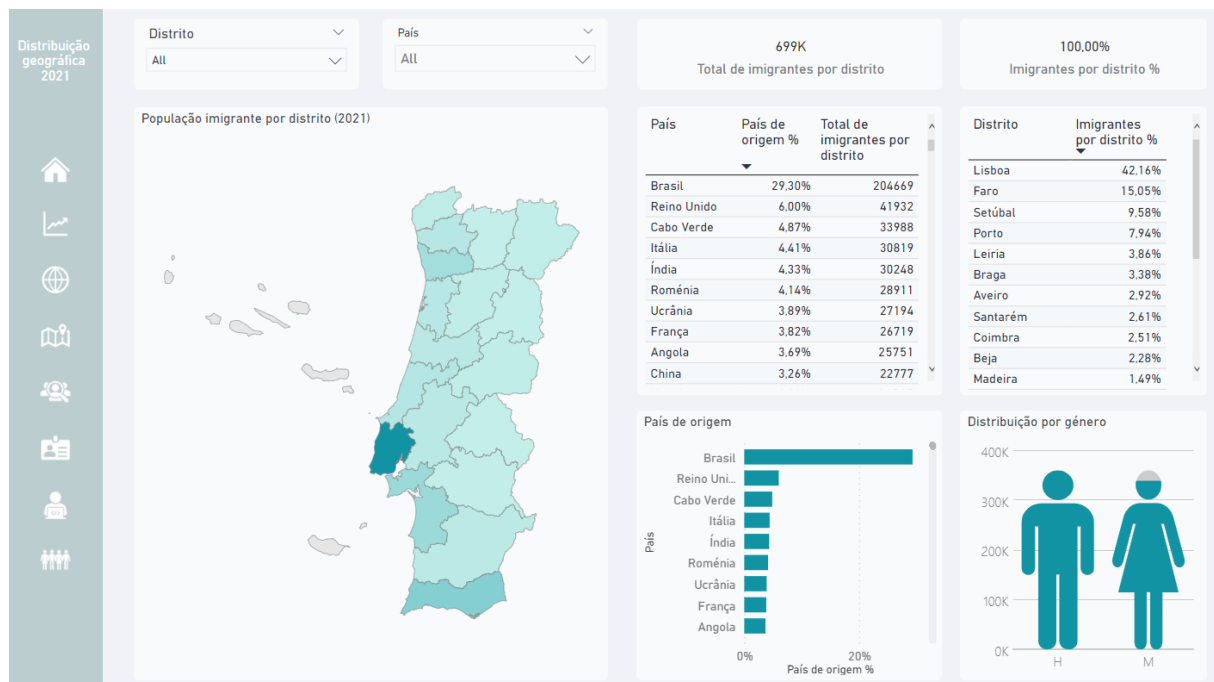
Figure 18. Dashboard geographical distribution

On the fourth page of the report, in Figure 18, the Geographical Distribution in Portuguese Territory in 2021 dashboard is presented, offering an overview of immigrant distribution in Portugal.

Located in the upper left corner of the dashboard is the dashboard's name, followed by eight buttons that direct users to different pages, each corresponding to a specific theme.

Two filters are available on the dashboard. The first filter allows users to select a specific district among the 18 districts of Portugal plus Azores and Madeira islands. The second filter enables users to choose the country of origin. Both filters have a comprehensive impact on all visuals, allowing for refined analysis.

The central visual focuses on a map of Portugal, wherein gradual color shading is employed. Darker shades of blue represent districts with higher numbers of immigrants, while lighter shades indicate districts with lower numbers of immigrants. This visual representation offers valuable insights into the geographic distribution of immigrants across the country.

In the top right section, two cards are displayed. One card presents the total number of immigrants, while the other card shows the percentage of immigrants per district when a specific district is selected.

Two tables are provided. The first table presents the countries of origin, displaying the percentage of immigrants from each country and the corresponding total number of immigrants. The second table presents the districts, showcasing the percentage of immigrants in each district.

Below, a bar chart illustrates the countries of origin, depicting the percentage of immigrants from each country.

Lastly, for the analysis of the gender composition of immigrants a visual infographic is used with female and male symbols, with these symbols being filled according to the respective total values for each gender.

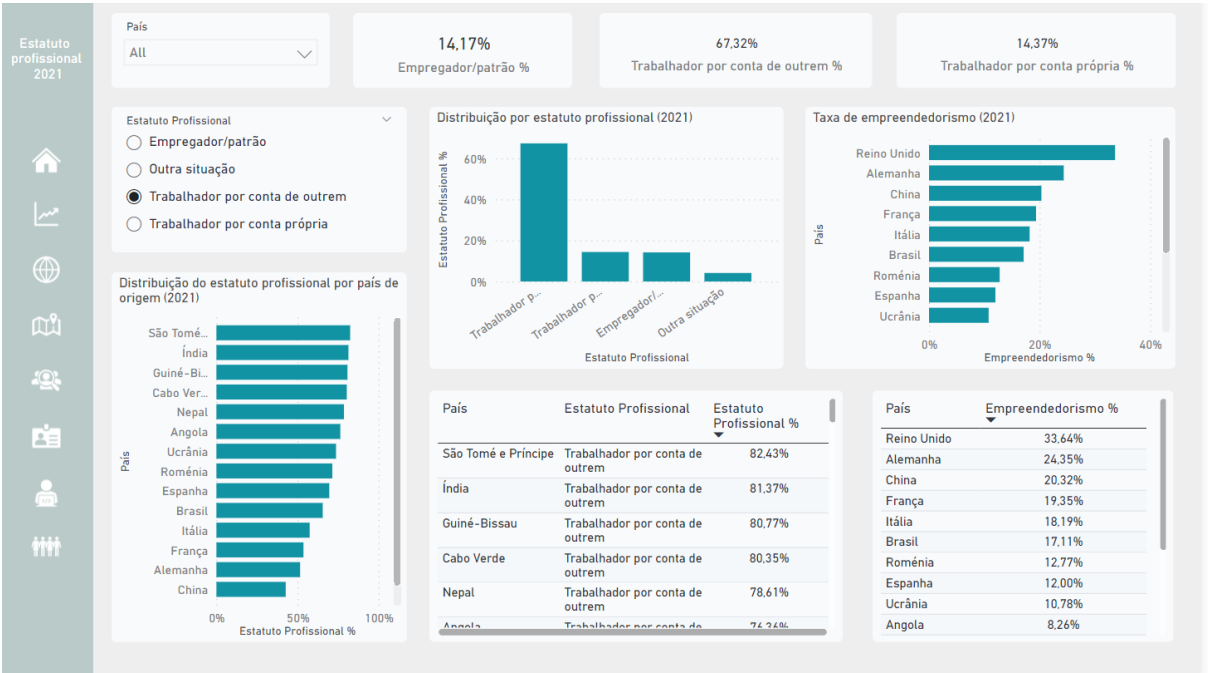Figure 19. Dashboard professional status

On the fifth page of the report, depicted in Figure 19, the Professional Status dashboard is presented, allowing for an analysis of the distribution of immigrants across different professional statuses in 2021.

Similar to the previous pages, the dashboard's name is located in the upper left corner, followed by eight buttons that provide navigation to various themed pages.

Two filters are available on the dashboard, one for selecting the country of origin and another for choosing the professional status. These filters enable users to refine their analysis based on specific criteria.

Below the filters, a bar chart displays the distribution of professional statuses based on the country of origin.

At the top of the page, three cards indicate the percentages of immigrants categorized as employers, employees, and self-employed individuals. These percentages vary according to the selected country.

In the center, a bar chart visualizes the distribution of professional statuses, with the ability to view the percentage breakdown for each professional status when a specific country is selected. Additionally, a table below provides fields for professional status, percentage breakdown per professional status, and country of origin.

On the right side of the page, a bar chart and a table display the percentage of entrepreneurship among immigrants, categorized by their country of origin.

These visual elements offer insights into the professional statuses of immigrants, facilitating an understanding of their employment patterns and entrepreneurial activities. The dashboard enables users to analyze the distribution of immigrants across different professional statuses and explore variations based on country of origin.

Figure 20. Dashboard activity status

On the sixth page of the report, depicted in Figure 20, the Activity Status dashboard is presented, providing an analysis of the distribution of immigrants across different activity statuses in 2021.

Continuing the consistent layout, the dashboard's name is located in the upper left corner, accompanied by eight buttons for seamless navigation between themed pages.

A single filter is available, allowing users to select the country of origin and view the data with a different level of detail.

The dashboard features three bar charts: one showcasing the distribution of retirees by country of origin, another displaying the distribution of unemployed individuals, and a third illustrating the distribution of employed individuals. These visualizations enable users to draw conclusions and identify patterns within the data.

At the top of the page, three cards indicate the percentages of unemployed, employed, and retired immigrants, dynamically updating based on the selected country in the filter.

In the center, a larger bar chart presents all the activity status fields, with the visualization adjusting based on the chosen country. Additionally, in the lower right corner, a table provides a comprehensive overview of all activity statuses and their corresponding percentages of immigrants.

This dashboard facilitates the analysis of the activity status distribution among immigrants, allowing users to identify trends and patterns across different countries of origin. The combination of visualizations and data summaries enhances the understanding of immigrant activity statuses in 2021.
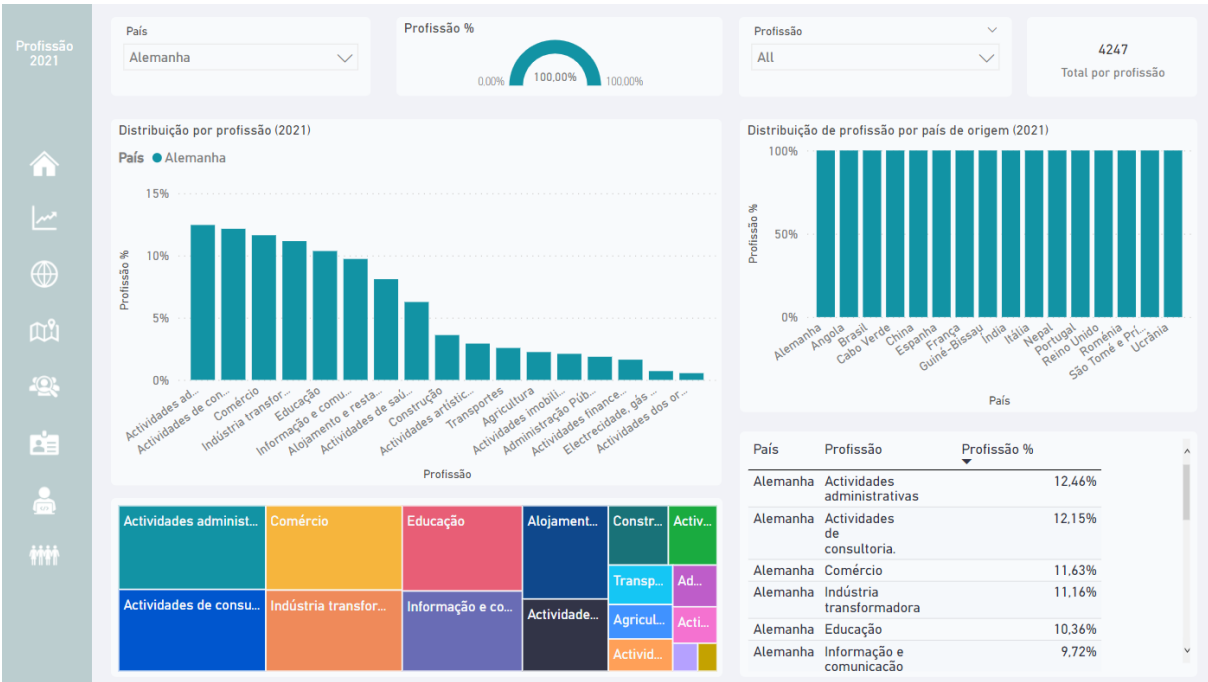

Figure 21. Dashboard Job

On the seventh page of the report, displayed in Figure 21, the Job dashboard is presented, offering an analysis of the distribution of immigrants across different job fields in 2021.

Consistent with the layout of previous pages, the dashboard's name is located in the upper left corner, accompanied by eight buttons for effortless navigation between themed pages.

The dashboard begins with a filter located in the upper section, allowing users to select the country of origin. This filter serves as a starting point for examining the distribution of immigrants within different jobs.

The first bar chart visually presents the distribution of immigrants across jobs when a specific country of origin is selected. Complementing this chart, below a tree map visualization provides an alternative perspective on the distribution, offering a hierarchical view of the professions.

In the upper center, an additional filter empowers users to delve deeper into the analysis by selecting a specific job. Adjacent to this filter, a dynamic gauge displays the percentage of immigrants in each job. On the right-hand side, a card visual presents the total number of immigrants associated with the chosen job, both dynamically adjusting as jobs are selected.

To further enhance the understanding of the job landscape, a second bar chart positioned in the center-right unveils the primary countries of origin for the selected job. This chart highlights the international diversity within specific professional domains.

Lastly, a comprehensive table presents detailed information, including country of origin, profession, and the corresponding percentage of immigrants in each profession. This tabular view enables users to analyze the data in a structured format.
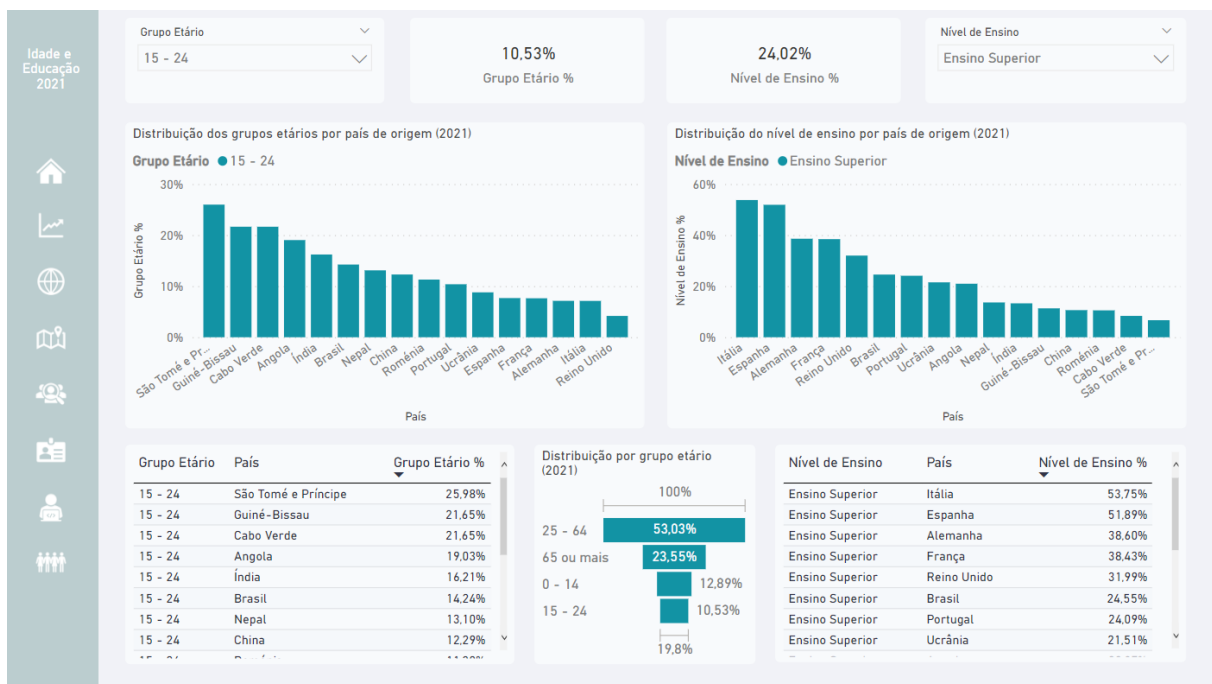

Figure 22. Dashboard age and education

The eighth and final page of the report, represented in Figure 22, presents data concerning the age and educational level of immigrants.

Continuing the consistent layout observed in previous pages, the dashboard's name is positioned in the upper left corner, accompanied by eight buttons that facilitate seamless navigation between different sections.

The page is nearly divided into two sections, with age-related data displayed on the left and educational level data presented on the right.

Beginning with the age-related section, a filter allows users to select a specific age group, enabling focused analysis. A card visualization provides a clear percentage representation of immigrants within the selected age group.

Beneath it, a bar chart illustrates the countries of origin, ordered within each age group, offering insights into the international diversity within different age brackets.

At the bottom of the page, a comprehensive table showcases fields such as age group, country, and the corresponding percentage of immigrants within each age category. Additionally, a funnel visualization presents a percentage distribution across different age groups, allowing for an understanding of the age demographics among immigrants.

Moving to the educational level section on the right, a filter empowers users to select a specific educational level for analysis. An accompanying card visualization presents the percentage of immigrants within each educational level, providing valuable insights into the educational backgrounds of immigrants. Below it, a bar chart depicts the countries of origin, arranged within each educational level, further highlighting the diversity of educational attainment among immigrants.

Lastly, a detailed table displays information regarding educational levels, countries of origin, and the corresponding percentage of immigrants within each educational category.

5. RESULTS AND DISCUSSION

This section marks the culmination of the DSR (Data Science Research) methodology, known as the "Evaluation" phase. During this step, the primary focus lies on assessing the extent to which the achieved outcome aligns with the pre-established objectives. Comprehensive evaluations are conducted to validate the effectiveness and success of the implemented solution. Furthermore, a thorough analysis is performed to determine if the defined objectives have been met.

The project followed a well-defined process, encompassing the following key steps:

Conceptual Model Development: The conceptual model was constructed based on an extensive review of relevant literature, incorporating valuable insights and recommended data from various sources.

Data Extraction, Transformation, and Loading: The extracted data underwent a comprehensive transformation process to ensure its accuracy and consistency. The transformed data was then loaded into the dimensional model, where all the defined metrics and formulas from the conceptual model were successfully implemented using Power BI's DAX code. Both calculated columns and measures were employed, serving different functions within the dimensional model.

Dashboard Prototyping: The developed dashboard prototypes effectively addressed the project's requests. The outcome provided a user-friendly interface facilitating the process of taking decisions. The information showcased was succinct, pragmatic, and of great utility, ensuring effortless user access to the final dashboard.

Moving towards the visual results of the dashboards, beginning with the overview page, which encompasses essential metrics such as Immigrant Population Share, Gender Distribution, Unemployment Rate, and GDP. Through a comprehensive analysis of these visualizations, it can be readily deducing the significant growth in the number of immigrants in recent years. Moreover, these dashboards provide a convenient platform for comparing the influence of unemployment rates and GDP on immigrant numbers and vice versa. The interactive nature of the visualizations enables users to gain deeper insights into the relationships and correlations between these factors, facilitating informed decision-making and policy considerations.

On the world scenario page, it is incorporated metrics such as Country of Origin and Immigrant Population Share, presenting them in various insightful ways. For example, when the year 2021 is selected, it is easy to notice the difference in numbers between Brazil and the other countries. Additionally, by adjusting the year, users can observe the evolving distribution patterns over time. It is particularly interesting to explore the evolution from 1980 to 2021 when a specific country is selected, unveiling significant trends and changes in immigration patterns. The visualizations on this page offer a comprehensive view of the global immigration landscape, empowering users to gain valuable insights and understand the dynamics of immigration trends across different countries and time periods.

On the Geographical Distribution page, it is presented metrics such as Geographic Distribution, Gender Distribution, and Country of Origin. This page offers valuable insights into the concentration of the immigrant population across different districts in 2021, with a particular emphasis on coastal regions, notably Lisbon. By examining the details within each district, interesting patterns can be observed. For instance, in Lisbon, the primary nationality is Brazil, and there is a slightly higher proportion of males.

However, when the focus is shifted to Beja district, it is found that the main nationalities are India and Nepal, with a male population that is twice the size of the female population. These visualizations provide a comprehensive understanding of the regional distribution of immigrants, allowing users to analyze specific districts and uncover demographic and national origin trends.

On the Professional Status page, it is analyzed metrics such as Employment Status, Labor Force Participation Rate, Entrepreneurship Rate, and Country of Origin. The data reveals that the majority of immigrants, 67.32%, work as employees, while 14.37% are self-employed and another 14.17% are employers. Notably, individuals from China and the United Kingdom have a higher representation in the employers category, while for employees category the higher numbers goes to Sao Tome and Principe and India. In terms of entrepreneurship, immigrants from the United Kingdom, Germany, and China exhibit the highest rates. These insights provide a comprehensive view of the professional landscape and entrepreneurial activities among immigrant populations.

Moving on to the sixth page, which focuses on Activity Status, it is examined metrics such as Employment Status, Labor Force Participation Rate, and Country of Origin. In the year 2021, the data reveals that the unemployment rate among immigrants was only 6.82%, while 49.35% were employed and 8.31% were retirees. Easy to visualize that, nearly 50% of immigrants from the United Kingdom residing in Portugal were retirees. The highest unemployment rate was observed among immigrants from Guinea-Bissau, with a rate of almost 10%. On the other hand, India and Nepal had the highest percentage of employed immigrants, surpassing 60%. These findings shed light on the diverse activity statuses of immigrants and provide valuable insights into the employment landscape among different countries of origin.

On the seventh page, dedicated to the Job theme, it is explored metrics such as Employment Status, Labor Force Participation Rate, and Country of Origin. A comprehensive analysis reveals that the primary activities among immigrants are commerce, accommodation and food services, and construction. Taking a closer look at specific countries, for instance, Angola, construction emerges as the dominant sector with a significant share of 17%. Furthermore, by examining the data from a profession-based perspective, it can be observed the job share for each occupation. For example, using commerce as an example, it represents a job share of 12.93%, whereby, the leading countries contributing to this activity includes China, with a substantial presence of 67% of immigrants in this field. These insights shed light on the major job sectors among immigrants, their country-specific variations, and the distribution across different professions.

On the eighth and final page, dedicated to age and educational level, it is explored metrics such as Age Distribution, Education Level, and Country of Origin. Regarding age distribution, a notable finding is that 65.92% of immigrants fall within the 25-64 age group. Within this age range, the countries with a significant presence of immigrants are Nepal and Romania. Looking at the numbers of immigrants over 65 years old, they represent only 7.91%, the main countries being the United Kingdom and France. Turning our attention to educational attainment, is observed that Italy and Spain have a higher proportion of immigrants with a higher education degree, while Cabo Verde stands out in the primary education level. These insights provide valuable information on the age composition and educational backgrounds of immigrants, highlighting notable patterns across different countries of origin.

Upon careful examination of the generated reports and the achieved outcomes, it is evident that the developed dashboard effectively fulfills the stipulated requirements and objectives. The

comprehensive analysis and visualization of the data provide valuable insights into the dynamics of the immigrant population in the Portuguese economy.

6. LIMITATION AND RECOMMENDATIONS FOR FUTURE WORKS

During the course of this study, several limitations were identified that may have impacted the comprehensiveness and depth of the analysis. These limitations are outlined below:

Lack of Financial Data: One notable challenge was the absence of comprehensive data on the financial contributions made by immigrants to the social security system, particularly in terms of tax income. This limitation restricted our ability to assess the economic impact of immigrants in terms of their financial contributions to the country.

Limited Availability of Census Data: Another limitation stemmed from the availability of census data related to education and employment. Although the census for the year 2021 was accessible, the absence of historical data hindered our ability to conduct meaningful comparisons with previous census years, such as the 2011 census and subsequent editions. Access to a more extensive historical dataset would have facilitated a more comprehensive analysis of trends over time.

Based on the limitations encountered, the following recommendations are proposed to enhance future research in this field: Enhance Geographic Detail: One suggestion for future studies is to incorporate a finer level of geographic detail, such as the inclusion of NUTS or even municipality. This additional granularity would enable a more localized analysis and provide insights into regional variations in immigrant demographics and socioeconomic factors.

Comparative Analysis with Native Population: Building upon the existing analysis, it would be beneficial to conduct comparative studies between immigrant populations and the native population. By juxtaposing the characteristics and outcomes of these two groups, a deeper understanding of the integration process and potential differences in socioeconomic indicators can be gained.

Expanded Data Collection: To gain further insights into immigrant experiences and their impact on the economy, it is recommended to collect additional data beyond the scope of this study. This could include data on social integration, such as language proficiency, cultural assimilation, and community engagement. Additionally, collecting data that captures other economic impacts, such as entrepreneurship rates, job creation, and industry-specific contributions, would provide a more comprehensive understanding of the immigrant population's role in the overall economy.

7. CONCLUSION

The objective of this project was to design and implement a conceptual BI model that enables the analysis of the evolution of immigration numbers in Portugal from 1980 to 2021 and connects it to socioeconomic data to explore the relationship between the economy and immigration. The model can be accessed and utilized by various entities, including government agencies, political parties, and academic researchers, to make informed decisions related to immigration and enhance the quality of research in this field.

The project started with a contextualization of the topic, emphasizing the significance of immigration in the country's economy. Clear objectives were established, and a methodology was devised to provide a scientific framework for the project. The execution followed the Design Science Research methodology, encompassing all its phases to achieve the final outcome of the project, namely the dashboards.

A comprehensive literature review was conducted, delving into various aspects such as studies on immigration, the relationship between immigration and the economy, and business intelligence. Building upon the insights gained from the literature, a conceptual solution model was developed, utilizing the studied concepts.

The development phase played a crucial role in implementing the model. Leveraging available tools and data sources, a data model and a set of indicators were created, utilizing a business intelligence approach. The careful definition of objectives and steps was pivotal in ensuring that the developed solution aligned with the desired outcomes and addressed the identified need for decision-making in the field of immigration.

Regarding the final product, it successfully centralized the gathered information by integrating databases from the Portuguese Immigration and Borders Service (SEF), Pordata, and the 2021 census. The dashboard provided a dynamic and alternative perspective on the data, allowing end users to navigate through the information, obtain details, and explore different viewpoints and comparisons using filters and drill-down capabilities. Additionally, it included key performance indicators and measures that facilitated quick insights and conclusions.

Based on the adherence to the Design Science Research methodology, it can be affirmed that the final artifact effectively achieves the intended objectives. The development process meticulously incorporated all the specified targets, ensuring their comprehensive consideration. Furthermore, the implementation adhered to the best practices identified in the literature review, assuring a quality solution.

In conclusion, this project has successfully delivered a powerful and user-friendly BI solution that enables the analysis of immigration trends in Portugal and their correlation with socioeconomic factors. The developed dashboard serves as a valuable resource for decision-makers in government entities and political parties, as well as for academic researchers conducting studies in this area. Its contribution to the field of immigration and the potential for informed decision-making make it a valuable tool for understanding the complex relationship between the economy and immigration in Portugal.

8. BIBLIOGRAPHICAL REFERENCES

Ahmad, A. (2020). Do Equal Qualifications Yield Equal Rewards for Immigrants in the Labour Market? *Work, Employment and Society*, *34*(5), 826–843. https://doi.org/10.1177/0950017020919670

Badawy, M., El-Aziz, A. A. A., Idress, A. M., Hefny, H., & Hossam, S. (2016). A survey on exploring key performance indicators. *Future Computing and Informatics Journal*, *1*. https://doi.org/10.1016/J.FCIJ.2016.04.001

Baganha, M. J., Marques, J. C., & Góis, P. (2004). *Novas migrações, novos desafios: A imigração do Leste Europeu*. https://www.ces.uc.pt/myces/UserFiles/livros/246_BAGANHA%2C_M.%3B_MARQUES%2C_J.%3B_GOIS%20%282004%29%2C_P..pdf

Ben-Gad, M. (2004). The economic effects of immigration—a dynamic analysis. *Journal of Economic Dynamics and Control*, *28*(9), 1825–1845. https://doi.org/10.1016/J.JEDC.2003.04.008

Bento, A. R., Martins, L. A., Machado, R., & Sousa, P. (2011). *Relatório de Imigração Fronteiras e Asilo 2010*. https://sefstat.sef.pt/Docs/Rifa_2010.pdf

Boateng, F. D., McCann, W. S., Chenane, J. L., & Pryce, D. K. (2021). Perception of Immigrants in Europe: A Multilevel Assessment of Macrolevel Conditions. *Social Science Quarterly*, *102*(1), 209–227. https://doi.org/10.1111/SSQU.12888

Borjas, G. J. (2019). *Immigration and Economic Growth*. http://www.nber.org/papers/w25836

Campos, R. L. S. de. (2021). Imigração, "desenvolvimento" e trabalho precário na agricultura alentejana: a marca do "azeite português." *SER Social*, *23*(49), 380–398. https://doi.org/10.26512/sersocial.v23i49.35723

Chen, H., Chiang, R. H. L., & Storey, V. C. (2012). Business intelligence and analytics: From big data to big impact. *MIS Quarterly: Management Information Systems*, *36*(4), 1165–1188. https://doi.org/10.2307/41703503

Coelho, M. T. (2021). *FORESIGHT PORTUGAL 2030 Portugal-Ponto de Partida*. https://gulbenkian.pt/

Cotgreave, A. (n.d.). *6 Best Practices for Creating Effective Dashboards*.

Dias, S., & Gonçalves, A. (2007). *Migração e Saúde*. *1*, 15–26.

Docquier, F., Ozden, Ç., & Peri, G. (2014). The Labour Market Effects of Immigration and Emigration in OECD Countries. *The Economic Journal*, *124*(579), 1106–1145. https://doi.org/10.1111/ECOJ.12077

Dustmann, C., Frattini, T., & Glitz, A. (2006). *The impact of migration: a review of the economic evidence*.

Dykes, B. (2019). *Effective Data Storytelling*. https://books.google.pt/books?hl=en&lr=&id=rHDDDwAAQBAJ&oi=fnd&pg=PR9&dq=Storytelling+with+data+-

+a+data+visualization+guide+for+business+professionals.&ots=M1WkNklLWX&sig=aLYOAahW4
weJak_wEd883KIlpRE&redir_esc=y#v=onepage&q&f=false

Edo, A. (2019). The Impact of Immigration on the Labor Market. *Journal of Economic Surveys*, *33*(3), 922–948. https://doi.org/10.1111/JOES.12300

Esposito, P., Collignon, S., & Scicchitano, S. (2020). The effect of immigration on unemployment in Europe: Does the core-periphery dualism matter? *Economic Modelling*, *84*. https://doi.org/10.1016/j.econmod.2019.04.014

Estrela, J., Lopes, S. M., Menezes, A., Sousa, P., & Machado, R. (2022a). *Relatório de Imigração, Fronteiras e Asilo*.

Estrela, J., Lopes, S. M., Menezes, A., Sousa, P., & Machado, R. (2022b). *Relatório de Imigração, Fronteiras e Asilo 2021*. https://www.sef.pt/pt/Documents/RIFA2021%20vfin2.pdf

Fairlie, R. W., & Lofstrom, M. (2015). Immigration and Entrepreneurship. *Handbook of the Economics of International Migration*, *1*, 877–911. https://doi.org/10.1016/B978-0-444-53768-3.00017-5

Ferreira, S., & Rodrigues, T. (2021). Guaranteeing migrants' rights in a time of pandemics : The Portuguese exception. *Global Pandemic, Security and Human Rights*. https://doi.org/10.4324/9781003176824-8

Fitzsimmons, S. R., Baggs, J., & Brannen, M. Y. (2020). Intersectional arithmetic: How gender, race and mother tongue combine to impact immigrants' work outcomes. *Journal of World Business*, *55*(1), 101013. https://doi.org/10.1016/J.JWB.2019.101013

Fonseca, M. L., & Mcgarrigle, J. (2014). *Immigration and policy: new challenges after the economic crisis in Portugal*. https://www.researchgate.net/publication/261215904_Immigration_and_policy_new_challeng es_after_the_economic_crisis_in_Portugal

Góis, P. (2022). Redes, Interligações e Sistemas Migratórios num Portugal Europeu e Atlântico. *Relações Internacionais*.

Goujon, A., Jacobs-Crisioni, C., Natale, F., Lavalle, C., Aurambout, J.-P., Silva, F. B. e, Bosco, C., Conte, A., Ghio, D., Kalantaryan, S., Kompil, M., Castillo, C. P., Proietti, P., Scipioni, M., Sulis, P., & Tintori, G. (2021). *The Demographic Landscape of EU Territories*. https://doi.org/10.2760/658945

Guedes, M. (2018). *Como transformar dados em diamantes | Business Analytics Portugal*.

Homsuwan, P., Soonklang, K., Pongpun, W., Saeloo, S., Roekkasame, S., Ungtrakul, T., Siripongpreeda, B., Kantathavorn, N., Triphuridet, N., & Wittayasak, K. (2018). Visualization Development of Health Data Reporting with Business Intelligence Techniques. *JOURNAL OF THE MEDICAL ASSOCIATION OF THAILAND*, *101*(6), 49. http://jmatonline.com/index.php/jmat/article/view/9476

Işik, Ö., Jones, M. C., & Sidorova, A. (2013). Business intelligence success: The roles of BI capabilities and decision environments. *Information & Management*, *50*(1), 13–23. https://doi.org/10.1016/J.IM.2012.12.001

Kerr, S. P., & Kerr, W. R. (2011). *Economic Impacts of Immigration: A Survey*.

Kerzner, H. (2023). *Project Management Metrics, KPIs, and Dashboards*. https://books.google.pt/books?hl=en&lr=&id=XDiMEAAAQBAJ&oi=fnd&pg=PA1&dq=Project+m anagement+metrics,+KPIs,+and+dashboards+:+a+guide+to+measuring+and+monitoring+projec t&ots=PENaJWPZM4&sig=T_ufSJvaDY5HJKKKneyw_vynUC8&redir_esc=y#v=onepage&q=Projec t%20management%20metrics%2C%20KPIs%2C%20and%20dashboards%20%3A%20a%20guide %20to%20measuring%20and%20monitoring%20project&f=false

Kunczer, V., Lindner, T., & Puck, J. (2019). Benefitting from immigration: The value of immigrants' country knowledge for firm internationalization. *Journal of International Business Policy*, *2*(4), 356–375. https://doi.org/10.1057/S42214-019-00034-9/TABLES/5

Lewis, E., & Peri, G. (2015). Immigration and the Economy of Cities and Regions. *Handbook of Regional and Urban Economics*. https://doi.org/10.1016/B978-0-444-59517-1.00010-6

Luhn, H. P. (1958). A Business Intelligence System. *IBM Journal of Research and Development*, 314–319. https://doi.org/10.1147/RD.24.0314

Magaireah, A. I., Sulaiman, H., & Ali, N. (2019). Identifying the Most Critical Factors to Business Intelligence Implementation Success in the Public Sector Organizations. *The Journal of Social Sciences Research ISSN*, *5*(2), 450–462. https://doi.org/10.32861/jssr.52.450.462

Marr, B. (2015). *Key Performance Indicators (KPI): The 75 measures every manager needs to know*. https://books.google.pt/books?hl=en&lr=&id=WleQ-F6WC3sC&oi=fnd&pg=PT24&dq=what+is+a+KPI:+key+performance+indicator&ots=3wLBea3LZ7 &sig=94WUReMI9jCR0bQkm6MLbHXYDI0&redir_esc=y#v=onepage&q=what%20is%20a%20KPI %3A%20key%20performance%20indicator&f=false

Merhi, M. I. (2021). Evaluating the critical success factors of data intelligence implementation in the public sector using analytical hierarchy process. *Technological Forecasting and Social Change*, *173*, 121180. https://doi.org/10.1016/J.TECHFORE.2021.121180

Negash, S., & Gray, P. (2008). Business Intelligence. *Handbook on Decision Support Systems 2*, 175–193. https://doi.org/10.1007/978-3-540-48716-6_9

Nofal, M. I., & Yusof, Z. M. (2013). Integration of Business Intelligence and Enterprise Resource Planning within Organizations. *Procedia Technology*, *11*, 658–665. https://doi.org/10.1016/J.PROTCY.2013.12.242

OECD. (2021). *International Migration Outlook 2021*. https://doi.org/10.1787/29F23E9D-EN

Oliveira, C. R. (2021a). *Indicadores de Integração de Imigrantes RELATÓRIO ESTATÍSTICO ANUAL 2021*.

Oliveira, C. R. (2021b). *Indicadores de Integração de Imigrantes RELATÓRIO ESTATÍSTICO ANUAL 2021*.

P. Smith, J., & Edmonston, B. (n.d.). *The New Americans: Economic, Demographic, and Fiscal Effects of Immigration* . Retrieved November 13, 2022, from https://books.google.pt/books?hl=en&lr=&id=-JacAgAAQBAJ&oi=fnd&pg=PT12&dq=immigration+effects&ots=b_UjY3DGaE&sig=_ZlGwUxDhwGZ952xBHMj8IofAUs&redir_esc=y#v=onepage&q=immigration%20effects&f=false

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A design science research methodology for information systems research. *Journal of Management Information Systems*, *24*(3), 45–77. https://doi.org/10.2753/MIS0742-1222240302

Peixoto, J. (2004). *"País de emigração ou país de imigração? Mudança e continuidade no regime migratório em Portugal."* http://pascal.iseg.utl.pt/~socius/index.htm

Peixoto, J., Craveiro, D., Malheiros, J., & Oliveira, I. T. (2017a). *MIGRAÇÕES E SUSTENTABILIDADE DEMOGRÁFICA*.

Peixoto, J., Craveiro, D., Malheiros, J., & Oliveira, I. T. (2017b). *MIGRAÇÕES E SUSTENTABILIDADE DEMOGRÁFICA*.

Peixoto, J., Marçalo, C., & Tolentino, N. C. (2011). *IMIGRANTES E SEGURANÇA SOCIAL EM PORTUGAL*.

Rahman, A. (2011). *A Five-Layered Business Intelligence Architecture*. https://doi.org/10.5171/2011.695619

Rodrigues, T. (2021). *FORESIGHT PORTUGAL 2030 Portugal-Ponto de Partida* (Vol. 03). https://gulbenkian.pt/

Rodrigues, T., & Chorincas, J. (2021). *FORESIGHT PORTUGAL 2030 Portugal- Ponto de Partida* (pp. 26–32). https://gulbenkian.pt/

Rodrigues, T. F. (2009). *HISTÓRIA DA POPULAÇÃO PORTUGUESA*.

Rodrigues, T. F., & Henriques, F. C. (2017). *Re(birth) - Desafios demográficos colocados à sociedade portuguesa*.

Sisense. (2019). *Dashboard Design Best Practices - 4 Key Principles | Sisense*. https://www.sisense.com/blog/4-design-principles-creating-better-dashboards/

Stanford, B., Foster, S., & Berdud, C. E. (2021). *Global pandemic, security and human rights : comparative explorations of COVID-19 and the law*. https://www.routledge.com/Global-Pandemic-Security-and-Human-Rights-Comparative-Explorations-of/Stanford-Foster-Berdud/p/book/9781032010250

Tani, M. (2020). *Migration Policy and Immigrants' Labor Market Performance*. https://doi.org/10.1177/0197918318815608

van der Merwe, A., Gerber, A., & Smuts, H. (2019). *Guidelines for Conducting Design Science Research in Information Systems*.

Vargas-Silva, C., Sumption, M., & Walsh, P. W. (2022). *The fiscal impact of immigration to the UK*.

Wilke, C. O. (2019). *Fundamentals of Data Visualization: A Primer on Making Informative and Comprlling Figures*. https://books.google.pt/books?hl=en&lr=&id=XmmNDwAAQBAJ&oi=fnd&pg=PP1&dq=fundam entals+of+data+visualization&ots=6LN8lZ1DA6&sig=6CJNPPOHGo6crdlw4v27eLBpZhQ&redir_e sc=y#v=onepage&q=fundamentals%20of%20data%20visualization&f=false

Zheng, J. G. (2017). Data visualization in business intelligence. *Proc. of the 11th WSEAS Int. Conf. on Mathematics and Computers in Business and Economics, MCBE '10, Proc. of the 11th WSEAS Int. Conf. on Mathematics and Computers in Biology and Chemistry, MCBC '10*. https://doi.org/10.4324/9781315471136-6/DATA-VISUALIZATION-BUSINESS-INTELLIGENCE-JACK-ZHENG