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A Comparative Dashboard of European Countries Living Conditions

Supporting users on emigration decision-making process

Rui Pedro Bagarrão de Assis Ribeiro

Project Work

presented as partial requirement for obtaining a Master's Degree in Data Science and Advanced Analytics

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação

Universidade Nova de Lisboa

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by

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Master's Project Work presented as partial requirement for obtaining the Master's degree in Data Science and Advanced Analytics, with a specialization in Business Analytics

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July, 2025

STATEMENT OF INTEGRITY

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

[Rui Pedro Bagarrão de Assis Ribeiro]

[Lisbon, July 11th 2025]

DEDICATION

I would like to dedicate this project to my family and friends for all the support and motivation that they gave me throughout this period.

A special thanks to my girlfriend for her patience, understanding, and for always being there for me, even in the most challenging moments. This would not be possible without you.

Finally, I would like to thank my supervisor, professor Teresa Ferreira Rodrigues, for her guidance, availability, and advice. Your support made a real difference in the development of this work.

ABSTRACT

This project aims to develop a decision-support tool for individuals considering emigration, through the development of a dashboard that compares relevant emigration factors, such as cost of living, safety, demographics and other characteristics of various European countries. Initially, an analysis of the most recent global emigration data was conducted, followed by research into the key factors considered by potential emigrants during the decision-making process. It was found that the existing information was mostly generic and lacked specificity. To tackle the lack of detailed information, a survey was created to not only identify the most relevant factors for people looking to emigrate, but also to evaluate the difficulty of accessing this type of information in a clear, reliable, and centralized platform. Additionally, the survey helped understand users' receptivity to using dashboards as a decision-support tool for this particular topic. Based on the results gathered, an interactive dashboard was developed by using Power BI. This dashboard integrates the most important factors considered by the respondents. This project demonstrates how Business Intelligence tools can be valuable in providing accessible, reliable, and personalized information, thus facilitating the decision-making process in the context of emigration.

KEYWORDS

Business Intelligence; Data-Driven; Demography; Emigration; PowerBI; Data Visualization

Sustainable Development Goals (SDG):



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LIST OF ABBREVIATIONS AND ACRONYMS

BI – Business Intelligence

DAX – Data Analysis Expression

ETL – Extract, Transform and Load

KPIs – Key Performance Indicators

OECD - Organisation for Economic Co-operation and Development

PBI – Power BI

1. INTRODUCTION

In an increasingly globalized world, more people are seeking new opportunities beyond their home countries. According to the United Nations, the estimated number of international migrants was 304 million in 2024, which represents a 10% increase when compared to 2020, when that number was around 275 million, and a 97% increase regarding 1990, when that number was only 154 million (Reyes, Kenneth S., 2025).

Whether motivated by career growth, educational prospects, a better quality of life, or the desire for cultural experiences, emigration has become a major life decision for many individuals and Portugal is no different to this trend, with almost 1.8 million Portuguese living abroad by 2024 (Vidigal, Inês, 2025). Europe remains the primary destination, retaining around 70% of the total Portuguese expats' population.

The selection of the right country to move to is a difficult process that requires careful consideration of multiple factors, such as job availability, cost of living, education, safety, healthcare and a lot of other factors (United Nations, Migration, s.d.). Without access to reliable and structured information, many people struggle to make well-informed choices, often relying on dispersed sources that may provide incomplete or outdated information.

Enhancing Data Visualization through a diverse array of visual tools facilitates a more comprehensive understanding of complex circumstances. In recent years, dashboards have increasingly been recognized and adopted as valuable assets for understanding information and make a final decision (Unwin, 2020).

The objective of this project is to address the lack of reliable and centralized information, which creates challenges in the emigration decision-making process, by offering a powerful data-driven solution that will help simplify and improve this process. By applying advanced BI techniques, the construction of a dashboard that consolidates updated insights and presents them in an intuitive and interactive format, will allow users to compare different countries based on key metrics that are aligned with their personal needs and aspirations. Whether someone is looking for a country with high salaries and job opportunities, affordable living costs or higher security indexes, this dashboard should provide the required data to make an informed decision and help the user choose the country that most fits its needs. With a commitment to accuracy and usability, this tool is an essential resource for anyone considering moving abroad. However, given the complexity of emigration decisions, the dashboard must be structured to present relevant, accurate, and up-to-date information in an intuitive approach.

The development of this dashboard is driven by a set of key objectives focused on providing a comprehensive, data-driven, and user-friendly tool to support individuals in selecting the best European country for relocation. The key objectives guiding its creation are:

- Identification of the factors that have the greatest impact when choosing a country to emigrate to;
- Assess the importance of an interactive and intuitive dashboard in the decision-making process.

To achieve the key objectives, a survey will be conducted to a sample of individuals, both Portuguese and other nationalities, in order to compare primary data with existing secondary data from the current literature. The purpose of this comparison is to determine whether the responses from the sample support the findings from the existing literature, or if there are additional factors that are starting to have a bigger impact in the decision-making process of emigration.

Furthermore, the survey will also serve to assess the importance of developing an interactive dashboard, such as the one proposed in this project, in influencing emigration decisions.

To ensure a focused and in-depth analysis, this dashboard will only consider a list of European countries, providing users with a comprehensive overview of the best destinations within this continent. By narrowing the scope, this dashboard allows for a more detailed comparison of the factors in analysis, ensuring that users access precise and relevant information to make well-informed decisions about their possible future destination.

Regarding the handling of both primary and secondary data, a CRISP-DM (Cross-Industry Standard Process for Data Mining) methodology will be used as the base of this project. This methodology is composed by six phases: Business Understanding, Data Understanding, Data Preparation, Modelling, Evaluation, and Deployment (Schröer, 2021). Since this project faces multiple data sources, analytical tasks and construction of a user-centred interactive and intuitive tool, CRISP-DM serves as a practical and theoretical methodology to increase both validity, consistency, accuracy and a sustainable decision-support instrument for users who are considering emigrating. Besides, it ensures methodological diligence during the development phases of this final project.

A successful implementation of the CRISP-DM approach guarantees that the dashboard is not only technically robust but also based on trustworthy data and in accordance with user requirements. By applying this framework, the project provides a solid solution to the issue of obsolete and fragmented information in the decision-making process for emigration.

2. LITERATURE REVIEW

2.1. MIGRATION OVERVIEW

Every year more people are living outside their home country. International migration is an increasingly current reality with a major impact on the development of each country, as it has transformed both the local and global economy, demographics, and national and international policies. The fact that the number of migrants in 2024 is almost the double of the number identified in 1990, shows that people are willing to move but also shows that migration is increasing its relevance as a strategy to pursue better opportunities and respond to challenges. The majority move for reasons related to employment, family and education, while a minority is forced to leave their home countries due to conflict, persecution, or natural disasters (United Nations, Exploring Migration Causes: Why People Migrate, 2024).

Although the number of international migrants has progressively increased over the past five decades, it is important to highlight that the majority of people continue to reside in their country of birth and the share of international migrants regarding the rest of the world's population has continued steady over the years, standing at 3.7%, 0.8% higher than in 1990 (Reyes, Kenneth S., 2025).

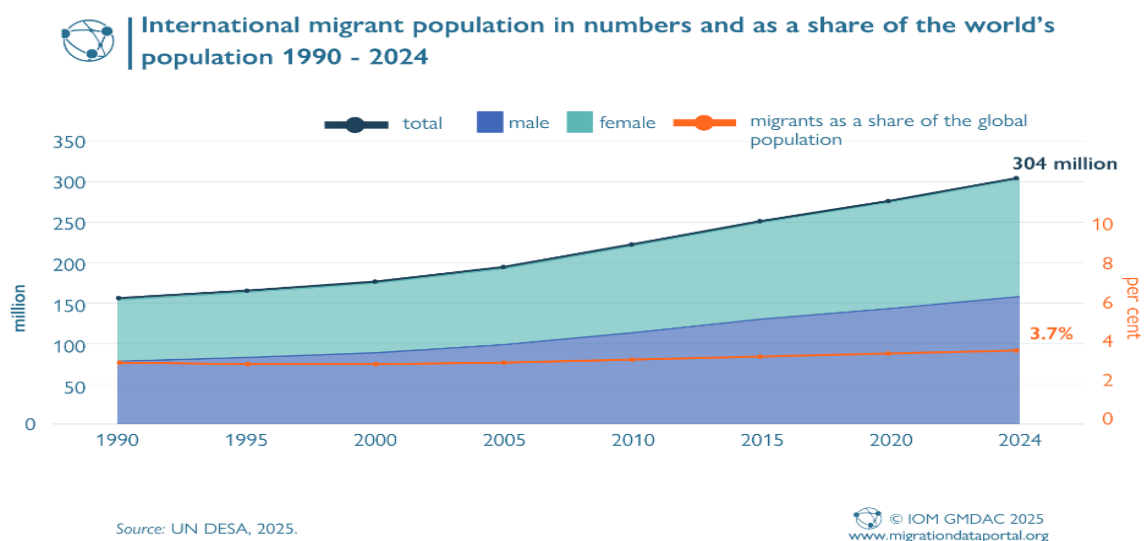


Figure 1. Evolution of international migrant population between 1990 – 2024 (United Nations, Exploring Migration Causes: Why People Migrate, 2024)

In Europe, countries have increasingly become both destinations and sources of migrants, creating a dynamic intra-EU mobility system (Batut, Gantois, & Lavallée, 2024). This continent has hosted, at mid-year 2024, 94.1 million international migrants, showing an increase of 13% when compared to 2020. According to United Nations, for this period, approximately half of all international migrants are originated from Europe where 28% are from Eastern Europe,

10% are from Southern Europe while Western Europe and Northern Europe represents 6% and 4%, respectively. Asia represents around 21%, followed by Africa that stands on 11%, whereas Latin America and the Caribbean corresponds to 7%. Northern America and Oceania reflects less than 2%. (Reyes, Kenneth S., 2025).

The Migration Data Portal reports that the top five destination countries for international migrants have remained the same since mid-2020 being them the United States of America, Germany, Saudi Arabia, the United Kingdom, and France. However, eight of the top ten countries presented rises in the proportion of migrants. For instance, Spain recorded an increase of 3.5%, while Germany and United Kingdom displayed rises of 1.9% and 1.5%, respectively. The remaining countries showed a more modest growth as Australia grew 0.8%, France by 0.7% and both Canada, the United States, and the Russian Federation presented increases of 0.3% each.

Ukraine became one of the top five countries of origin for international migrants due to a 124% growth in the volume of emigrants from mid-2020 to mid-2024, the largest percentage increase between the top 10 countries of origin in that period. These results of the conflict with Russia, as more than 5.6 million refugees from Ukraine were registered worldwide until May 2025. Furthermore, 91% of these refugees, around 5.1 million, moved to another country in Europe, being Germany and Poland the countries most frequently chosen, since the first country provided the highest monthly financial allowance for Ukrainians, while the latter attracted attention due to its proximity to their homeland. (Statista, 2025).

These outcomes indicate that certain European countries, such as Germany and France, attract more migrants due to their strong economic prospects and well-developed social welfare systems. In contrast, countries like Ukraine face notorious outflows, mainly caused by social, political, and security challenges.

Portugal also reveals elevated levels of emigration which has traditionally been associated with economic adversity, but current flows are also related to highly skilled professionals seeking career progression and better quality of life (Pires, Azevedo, Vidigal, & Veiga, 2019).

Understanding these tendencies is vital for creating tools, such as interactive dashboards, that could help individuals in making informed decisions about emigration. The continuous growth of international mobility and the shifting on migration behaviour indicate a necessity for available, updated, and organized data to support in one of the most important decisions individuals may face.

2.2. FACTORS INFLUENCING EMIGRATION DECISIONS

The decision to emigrate can be influenced by a great combination of economic, social, political, environmental, and personal indicators and motivations. Traditional theories like the

neoclassic economic model consider that migration is mostly determined by wage differences and employment opportunities, inspiring individuals to move from low-income to high-income countries (Todaro & Smith, 2009).

Nevertheless, modern research indicates that these decisions are multidimensional, designed by both structural and individual-level factors, and it is not correct to only consider economic motivations (de Haas, Migration and Development: A Theoretical Perspective, 2010).

To understand migration motivations the push-pull model is commonly used as a conceptual framework. According to this model, people migrate due to a combination of "push" factors in their home country and "pull" factors in the destination country (Niu, 2022).

2.2.1. Push Factors

Push factors are highly connected to negative conditions in the country of origin which inspire individuals to move out of their country of origin (Parliament, 2020). Economic adversity is one of the primary drivers for individuals to emigrate as it comprises high unemployment rates, lower wages, and lack of career opportunities. Furthermore, political instability, insecurity, limited access of quality public services, like healthcare and education, can have a huge impact on the quality of life of individuals creating the urge to emigrate. Environmental factors, such as climate changes or even natural disasters but also demographic pressures, additionally aggravate the need to move to a foreign country (de Haas, Castles, & Miller, The Age of Migration: International Population Movements in the Modern World, 2020).

2.2.2. Pull Factors

Pull factors are the opposite of push factors as they correspond to the positive traits and prospects presented by the destination country that attract migrants (Parliament, 2020). Improved employment opportunities among higher wages, political and social stability, and also advanced public services covering healthcare and education systems are examples of these type of factors that have a great impact on the decision of moving abroad (de Haas, Castles, & Miller, The Age of Migration: International Population Movements in the Modern World, 2020).

The importance of push and pull factors differs between individual's circumstances, as this decision is personalized for each individual. For instance, younger adults might emphasize professional development opportunities, while elder migrants may prioritize healthcare availability. Individual's gender or socioeconomic status can also influence migration outcomes.

2.3. THE IMPORTANCE OF INFORMATION ON MIGRATION DECISION-MAKING

The process of emigration poses as a difficult task as it is required to have access to accurate, valid and updated information. Due to a continuous and rapid increase in international mobility, along with the social, political and economic contrasts between countries, the need of consistent information available as become an essential part of the decision-making process (Czaika & de Haas, 2014). Nowadays, individuals are not simply persuaded by personal ambitions or push-pull factors, they are also very dependent on the quality and availability of data they can collect before making the decision to move abroad.

Studies previously conducted have shown that knowledgeable migrants are more likely to make effective exchanges, with easier integration, exhibiting higher satisfaction with their moving choices (Czaika, Bijak, & Prike, Migration Decision-Making and Its Key Dimensions, 2021).

Data-driven decision-support systems, for example dashboards, are a possible approach to tackle the existing gaps in migration information access. These tools combine several sources of data and turn them into an interactive and user-friendly format. Nonetheless, the benefit of these instruments is dependent on their usability and the significance of the information they provide. If these are not properly structured, or based on unreliable data, they can become useless or even misleading. Data accessibility, analytical literacy and accurate interpretation are yet critical concerns when using these types of tools (Matheus, Janssen, & Maheshwa, 2020).

2.4. THE IMPORTANCE OF BUSINESS INTELLIGENCE ON MIGRATION DECISIONS

As mentioned earlier, with migration steadily increasing over the past 50 years, the need for interactive and up-to-date information on a single platform has become essential for those who are looking to move across countries. Finding the most suitable country to emigrate to, based on individual needs can be challenging, especially when information is scattered and most times difficult to interpret.

Currently, migration-related data is mostly available in extensive reports that are not adapted to individual preferences. These reports are often dense and complex, making it difficult for individuals to obtain applicable insights and compare different countries effectively. This lack of ease access complicates the decision process.

An interactive dashboard presents a viable solution to this issue by providing a centralized, user-friendly platform that allows individuals to filter and analyse key factors based on their specific needs. By simplifying access to essential information and presenting it in a clear and engaging format, such tool would substantially improve the country's selection process (Few, 2006).

2.5. BUSINESS INTELLIGENCE AND DASHBOARDS FOR PUBLIC USE

Business intelligence tools have become increasingly popular among the private and public sectors as they help to support decision-making problems. Although there is no universally accepted definition of BI (Wixom & Watson, 2010), Business Intelligence (BI) includes a set of technological processes designed to collect, manage, and analyse data, transforming it into valuable insights that can drive strategic decision-making and optimize business operations (Chen, Chiang, & Stor, 2012).

Interactive dashboards are among the most used BI tools as they translate significant amounts of complex information into insightful visualizations, facilitating analysis and insight production. With these tools, users can navigate through data, while applying filters, and compare factors or KPIs in real time. Regarding public use, dashboards can substantially improve information availability, making complex findings accessible to every user through visual minimalism and interactivity (Few, 2006).

The use of this tool is essential in migration perspectives, as individuals must evaluate complex data, scattered throughout the internet, before deciding to move. Dashboards can perform as decision-support systems, lowering ambiguity and helping migrants identify the countries that support their priorities and needs.

2.6. GAPS AND RELEVANCE OF THIS PROJECT FOR THE LITERATURE

The literature on migration and its trends nowadays is accessible to anyone yet it is quite complex. Furthermore, there is a great lack of information regarding how individuals can access up-to-date and truthful information and, even when they have this information, what their perception is when analysing this data.

A major gap identified is regarding the fragmentation of information sources. People interested in emigrating are frequently forced to access a huge number of websites and reports, which may sometimes be unreliable or out of date. This fragmentation can interfere on decision-making, particularly for individuals without previous migration understanding or advanced research skills (Czaika, Bijak, & Prike, Migration Decision-Making and Its Key Dimensions, 2021).

A centralized, reliable and easy-to-use tool that allows users to investigate and compare countries based on structural criteria is crucial to improve the entire decision-making process about whether or not to move to other country.

3. METHODOLOGY

This project adopted the CRISP-DM methodology, with some modifications, due to its proven flexibility, efficiency, and broad applicability across various industries. It also allows for the selection of the technologies best suited to the specific needs and context of the project itself (Wirth & Hipp, 2000). This methodology is comprised the six initial components, business understanding, data understanding, data preparation, modelling, evaluation and deployment. The figure below shows the full CRISP-DM approach.



Figure 2. CRISP-DM Methodology Framework (Sharma, 2025)

The initial phase, business understanding, focuses on understanding the objectives and requirements of the project. This phase is followed by the data understanding phase where the initial data is collected, described and explored to ensure data quality. The next phase, data preparation, involves the cleaning and processing of the data into a structure that will suit the final model. With the data cleaned and structured, the next phase, modelling, is used to define the best possible model for the data in question. After this phase, the model needs to be tested to ensure it meets the objectives defined in the first phase and this is obtained in the evaluation phase. The last phase corresponds to the deployment of the solution developed.

In order to complete the methodological approach, it is necessary to make use of different tools and technologies, including software and any other resources essential for data

collection, analysis, and implementation. A clear understanding of these tools helps in comprehending how the methodology is effectively executed.

The tools used in this project are briefly described below.

Microsoft Excel

Microsoft Excel is a Microsoft application used for data organization, analysis, and visualization. It provides a grid-based interface that allows users to input, manipulate, and calculate data using its incorporated functions and formulas. Its ability to handle large volumes of data contribute to its utility on fields such as business, engineering, research, and education (Microsoft, 2024).

In this project this tool is used to storage raw data from the sources and store the final tables.

Jupyter Notebooks

Jupyter Notebooks is an open-source web-based interactive computing environment that allows users to create and share code related documents, including live code. It allows the use of many programming languages among which are Python, Ruby, and JavaScript, and others (Jupyter Notebook Documentation, s.d.). This tool provides a user-friendly and flexible platform for importing, cleaning, converting, and exploring data. With it its users can code, visualize data, document their work using Markdowns, and bring in different libraries such as Pandas, NumPy, and Matplotlib to carry out data processing and analysis more efficiently.

Jupyter's reproducibility and simplicity make it a powerful tool for both collaborative research and personal projects.

In this project, Jupyter notebooks were mainly used to clean and transform the data retrieved from the sources.

Python

Python is a worldwide used programming language that is known for its simplicity, readability, and versatility. Its ecosystem includes a set of libraries designed for data manipulation, analysis, and visualization. One of these libraries is Pandas which provides robust data structure commands for handling structured data. (Python, s.d.)

Due to the factors mentioned above, this was the programming language chosen to incorporate in the Jupyter notebooks in order to perform some ETL processes.

Power BI

Power BI is a tool created by Microsoft that is used for analytics and data visualization projects, with the aim off converting data into interactive and insightful dashboards and reports. This

software gives its users functions that allows them to directly connect with different data sources, model data, and create visualizations for making decisions based on data.

The integration of PBI with other Microsoft products and the capability of dashboards to refresh automatically in real time make a powerful harness for communicating complex findings to a wider audience (Microsoft, 2025).

For this project, PBI was selected as the primary business intelligence instrument due to its intuitive interface and functionalities.

DAX

DAX (Data Analysis Expressions) is a coding language used in Microsoft Power BI, Excel Power Pivot, and SQL Server Analysis Services (SSAS) to create custom calculations and expressions for data analysis (Microsoft, 2023).

In the context of this project, DAX was essential for building dynamic and interactive visuals as it allowed to perform calculations and create measures that change based on specific conditions or user interactions.

Figma

Figma is a cloud-based user interface (UI) and user experience (UX) design tool that is designed to be collaborative in nature and is widely known in collaborative design. It enables users to produce wireframes, mockups, and attractive visual layouts right from the browser (Figma, n.d.).

Figma was utilized in this project to create the visuals and organization of the pages of the dashboard. This includes the aesthetic arrangement of components such as headers, sections, icons, and visual themes that enhance the clarity and visual appeal of the data presented. Figma's clean interface and powerful design features make it easy to align visual elements with the functional aspects of the dashboard created in PBI.

By using Figma, the design process became more structured and visually appealing, ensuring that the final dashboard is not only data-rich but also user-friendly and visually engaging.

3.1. BUSINESS/PROJECT UNDERSTANDING

This project emerges from a growing need to support individuals in one of the most complex decisions of their lives, that is emigration. As global mobility increases and more people seek better opportunities abroad, the process of choosing a destination country becomes increasingly data dependent. Although there is already information online about employment rates, living costs or even health/education support, this information is quite dispersed. This may result in a hard analysis process, when choosing between countries, as the information may be outdated or simply difficult to interpret. Consequently, potential migrants may feel overwhelmed or misinformed, which may retard their ability to make informed decisions.

The main objective of this project is to develop a dashboard that helps its users to evaluate and compare European countries based on multiple indicators that are relevant to emigration decision making. These indicators were gathered both from existing literature and from secondary data collected by a survey. Through the integration of this data into a unified, user-friendly tool, the dashboard aims to simplify the decision-making process for those considering relocation by providing them with easily available and personalized insights.

The success of this project depends on several elements. First, the dashboard must respond to the users' needs by allowing them to filter their preferred indicators. Additionally, the tool must ensure high usability by allowing non-expert users to navigate, compare, and interpret information easily.

While the scope of the dashboard is limited to European countries, this regional focus enables a more detailed and context-specific analysis. Nonetheless, some limitations are expected, particularly regarding data availability, inconsistencies across sources, and potential sample bias in survey responses. Despite these constraints, the dashboard is expected to fill a significant gap in the current landscape by offering a user-oriented, research-informed tool that improves transparency and confidence in the emigration decision-making process.

By applying the CRISP-DM methodology, with a few modifications, this project ensures that the development process follows a structured and theoretically grounded approach. The business understanding phase serves as the foundation for correctly combining data collection, analysis, and visualization efforts with the practical needs of the intended users-migrants. Thus, the project not only advances the academic research on emigration support tools but also contributes as a tangible solution to a real-world challenge.

3.2. DATA UNDERSTANDING

The data understanding phase of this project was done both through a survey and the analysis of literature review.

The survey was developed to verify and add on the key factors influencing emigration decisions identified in the literature review, as well as to assess the perceived usefulness and relevance of the proposed decision-support tool from the perspective of potential users. Additionally, it provided an opportunity for participants to suggest new ideas and features that could be incorporated into the dashboard.

The survey was created through Qualtrics, and it was shared in a vast number of platforms. This survey included the following questions:

1. What is your age group? / Qual é o seu grupo etário?
2. What is your gender? / Qual é o seu género?
3. In which country do you currently reside? / Em que país reside atualmente?
4. What is your nationality? / Qual é a sua nacionalidade?

5. What is your current employment status? / Qual é a sua situação profissional?
6. What is your approximate monthly net income? Qual é o seu rendimento mensal líquido aproximadamente?
7. What is the highest level of education you have completed? / Qual é o nível mais elevado de escolaridade que concluiu?
8. Have you ever considered emigrating to another country? / Alguma vez considerou emigrar para outro país?
9. Are / were you an emigrant? É ou já foi emigrante?
10. If you answered "Yes" to the previous question, what was / is your situation while living abroad? / Se respondeu "Sim" à pergunta anterior, em que situação se encontrava / encontra?
11. If you were to emigrate, which countries would you most likely consider relocating to? / Se emigrasse, para que países consideraria mudar-se?
12. What would be / was your primary motivation for emigrating? / Qual seria / foi a principal motivação para emigrar?
13. Please rate the following factors based on their importance in your decision to emigrate. / Por favor, classifique os seguintes fatores com base na sua importância na decisão de emigrar. (Rate each from 1 = Least Important to 5 = Most Important / Classifique de 1 = Menos importante a 5 = Mais importante)
 - a. Average salary / Salário médio
 - b. Healthcare quality / Qualidade dos cuidados de saúde
 - c. Personal safety / Segurança pessoal
 - d. Unemployment rate / Taxa de desemprego
 - e. Food prices / Preço dos alimentos
 - f. Entertainment and leisure costs / Custo com lazer e hobbies
 - g. Climate and environment / Clima e ambiente
 - h. Taxes / Taxas
 - i. Housing prices (rent or purchase) / Preços da habitação (arrendamento ou compra)
 - j. GDP / PIB
 - k. Emigration rate / Taxa de emigração
 - l. Sociocultural characteristics / Características socioculturais
 - m. Transportation Prices / Preços dos transportes
14. Are there any other factors you believe should be considered in emigration decisions? If so, please specify which ones. / Existem outros fatores que considera relevantes na decisão de emigração? Se sim, por favor indique quais.
15. In your experience, is it difficult to find reliable, consolidated and centralized information for comparing countries as potential emigration destinations? / Na sua experiência, é difícil encontrar informações fiáveis, consolidadas e centralizadas para comparar países como destinos de emigração?

16. If you had access to an interactive dashboard that provides comparative data on countries (e.g., salaries, cost of living, safety, climate), would this positively influence your emigration decision-making process? / Se tivesse acesso a um dashboard interativo com dados comparativos sobre vários países (por exemplo: salários, custo de vida, segurança, clima), isso influenciaria positivamente o seu processo de decisão para emigrar?
17. Would a dashboard page that compares your current income and expenses with the cost of living in another country help you make better-informed decisions about emigrating? Considera que uma página do dashboard que compara o seu rendimento e despesas atuais com o custo de vida noutra país ajudaria a tomar decisões mais informadas sobre emigração?
18. Which format would you prefer for comparing countries on the dashboard? / Qual o formato que preferiria para comparar países no painel?
19. To what extent would this dashboard help you understand and compare your current situation with your desired country? / Até que ponto este dashboard o ajudaria a compreender e comparar a sua situação atual com o país de destino?
20. Do you have any suggestions or features you believe this emigration dashboard should include? / Tem sugestões ou funcionalidades que considera que este painel de emigração deveria incluir?

Once the survey results were analysed, and the key factors were identified from both survey and literature review, a search was conducted to identify possible sources to use in order to create the foundation for this project. After understanding which sources were more aligned with the objective of the project, the following were the final selected:

Eurostat Database

Eurostat is the statistical office of the European Union, its responsibilities include collecting and sharing accurate statistical data for the EU and its member countries as the main statistical office for the European Union. Eurostat can be considered as a repository of statistics as it manages highly diversified sets of data Europe wide.

This database includes various datasets on areas such as demography, employment, education, industry, commerce, health, and regional development, among others. It is known for its uniform criteria and strict verification methods, guaranteeing international and historical worthiness across nations. Usually, data is gathered from the national statistical offices and centralized within the frameworks of the EU rules and global benchmarks.

World Bank Database

The World Bank Database is a repository of economic, financial, social, and environmental data on a global scale, it is maintained by the World Bank Group. It is a valuable source for decision-makers, scholars, and organizations as it enables them to get efficient access to high-quality data on development indicators for different nations and regions. The database is

huge, and it covers a big range of topics like poverty, education, health, infrastructure, trade, and governance.

World Bank looks for data from internationally recognized sources such as the agencies of the national statistical, international organizations, and other reliable institutions. The database had not just the past data but also the current data which is really important for analysing the global trends and patterns. It has over 200 indicators which cover more than 200 economies and regions, and it provides data on the different levels, from national aggregates to specific subnational regions.

Numbeo

Numbeo is a website that allows people to research, compare, and insert worldwide cost of life factors (Numbeo, 2024). It offers numerous variables such as average house prices, public transport monthly pass fares, and other living expenses, which are all collected by time and country. This website is a useful source to get an idea of and compare living costs in different parts of the world.

GitHub

GitHub is a popular website that enables version tracking and teamwork software development. It serves as a massive storage of open-source projects, codes, and datasets that have been contributed by developers, researchers and organizations around the world. GitHub enables users to retain, control and distribute code, while keeping a record of modifications through its built-in version control system.

Kaggle

Kaggle is an online platform and community for data science and machine learning, that is mostly known for its competitions, datasets, and collaborative tools. It acts as a repository for a collection of publicly available datasets from a variety of domains including economics, healthcare, social sciences, and environmental studies. Kaggle offers its users the chance to search, process, and communicate datasets in a comfortable and easily navigable environment.

Six Group

SIX Group is a leading provider of financial market infrastructure and services, offering a wide range of data solutions across various sectors such as banking, trading, and securities services. Based in Switzerland, SIX Group operates numerous platforms, including the Swiss Stock Exchange, and provides access to high-quality financial data, market information, and analytics.

NationalFlags.shop

This source is a website that sells worldwide national flags and was only used for the purpose of retrieving the flags image.

These sources contain over 5000 metrics. However, to streamline the analysis, only a selected few were chosen for inclusion in the dashboards, supported by the literature review and the survey developed for this purpose.

The selected variables were downloaded and gathered into excel files that were stored in my personal computer workspace.

The following table contains the chosen variables and its sources:

Data Extracted	Source
Land Area km2	https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.TOTL.K2&country=
Total Population	https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.TOTL.K2&country=
Average precipitation (mm per year)	https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.TOTL.K2&country=
Consumer price index (2010 = 100)	https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.TOTL.K2&country=
Current account balance (BoP, current US\$)	https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.TOTL.K2&country=
Deposit interest rate (%)	https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.TOTL.K2&country=
GDP (current US\$)	https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.TOTL.K2&country=
Inflation, consumer prices (annual %)	https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.TOTL.K2&country=
Life expectancy at birth, total (years)	https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.TOTL.K2&country=
Mortgage Interest Rate	https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.TOTL.K2&country=
Net migration	https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.TOTL.K2&country=
Population, total	https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.TOTL.K2&country=
Unemployment, total (% of total labor force) (national estimate)	https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.TOTL.K2&country=
Coordinates	https://gist.github.com/metal3d/5b925077e66194551df949de64e910f6
Capital	https://github.com/icyrockcom/country-capitals/blob/master/data/country-list.csv
Language	https://www.kaggle.com/datasets/jfreyberg/countries-continents-languages?resource=download
Militarisation	https://www.kaggle.com/datasets/natalyreguerin/global-peace-index-gpi?resource=download
On Going Conflict	https://www.kaggle.com/datasets/natalyreguerin/global-peace-index-gpi?resource=download
Safety and Security	https://www.kaggle.com/datasets/natalyreguerin/global-peace-index-gpi?resource=download

Average temperature	https://www.kaggle.com/datasets/palinatx/mean-temperature-for-countries-by-year-2014-2022
Flag	https://www.nationalflags.shop
12 Eggs	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Apartment Monthly Rent (t1) In Center	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Apartment Monthly Rent (t1) Outside Center	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Apartment Monthly Rent (t3) In Center	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Apartment Monthly Rent (t3) Outside Center	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Banana (1kg)	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Beef (1kg)	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Chicken Fillets (1kg)	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Fitness Club Monthly Fee	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Gasoline (1l)	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
International Primary School Price	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Loaf of Fresh White Bread (500g)	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
McMeal at McDonalds	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Meal for 2 People (Mid-Range 3 course)	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Meal, Inexpensive Restaurant	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Milk (1l)	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Monthly house expenses (Electricity, Heating, Cooling, Water, Garbage)	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Monthly Internet expenses	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Monthly Transportation Pass	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Net Salary	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
One-way Ticket (Local Transport)	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Potato (1kg)	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Private Preschool (or Kindergarten) Price	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Rice (1kg)	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Square Meter Value in Center	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Square Meter Value Outside Center	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Water (1,5l)	https://www.numbeo.com/cost-of-living/prices_by_country.jsp
Quality of Life Index	https://www.numbeo.com/quality-of-life/rankings_by_country.jsp?title=2025-mid&displayColumn=0

Currency	https://www.six-group.com/en/products-services/financial-information/data-standards.html#scrollTo=currency-codes
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Table 1. Variables and sources

3.3. DATA PREPARATION

The data used in this project came from multiple sources, identified in the data understanding phase. Each of these sources had its own formats and structures and because of this, some data cleaning and preparation was needed to be performed before the data could be imported to Power BI.

The first step involved reorganizing the Excel files to give them a standard tabular structure, with column names in the first row and the corresponding data arranged row by row. To ensure clarity and ease to this data preparation process, it was also added a separate worksheet to each file, containing the descriptions of all the metrics included.

From there, I used three Jupyter Notebooks to prepare the main datasets needed for the dashboard. These resulted in three key tables: FACT_METRICS, DIM_DESCRIPTION, and DIM_COUNTRY.

FACT_METRICS

This table brought together the main factors to be used in the dashboard. I started by reading all relevant Excel files by using the `pd.read_excel()` function from the pandas library. In some files, the year appeared as a column name, which wasn't ideal for the data model. In order to fix this, I used the `melt()` function to restructure the data into a more usable format.

Once all the files shared the same structure, I standardized the column names, so everything aligned correctly. After that, I merged the data into one combined table and filtered it to include only the countries, years, and metrics I needed. Finally, I exported this cleaned and aggregated dataset into a new Excel file ready to be imported for Power BI.

DIM_DESCRIPTION

Similarly to what was done for the "Fact_Metrics" notebook, the first step on this notebook was to read the excel files using the "`pd.read_excel()`" command, in this case for the metrics description sheet. The second step was to rename the columns in order to have a common schema for all the dataframes. After this, the dataframes were merged into a single dataframe. The next step was to filter only the metrics needed. The last step of this notebook was to export this dataframe into a new aggregated excel file in my workspace.

DIM_COUNTRY

This table focused on country-level information. After importing the data, I noticed that one source had all country names in uppercase, which would have caused issues in later steps. To fix this, I used the `str.title()` function to convert them into a standard format. Then, I joined the datasets to bring together all necessary country attributes. After renaming the columns to clearer names, I exported the final table to Excel.

In addition to these main tables, I also created a few supporting tables directly in Excel to enable specific features, related to the survey feedback, in the final dashboard, such as slicers and filters.

3.4. MODELLING

Normally, in the CRISP-DM methodology, the modeling phase is used to select and test the analytical models. However, since the project aims to build a dashboard, this phase focused on creating the data model that would support the dashboard.

Regarding the data model, it ended up with eleven tables, corresponding to the tables created in the data preparation phase, two-dimension tables, one fact table and eight additional tables. The main purpose of the additional tables added is to enhance the dashboard capabilities.

The following figure represents the final data model.

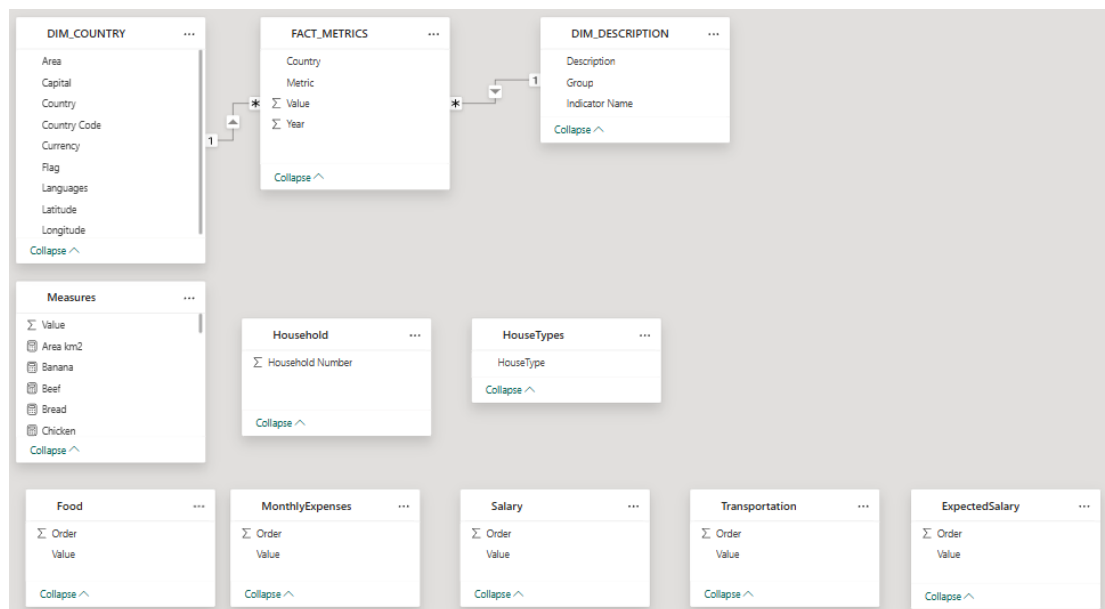


Figure 3. Data Model

The existing connections on this model are presented in table 2 below:

From Table	To Table	Connection Type	Columns Used
Fact_Metrics	Dim_Description	Many-to-One	Metric = Indicator Name
Fact_Metrics	Dim_Country	Many-to-One	Country = Country

Table 2. Data Model Relationship Connections

This data model was structured as a star schema to enable the filtering and aggregation of the visuals. Additionally, the measures created are included in a table in *Appendix 1*.

3.5. EVALUATION

In order not to duplicate the information, this chapter will be discussed in the “Results” section of this project.

3.6. DEPLOYMENT

The deployment phase encompasses the sharing and delivery of the dashboard to its intended users. In the case of this project, it results on sharing the final dashboard with individuals who are considering emigration and looking for information on possible emigration destinations. Just like the evaluation phase, this step will be explored in more detail in results’ section.

4. RESULTS AND DISCUSSION

In this section is presented a detailed analysis of the final results of this project. It includes the outcomes acquired from the performed survey and provides a complete walkthrough of the pages developed for the dashboard. More emphasis is given to the data visualizations implemented, the filtering options available to improve the displayed information and the overall navigation structure of the dashboard. The discussion highlights how these components impact the usability and effectiveness of the outcome in communicating the intended insights.

4.1. SURVEY ANALYSIS

To investigate the profiles, motivations and informational needs of possible emigrants, a structured survey was developed through the Qualtrics platform. The survey covered a total of 20 questions, both closed- and open-ended, designed to gather complete data on respondents' demographic traits, migration goals, past experiences, and preferences concerning decision-support instruments. This section summarizes and analyses the survey's findings, providing information on emigration consideration patterns, important determinants, and the perceived need for centralized informational resources.

A total of 269 responses were gathered through the survey. However, only 176 were considered valid for the purpose of this study. The invalid answers were eliminated due to incomplete answers or inconsistencies that could compromise the consistency of the results.

Respondent's Profile

Findings revealed that respondents were widely represented across age groups, with a greater proportion of those between the ages of 18 and 35. Gender distribution was fairly balanced, with 56% identifying as female and 44% as male. These outcomes are presented in two graphs below.

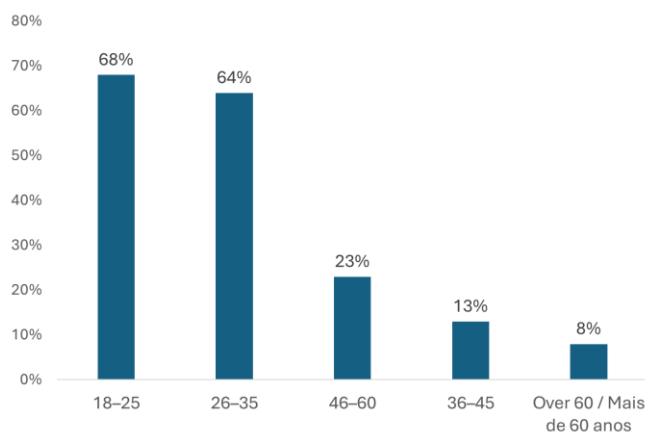


Figure 4. Age Group Distribution of Participants

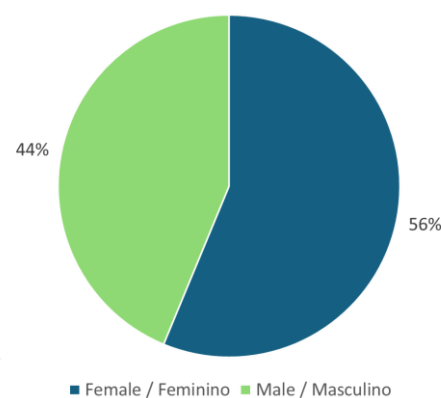


Figure 5. Gender Distribution

In terms of residence of those surveyed, 92% currently reside in Portugal. As presented in *Appendix 2*, the remaining 8% are based in countries including Australia, Austria, Denmark, the Netherlands, Switzerland, and the United Kingdom.

93% of the respondents were identified as Portuguese. Those from Angola, Bangladesh, Brazil, Cape Verde, Colombia, Germany, Russia, and Timor-Leste made up the remaining 7% (*in Appendix 3*).

Additional information, regarding employment status can be found in *Appendix 4*, and reveals that around 53% of respondents indicated being employed (working for an employer), 34% were students, 11% were self-employed, 2% retired, and 1% unemployed.

The distribution of participants' net monthly income was particularly diverse as 27% earned less than 600€, while 24% earned between 1000€ and 1499€. Moreover, 17% fell within 1500€ and 1999€ range and 10% earned between 600€ and 999€. Higher income groups were not that representative with 7% reporting a monthly income between 2000€ and 2499€, 6% earning 4000€ or more, 5% earning between 3000€ and 3999€, and only 4% earning between 2500€ and 2999€. A detailed breakdown of these results is presented in *Appendix 5*.

Additionally, the distribution of educational backgrounds was also varied as 24% had finished secondary school, 37% had a master's degree, 35% had a bachelor's degree, 2% had vocational training, 1% had a PhD, and 1% had other educational backgrounds (*in Appendix 6*).

As presented in Figure 6, a substantial proportion of participants (72%) indicated that they once thought or were currently considering emigrating to another country. This outcome underlines the significance and suitability of the present study, as it highlights an extensive interest in international mobility among the target population.

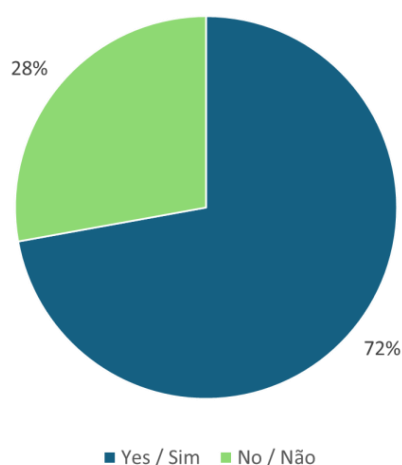


Figure 6. Distribution of responses to "Have you ever considered emigrating to another country?"

Furthermore, as presented in *Appendix 7*, while 78% of respondents had never emigrated, 22% indicated that they had previously lived abroad. Their destinations included Australia, Austria, China, Denmark, Ethiopia, France, Germany, Iceland, Ireland, Italy, the Netherlands, Portugal, Slovenia, Spain, Switzerland, Turkey, the United Kingdom, and the United States. The

most commonly mentioned destinations were Portugal, the Netherlands, and the United Kingdom, as it is shown in Figure 7.

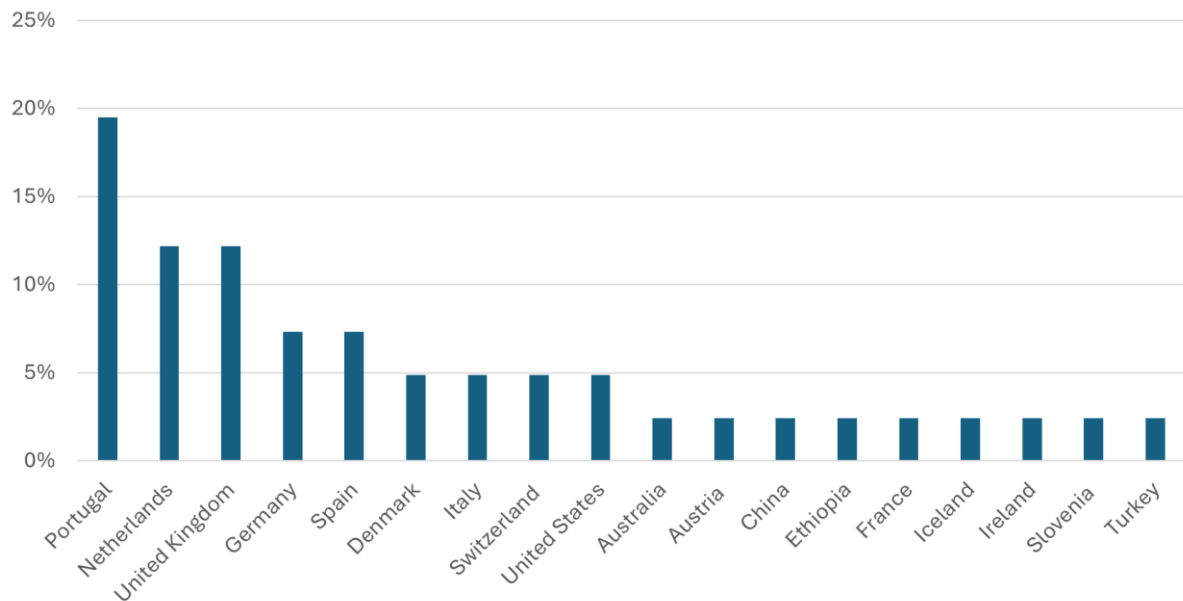


Figure 7. Migrants location distribution

It was also found that 58% of the people that already emigrated were working, 39% were students and the last 3% said that they emigrated for a different reason (*Appendix 8*).

Regarding possible emigration destinations, as presented in Figure 8, Switzerland, Spain, and Denmark were the most often listed European countries. The United States, Canada, and Australia were the most often mentioned countries outside of Europe.

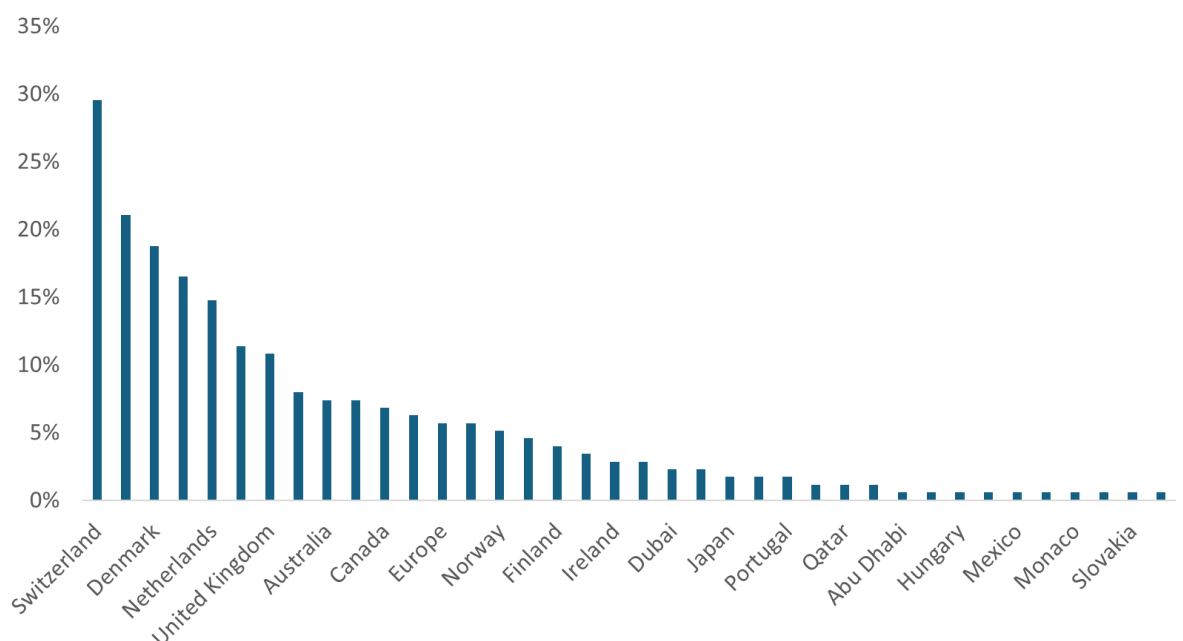


Figure 8. Countries most considered for reallocation

Key Factors for Emigration

When investigating the key motivations for emigration purposes, it becomes clear that economic and quality-of-life factors are the most relevant in influencing participants' decisions. Figure 9 reveals that the most significant identified driver was the prospect of a higher salary in the destination country, mentioned by 79% of participants. Not far behind, 70% of respondents identified the possibility of a higher quality of life as their primary motivating factor. Additionally, other pertinent variables including access to political stability (13%), personal safety (12%) and education (9%) were also noted. Around 5% of the participants indicated other factors such as improved employment prospects, exposure to new cultures, and life experiences as motivating factors.

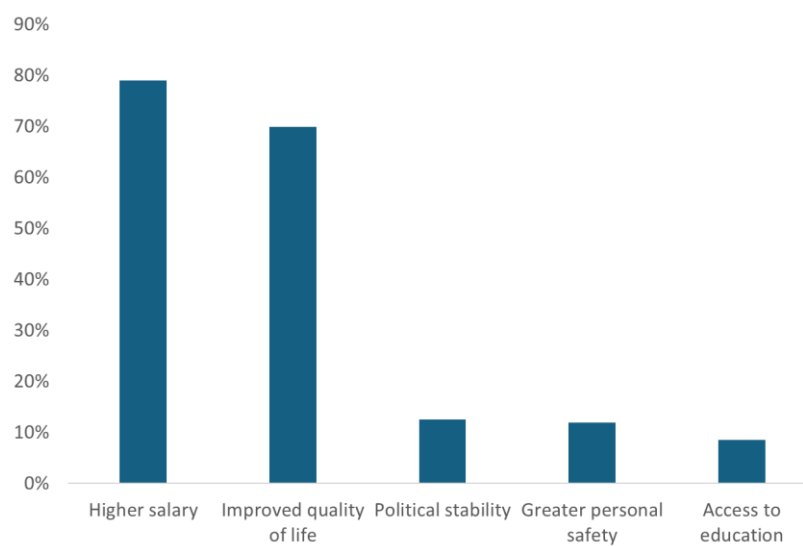


Figure 9. Primary emigration motivations

An investigation of the scores attributed to each factor exposed that the “average salary in the destination country” was considered as the most important, receiving a mean rating of 4.4 out of 5. In opposition, the “emigration rate” of a country was perceived the least influential factor, with an average score of 2.85. All the remaining factors are scored above 3, suggesting that, while contrasting in weight, they are mostly identified as relevant concerns when evaluating a country as a likely emigration destination (in *Appendix 9*)

Along with the predetermined variables, the survey also had an open-ended question to find out what other factors respondents thought were important to consider when assessing possible emigration destinations. This qualitative input permitted participants to freely express further motivations or concerns beyond those listed in the previous questions. The answers gathered through this question carry valuable insights into frequent reasons that may not have been originally reflected and help recognize factors that should potentially be integrated into the dashboard due to their perceived relevance. These additional factors are summarized in the table below.

Possible Additional Factors for Emigrating
Accessibility and travel time to home country
Access to higher education
Availability of culture and open society
Better career opportunities
Carreer progression
Carreer progression, adventure
Climate informations, Food related prices, Meal Prices, Housing Prices
Complexity to emigrate
Connectivity to home country through flights
Contact with different cultures, development of personal and professional skills in multicultural environments
Distance / travel time / ease of movement to my home country
Education prices, possible savings considering the average salary
Family
Have children here
Home country presence, absence/presence of friends and/or family, ease to travel to home country, ease in legalizing myself as a citizen
Job demand based on my course/studies
Job offers in my area of study
Labor Costs and their conditions
Language spoken
Language, better job recognition
Language, childcare, citizenship process
Language, politics, distance from home country, visa requirements, acceptance toward emigration and gender equality
Percentage of expenses in relation to income
Political stability
Political stability, the existence of agreements with my home country
Proximity to Home Country, Primary Language
School system, working hours
Security, employment rates, accommodation, culture
Sometimes emigrants think about their child's future career
Speak the main or secondary language of that country
Transports quality
Working Hours

Table 3. Additional Emigration Factors from Open-Ended Question

Dashboard Necessity

As the following chart reveals, a significant portion of participants, around 73%, expressed challenges in obtaining trustworthy, organized, and integrated data to evaluate possible emigration destinations. This draws attention to significant problems that potential emigrants might face in the decision-making processes.

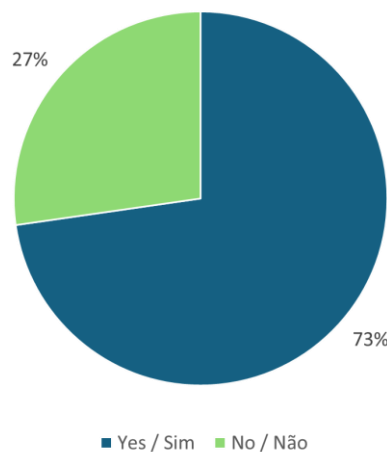


Figure 10. Responses of “Is it difficult to find reliable, consolidated and centralized information for comparing countries as potential emigration destinations”

Furthermore, 81% indicated that a dashboard that would allow them to compare factors across countries would be a valuable tool. Further, 90% considered a country-to-country cost-of-living comparison page to be particularly useful when making emigration decisions. In Figure 12 and 13 the results mentioned above are presented.

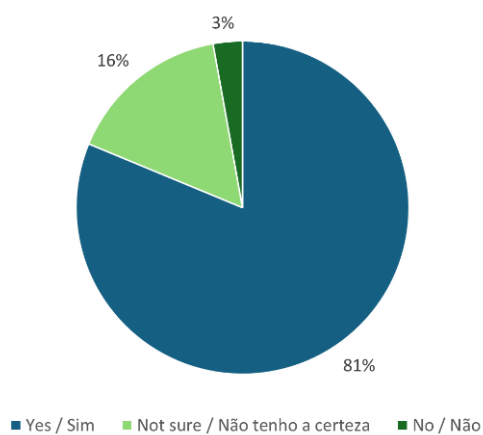


Figure 12. Responses on the positive influence would an interactive dashboard have on the emigration decision-making process

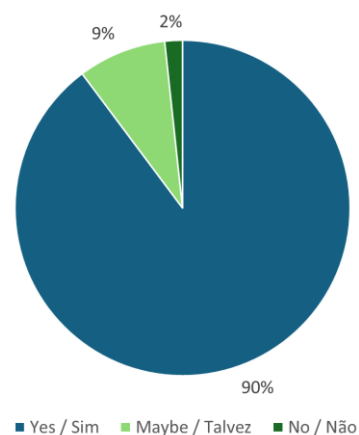


Figure 11. Responses on would a dashboard page comparing current income and expenses with the cost of living in another country help make better-informed decisions

When asked about preferred dashboard visuals, 65% of respondents preferred a combination of interactive maps, trend graphs, and comparison tables. 23% favoured comparative tables, 18% preferred interactive maps, and only 5% preferred trend graphs, as presented in Figure 13. In this question it was possible to select more than one option, for

example, there were people that had selected side by side comparison table and interactive map.

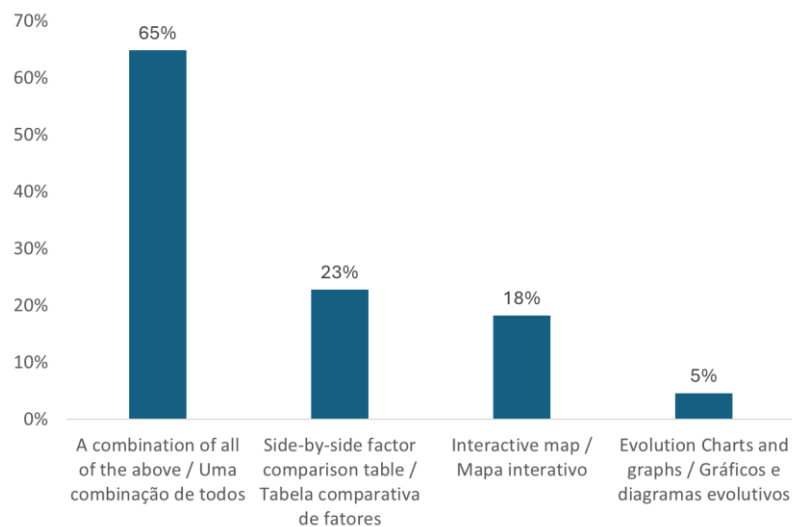


Figure 13. Preferred formats comparing countries on the dashboard

Finally, regarding the overall usefulness of a tool such as the proposed dashboard, Figure 14 shows that 80% of respondents indicated that they would find it very or extremely useful, while only 2% perceived it as having little or no usefulness.

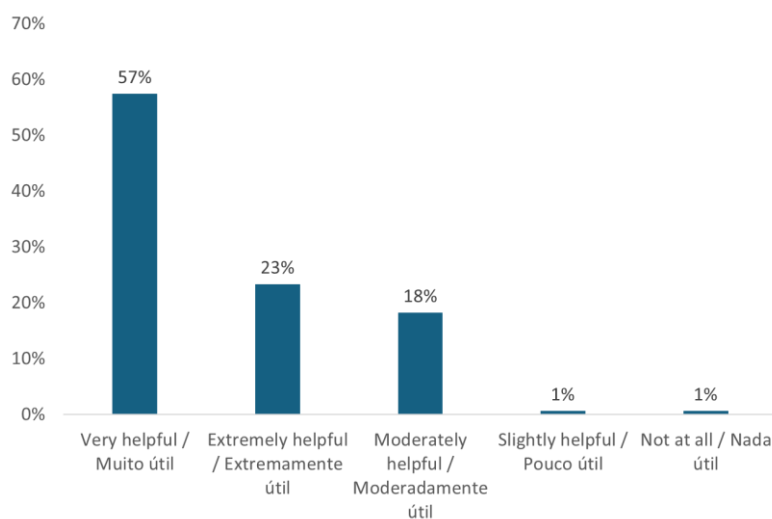


Figure 14. Helpfulness of an interactive dashboard for current situation and other countries comparison

4.2. FINAL DASHBOARD

The final dashboard includes key factors found in the literature review and in the survey responses. It also includes some of the suggestions gathered in the survey as they revealed to be relevant on the decision-making process of emigration.

The dashboard is structured into six core pages, each planned to support users in different stages of their evaluation and planning process. These pages include:

- Countries List
- Metrics Descriptions
- Country Analyser
- Country Comparison
- Country Expenses Comparison
- Expense Calculator

In this topic each page will be detailed individually.

Countries List

As demonstrated in Figure 15, this page is composed by a list, a map and one slicer. In the left side of this page, there is a list with the complete catalogue of countries that can be analysed in this tool, being all of them European Countries. On the right side, there is a map where each country is represented by a bubble and the slicer is in the above section, where the user can choose the metric desired to analyse.

The bubble size will vary according to the selected metric. Additionally, by hovering the bubbles on the map, a detail of each country will appear as shown in Figure 16.



Figure 15. Countries List Page

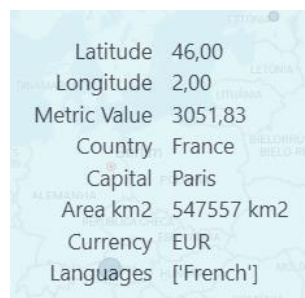


Figure 16. Bubble detailed information example

In addition, the list on the left side of the page allows the user to select specific countries by clicking on their names and they will be displayed on the map, so the user can see each bubble regarding the metric selected, as shown in the figure below.

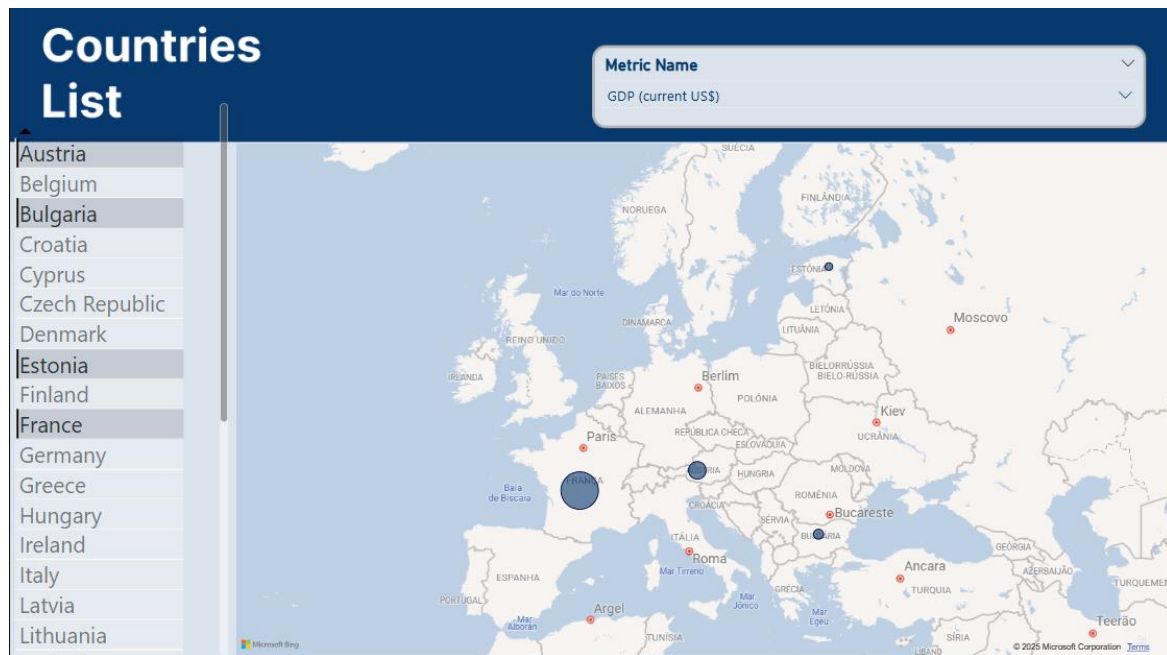


Figure 17. Countries List selection example

Metrics Description

The metrics detail page, shown in Figure 18, includes the complete list of metrics in the dashboard, including a detailed description of each metric. This page is relevant as it helps users truly understand what metrics are being used for the comparison between countries.

Metrics Detail	
Indicator Name	Description
Water (1,5l)	Price of 1,5l bottle of water
Unemployment, total (% of total labor force) (national estimate)	Unemployment refers to the share of the labor force that is without work but available for and seeking employment. Definitions of labor force and unemployment differ by country.
Square Meter Value Outside Center	Price Per Square Meter to buy an Apartment In Center
Square Meter Value in Center	Price Per Square Meter to buy an Apartment Outside Center
Safety and Security	This metric measures the level of harmony or discord within a nation through the use of factors such as political instability, number of homicides and other relevant informations.
Rice (1kg)	Price of 1kg rice package at the supermarket
Private Preschool (or Kindergarten) Price	Private Preschool (or Kindergarten) Monthly Price for 1 Child
Potato (1kg)	Price of 1kg of potatoes at the supermarket
Population, total	Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. The values shown are midyear estimates.
One-way Ticket (Local Transport)	Average price for a one-way ticket
On Going Conflict	This measure uses statistical indicators, such as the number and duration of internal conflicts, number of deaths from external organised conflict and other relevant factors, to investigate the extent to which countries are involved in internal and external conflicts, as well as their role and duration of involvement in conflicts.
Net Salary	Average Monthly Net Salary
Net migration	Net migration is the net total of migrants during the period, that is, the number of immigrants minus the number of emigrants, including both citizens and noncitizens.

Figure 18. Metrics Detail Page

Country Analyser

The “Country Analyser” page, in Figure 19, allows users to do a complete analysis of a chosen country. At the top of the page, the user can filter both the year, the country and the group of metrics to analyse. The left side of the page contains general information about the selected country such as the country name, the used currency, the population in the selected year and other relevant information. At the centre of the page, is displayed two-line charts. These line-charts enables the user to understand the evolution of the selected metrics throughout the years. It is divided in two charts for a better understanding the results of each Group selected for analysis. A group is a combination of different metrics, as for example, in the figure 19, the group 2 chosen, which was “Safety”, displays results of “militarisation”, “on going conflict” and “safety and security”.



Figure 19. Country Analyser Page

Country Comparison

The country comparison page grants the users the possibility to compare a set of selected metrics from two countries. At the top of the page, users can choose the year, the metrics and the two countries to be compared. The bottom of the page includes two tables with the metrics values for the chosen countries. At the left, there are the metrics from the “Country 1” and at the right the metrics from the “Country 2”. An example of a possible comparison between countries is presented in Figure 20.



Figure 20. Country Comparison

Country Expense Comparison

The Country Expense Comparison page allows users to compare the average income and key living expenses, such as food, transport, and other costs, for up to three countries of their choice. It also calculates the potential monthly savings (or deficit) based on the selected country, household size and housing type.



Figure 21. Country Expense Comparison Example

Expenses Calculator

The Expense Calculator page was created to facilitate a comparative analysis between a user's current financial situation and the average cost of living in a selected destination country. It allows users to input their personal financial data by including salary, food expenses, transport costs, and other expenditures but also compare these values against national averages for the filtered location. Furthermore, a button could be used in the “Desired Country Information” to enable the user to select his expected salary on the destination, when using this option the visuals automatically update according to the value selected.

Just like the previous page, to enhance the accuracy of the analysis, number of household members and type of rental housing were considered as filters. These parameters ensure that the cost estimates are appropriately contextualized to reflect the user's living circumstances.

On the right side of the interface, a bar chart shows the variation in the income and in the four expense categories, providing a visual representation of potential financial gains or losses resulting from relocation to the selected country. Additionally, a summary indicator labelled “Total Savings” displays the overall net difference between the user current situation vs the expected situation after emigrating, offering a clear and concise evaluation of whether the move out of the current country would result in greater financial efficiency or increased costs. An example of a practical use of this page is revealed in Figure 22.

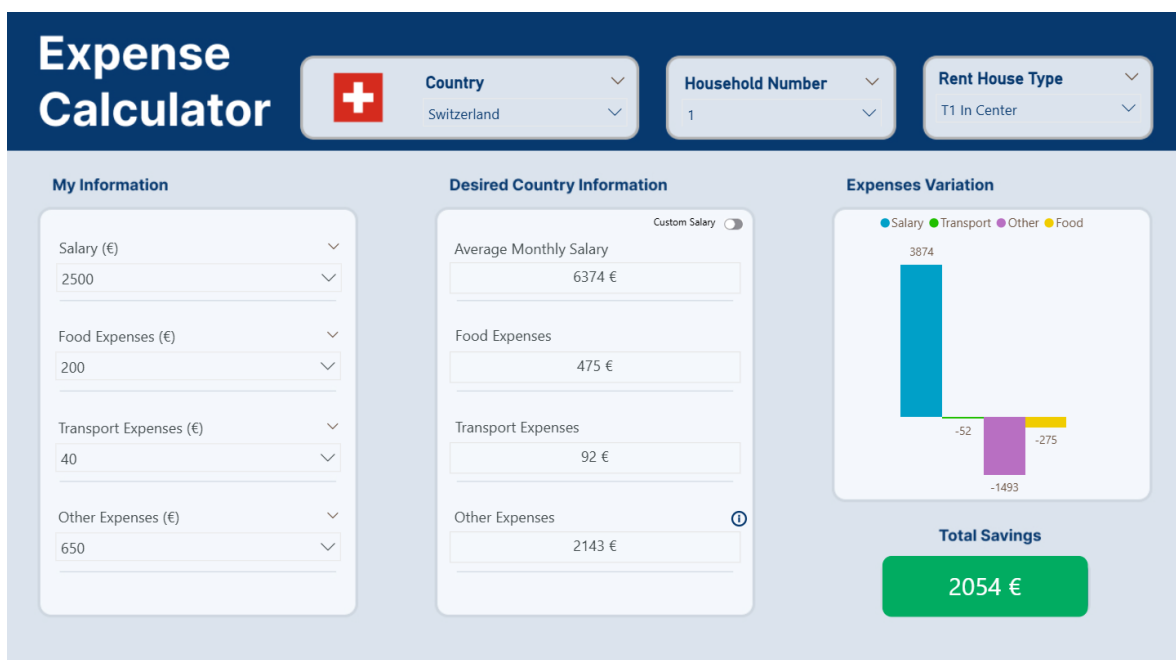


Figure 22. Expense Calculator Example

DEPLOYMENT

For the purpose of this project, this final step of the methodology was not fully carried out, as the developed dashboard is currently accessible only within my personal environment. This

restriction occurs due to licensing constraints, which restricts broader sharing with other users without incurring in added costs.

Since this tool is part of a master's final thesis, the lack of full deployment is not considered critical. Yet, to expand the project and fulfill its main objective which is supporting individuals in making knowledgeable decisions when considering moving abroad, it would be essential to proceed with deployment and assume the associated costs. This necessity currently represents one of the project's main limitations.

To move forward with the deployment, the first step, considering an upgraded license, would include publishing the dashboard to the Power BI Service, allowing online accessibility. Further, and assuming an optimal solution, this dashboard should be published on a public website to make it accessible to everyone who could benefit from this kind of tool.

Finally, creating a user guide that explains each page and features of the dashboard would be a significant step, as this documentation would help users comprehend how to navigate the interface and make the most of the insights provided.

5. CONCLUSIONS

This project aimed to develop a Business Intelligence (BI) tool to support individuals in the decision-making process of potential emigration.

To fully accomplish the objective of this project, a complete literature review was initially performed, which facilitated the understanding of the evolution of emigration interest and activity in recent years, specifically across Europe. This review also made it possible to identify the key factors that impact those who are considering emigration. However, the existing academic literature proved to be to some extent limited, as most of the factors discussed were broad and conceptual, lacking the specificity needed to be converted into measurable indicators.

In addition, the literature review emphasized the significance of delivering trustworthy and up-to-date information during the migration process. It also uncovered a significant gap in the accessibility of public BI solutions and dashboards that could help individuals in making well-informed emigration decisions. This absence impacts the difficulty and ambiguity around emigration. Ultimately, it also assisted to clarify how BI concepts and methodologies could be used during the project to shape the development of the final dashboard.

To complement and improve the findings from the literature available, a survey was conducted to determine which measurable factors were most significant from the perspective of potential or former emigrants. This survey not only proved the importance of specific pre-identified factors but also facilitated the collection of additional factors directly mentioned by participants. These insights were vital to confirming that the tool would be truly user oriented. Furthermore, the survey assessed the perceived value of such tool as the developed dashboard, with 80% of participants expressing that it would be very or extremely useful in the circumstances of an emigration decision.

During the project, a CRISP-DM methodology was followed to guide the development process. This framework was adjusted to align with the certain characteristics of Business Intelligence, with a strong focus on data visualization to guarantee clear and effective user experience.

This project's dashboard displays data through a combination of graphs, comparison tables, and an interactive map, in a structure that is visually intuitive, consistent, and based on relevant data. This tool was developed to be accessible and user-friendly, so that any user can explore and analyse the data autonomously, enabling a more knowledgeable and confident emigration decision.

The technical development of the dashboard included several steps and tools. Microsoft Excel was used for the initial storage of raw data and after the structured data. Data cleaning and preparation was carried out on Jupyter Notebooks, resulting in three excel files ready to be

imported. Ultimately, Power BI Desktop was used to build the dashboard by merging visuals and metrics in an organised and interactive way.

In summary, the objectives that guided the development of this dashboard, specifically, identifying the most influential factors when selecting a country to emigrate to, and evaluating the relevance of an interactive and intuitive tool, such as a dashboard, to support this choice, were successfully addressed during the development of the project. The combination of insights from the literature review with the practical data obtained through the survey made it possible to create a solution that is aligned with the real needs of potential migrants. By making this tool accessible, it is expected that the emigration decision-making process will become clearer, more informed, and more accessible for individuals who are either considering or actively planning to emigrate, ultimately, being this the core purpose of the project.

6. LIMITATIONS AND FUTURE WORK

6.1. LIMITATIONS

Throughout the development of this project, various limitations were met.

One primary challenge was finding the most relevant factors in the decision to move abroad. The literature review mainly emphasized broad concepts that were challenging to adapt into tangible indicators. To mitigate this problem, a survey was performed to acquire more targeted data and confirm which factors were identified as significant by individuals contemplating emigration. Nevertheless, this method presented its own limitations, most notably the relatively small sample size, which may not be completely representative of a broader population. The fact that most participants were Portuguese may have introduced cultural bias, limiting the generalizability of the findings.

Another substantial limitation is concern to data availability and consistency. Trustworthy, complete, and up-to-date data were only available for the selected countries up to 2023. While more recent data is already available for some metrics, a decision was made to standardize all indicators to the 2023 reference year to guarantee comparability. Additionally, the data collection process was conducted manually through Excel downloads, since most APIs were either inaccessible or needed a paid subscription. For example, Numbeo, a source used in this project, moved to a paid model shortly after the initial data extraction. This change may present challenges for preserving the dashboard with up-to-date information in the future, especially for corporations or public organizations that desire to use this tool. In such cases, the costs related with data access and automation would need to be contemplated.

Furthermore, the combination of grouped indicators with different units and scales was also a limitation. For example, the “Climate” metric combines average annual temperature (Celsius Degrees) and precipitation (millimetres in depth per year), and in some cases, users may find it challenging to understand since it has a mixed-scale data, potentially reducing the clarity and effectiveness of the dashboard’s visuals.

Lastly, the current deployment of the dashboard is restricted to my private Power BI workspace. This means access must be manually granted by me, which significantly limits the tool’s public availability. For wider use, future iterations of this tool should consider deploying the dashboard to an open platform, for instance a cloud-based Power BI service or institutional website.

6.2. FUTURE WORK

Considering the limitations described above and including user feedback from the survey, some recommendations for future development can be considered.

As mentioned previously, the data was collected manually, and its quality had some limitations as it only included information up to the end of 2023. Considering this, one possible improvement for the future would be to build a data pipeline that automatically pulls the latest data from the sources and updates the dashboard regularly.

Currently, the dashboard presents metrics aggregated at the country level. However, this kind of view may not fully reflect reality, as there are areas/regions within each country where the values can differ significantly from the national average. Therefore, a possible future improvement would be to add a more detailed level of granularity, such as city-level data, to provide a more accurate analysis.

Regarding the metrics and filters included, there is always capacity to include new factors and new filters for comparing countries, as many other aspects can influence the decision of someone considering emigration. Throughout the survey, many additional factors were mentioned and could be added in the future, since, at the moment of the elaboration of this project, some of these were either not available for all the countries for the period used for the construction of the dashboard or required paid solutions to extract the data. One possible future factor to add is “the average salary by profession” that could be extracted from sources such as Glassdoor, for example.

One of the main limitations of this project is the difficulty in sharing it with its final users. For future work, it would be really valuable to find partnerships with companies or organizations that could feature the dashboard on their websites, helping it reach people who truly need this kind of tool.

In sum, these are some key instructions for future work that could be carried out from this point onward, yet there remains significant potential for further enhancement this project.

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S0740624X18300303/main.pdf?X-Amz-Security-Token=IQoJb3JpZ2luX2VjEjF%2F%2F%2F%2F%2F%2F%2F%2F%2F%2FwEaCXVzLWVhc
3QtMSJIMEYCIQCCWoE%2BdQr4vMucnqoUxdb9O7lcP11XS1tMgz%2FjqJpOAlhANQ
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8. APPENDIX

Measure Name	Expression
MySavings	<pre> VAR salary = CONVERT(SELECTEDVALUE(Salary[Value]), INTEGER) VAR food = CONVERT(SELECTEDVALUE(Food[Value]), INTEGER) VAR expenses = CONVERT(SELECTEDVALUE(MonthlyExpenses[Value]), INTEGER) VAR transport = CONVERT(SELECTEDVALUE(Transportation[Value]), INTEGER) return CALCULATE(salary - food - expenses - transport) </pre>
Food	<pre> var one_egg = CALCULATE(CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "12 eggs (€)") / 12) var beef_portion = CALCULATE(CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Beef (1kg) (€)") * 0.3) var chicken_portion = CALCULATE(CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Chicken Fillets (1kg) (€)") * 0.3) var one_banana = CALCULATE(CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Banana (1kg) (€)") / 5) var one_bread_slice = CALCULATE(CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Loaf of Fresh White Bread (500g) (€)") / 10) var portion_milk = CALCULATE(CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Milk (1l) (€)") * 0.25) var portion_potato = CALCULATE(CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Potato (1kg) (€)") * 0.2) var portion_rice = CALCULATE(CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Rice (1kg) (€)") * 0.2) var water_bottle = CALCULATE(CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Water (1,5l) (€)") * 1) var lunch = beef_portion + portion_potato + one_bread_slice + one_banana + one_egg var dinner = chicken_portion + portion_rice + one_banana + one_egg var breakfast = portion_milk + one_banana + (one_egg * 2) + one_bread_slice var snack = one_banana + one_egg + (one_bread_slice * 2) var month_days = 30 </pre>

	<pre> var year_days = 365 return (breakfast + lunch + snack + dinner + water_bottle) * month_days --CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Net Migration") </pre>
Salary	<pre> CALCULATE(CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Net Salary (€)" * 1) </pre>
Transports	<pre> CALCULATE(CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Monthly Transportation Pass (€)" * 1) </pre>
Other Expenses	<pre> var house_type = SELECTEDVALUE(HouseTypes[HouseType]) var house_type_dsc = IF(house_type = "T1 In Center", "Apartment Monthly Rent (t1) In Center (€)", IF(house_type = "T1 Outside Center", "Apartment Monthly Rent (t1) Outside Center (€)", IF(house_type = "T3 Outside Center", "Apartment Monthly Rent (t3) Outside Center (€)", "Apartment Monthly Rent (t3) In Center (€)"))) var household = SELECTEDVALUE(Household[Household Number]) var house_expenses = CALCULATE(CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Monthly House Expenses (€)" * 1) var house_rent = CALCULATE(CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = house_type_dsc) * 1) return (house_expenses + house_rent) / household </pre>
ExpectedSavings	<pre> FORMAT([Salary] - ([Food] + [Transports] + [Other Expenses]), "0") & " €" </pre>
GainsOrLosses	<pre> CALCULATE([ExpectedSavings] - [MySavings]) </pre>
Salary Difference	<pre> VAR mysalary = CONVERT(SELECTEDVALUE(Salary[Value]), INTEGER) return [Salary] - mysalary </pre>
Food Expenses Difference	<pre> VAR myfood = CONVERT(SELECTEDVALUE(Food[Value]), INTEGER) return IF([Food] >= myfood, myfood - [Food], myfood - [Food]) </pre>
Transport Expenses Difference	<pre> VAR mytransport = CONVERT(SELECTEDVALUE(Transportation[Value]), INTEGER) return </pre>

	IF([Transports] >= mytransport, mytransport - [Transports], mytransport - [Transports])
Other Expenses Difference	VAR myexpenses = CONVERT(SELECTEDVALUE(MonthlyExpenses[Value]), INTEGER) return IF([Other Expenses] >= myexpenses, myexpenses - [Other Expenses], myexpenses - [Other Expenses])
Color	IF([GainsOrLosses] >= 0, "#01AC61", "#D04141")
Area km2	VAR max_value = FORMAT(MAX('DIM_COUNTRY'[Area]), "0") & " km2" return max_value
Population M	VAR max_value = FORMAT(MAX('FACT_METRICS'[Value]), "0.00") & " Million" return max_value
GDP Billion	VAR max_value = FORMAT(MAX('FACT_METRICS'[Value]), "0") & " Billion (US\$)" return max_value
Income Eur	VAR max_value = FORMAT(MAX('FACT_METRICS'[Value]), "0") & " €" return max_value
Net Migration K	VAR max_value = FORMAT(MAX('FACT_METRICS'[Value]) / 1000, "0") & " Thousand" return max_value
ExpectedSavingsCustom	var custom_salary = CONVERT(SELECTEDVALUE(ExpectedSalary[Value]), INTEGER) return custom_salary - ([Food] + [Transports] + [Other Expenses])
GainsOrLossesCustom	CALCULATE([ExpectedSavingsCustom] - [MySavings])
Salary Difference Custom	VAR mysalary = CONVERT(SELECTEDVALUE(Salary[Value]), INTEGER) VAR expected_salary = CONVERT(SELECTEDVALUE(ExpectedSalary[Value]), INTEGER) return expected_salary - mysalary
ColorCustom	IF([GainsOrLossesCustom] >= 0, "#01AC61", "#D04141")
Salary €	FORMAT([Salary], "0") & " €"
Food €	FORMAT([Food], "0") & " €"
Transports €	FORMAT([Transports], "0") & " €"
Other Expenses €	FORMAT([Other Expenses], "0") & " €"
GainsOrLosses €	FORMAT(CALCULATE([ExpectedSavings] - [MySavings]), "0") & " €"

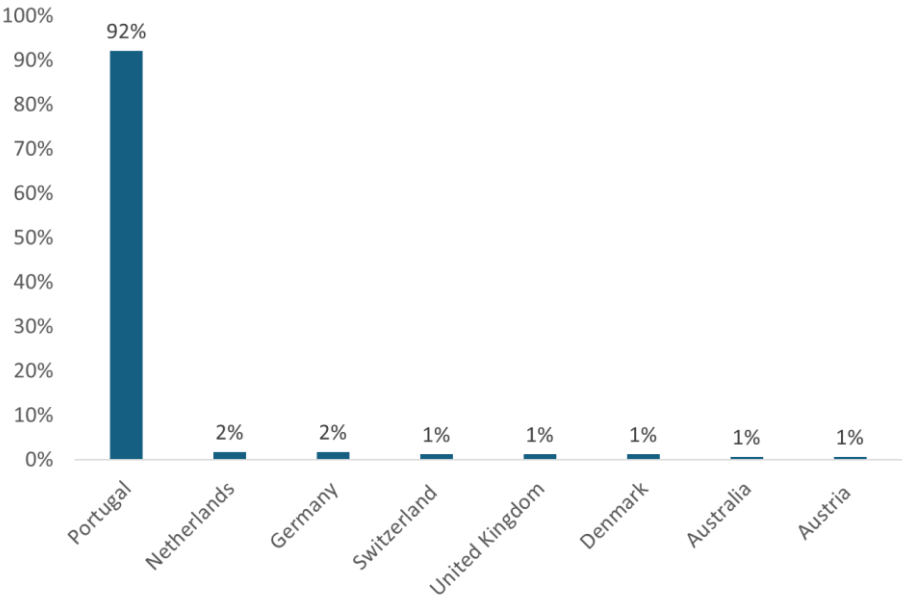
GainsOrLossesCustom €	FORMAT([GainsOrLossesCustom], "0") & " €"
Most Recent Value	<pre> VAR MaxYear = CALCULATE(MAX('FACT_METRICS'[Year]), ALLEXCEPT('FACT_METRICS', 'FACT_METRICS'[Metric])) RETURN CALCULATE(MAX('FACT_METRICS'[Value]), 'FACT_METRICS'[Year] = MaxYear) </pre>
Eggs	<pre> VAR MaxYear = CALCULATE(MAX(FACT_METRICS[Year]), FACT_METRICS[Metric] = "12 eggs (€)") RETURN CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "12 eggs (€)", FACT_METRICS[Year] = MaxYear) </pre>
Beef	<pre> VAR MaxYear = CALCULATE(MAX(FACT_METRICS[Year]), FACT_METRICS[Metric] = "Beef (1kg) (€)") RETURN CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Beef (1kg) (€)", FACT_METRICS[Year] = MaxYear) </pre>
Chicken	<pre> VAR MaxYear = CALCULATE(MAX(FACT_METRICS[Year]), FACT_METRICS[Metric] = "Chicken Fillets (1kg) (€)") RETURN CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Chicken Fillets (1kg) (€)", FACT_METRICS[Year] = MaxYear) </pre>

Banana	<pre> VAR MaxYear = CALCULATE(MAX(FACT_METRICS[Year]), FACT_METRICS[Metric] = "Banana (1kg) (€)") RETURN CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Banana (1kg) (€)", FACT_METRICS[Year] = MaxYear) </pre>
Bread	<pre> VAR MaxYear = CALCULATE(MAX(FACT_METRICS[Year]), FACT_METRICS[Metric] = "Loaf of Fresh White Bread (500g) (€)") RETURN CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Loaf of Fresh White Bread (500g) (€)", FACT_METRICS[Year] = MaxYear) </pre>
Milk	<pre> VAR MaxYear = CALCULATE(MAX(FACT_METRICS[Year]), FACT_METRICS[Metric] = "Milk (1l) (€)") RETURN CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Milk (1l) (€)", FACT_METRICS[Year] = MaxYear) </pre>
Potato	<pre> VAR MaxYear = CALCULATE(MAX(FACT_METRICS[Year]), FACT_METRICS[Metric] = "Potato (1kg) (€)") RETURN CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Potato (1kg) (€)", FACT_METRICS[Year] = MaxYear) </pre>

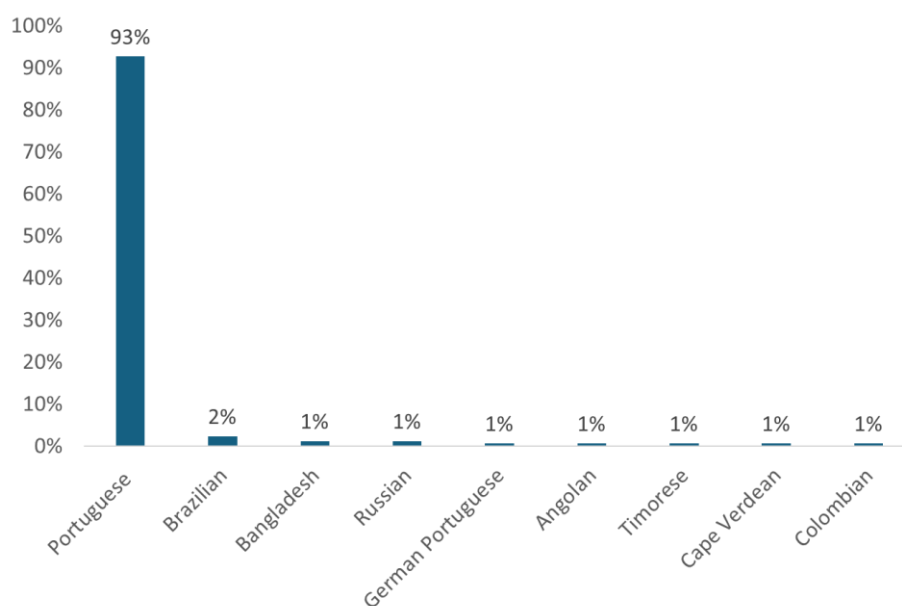
Rice	<pre> VAR MaxYear = CALCULATE(MAX(FACT_METRICS[Year]), FACT_METRICS[Metric] = "Rice (1kg) (€)") RETURN CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Rice (1kg) (€)", FACT_METRICS[Year] = MaxYear) </pre>
Water	<pre> VAR MaxYear = CALCULATE(MAX(FACT_METRICS[Year]), FACT_METRICS[Metric] = "Water (1,5l) (€)") RETURN CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Water (1,5l) (€)", FACT_METRICS[Year] = MaxYear) </pre>
Monthly House Expenses	<pre> VAR MaxYear = CALCULATE(MAX(FACT_METRICS[Year]), FACT_METRICS[Metric] = "Monthly House Expenses (€)") RETURN CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = "Monthly House Expenses (€)", FACT_METRICS[Year] = MaxYear) </pre>

Rent Prices	<pre> var house_type = SELECTEDVALUE(HouseTypes[HouseType]) var house_type_dsc = IF(house_type = "T1 In Center", "Apartment Monthly Rent (t1) In Center (€)", IF(house_type = "T1 Outside Center", "Apartment Monthly Rent (t1) Outside Center (€)", IF(house_type = "T3 Outside Center", "Apartment Monthly Rent (t3) Outside Center (€)", "Apartment Monthly Rent (t3) In Center (€)"))) VAR MaxYear = CALCULATE(MAX(FACT_METRICS[Year]), FACT_METRICS[Metric] = house_type_dsc) RETURN CALCULATE(AVERAGE(FACT_METRICS[Value]), FACT_METRICS[Metric] = house_type_dsc, FACT_METRICS[Year] = MaxYear) </pre>
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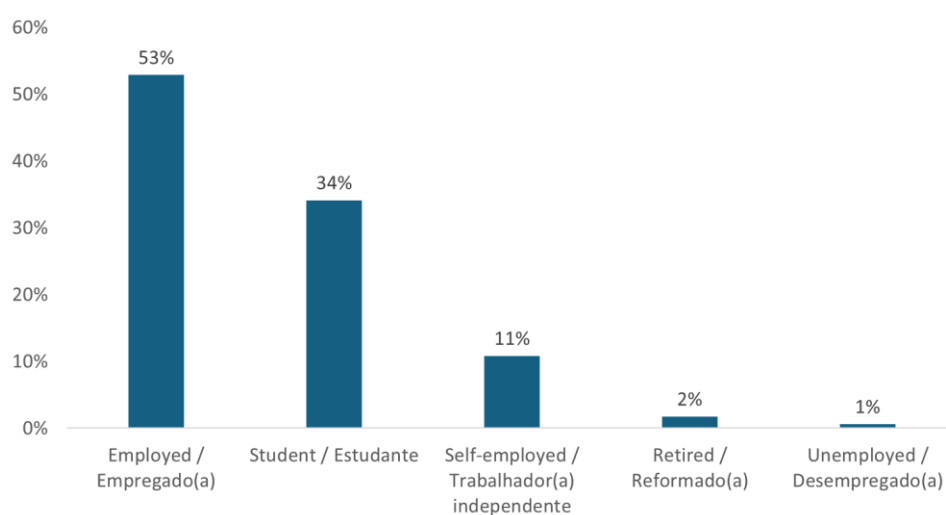
Appendix 1. Measures Table



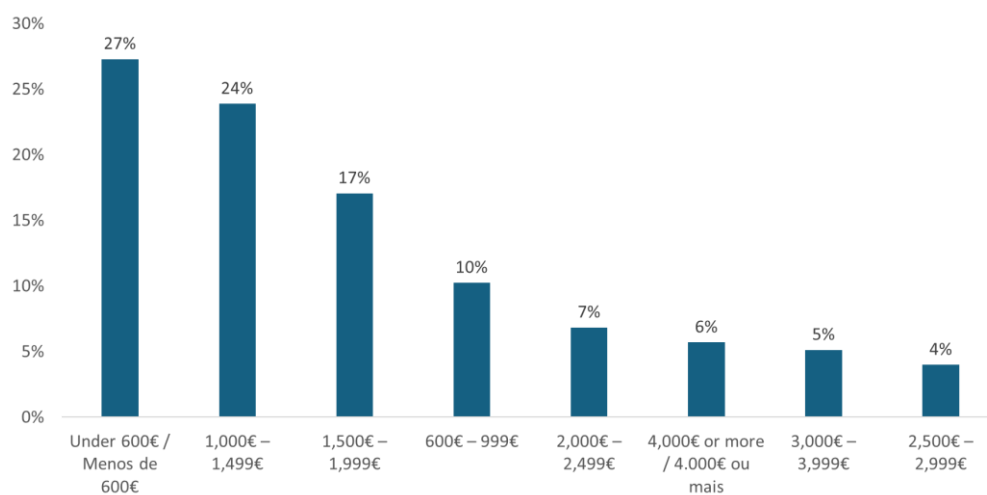
Appendix 2. Current Country of Residence



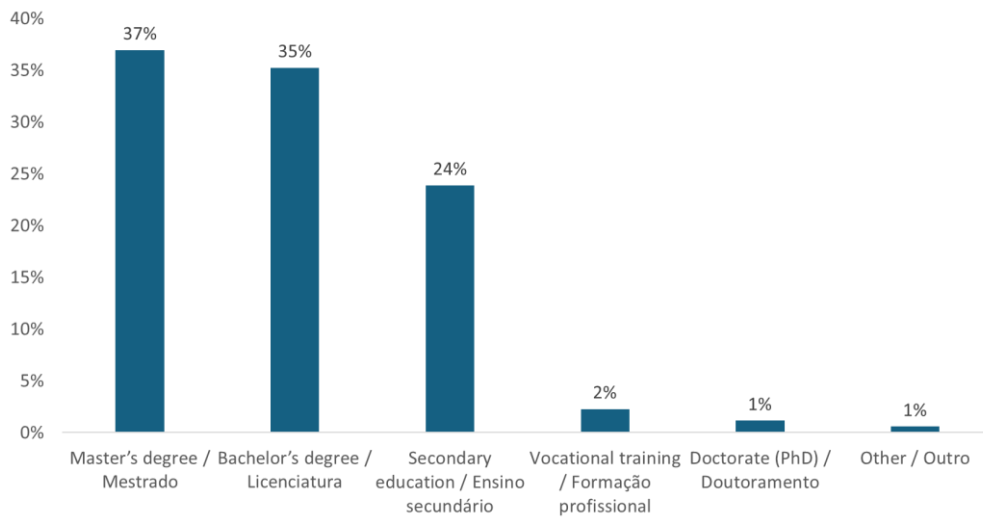
Appendix 3. Participants' Nationality



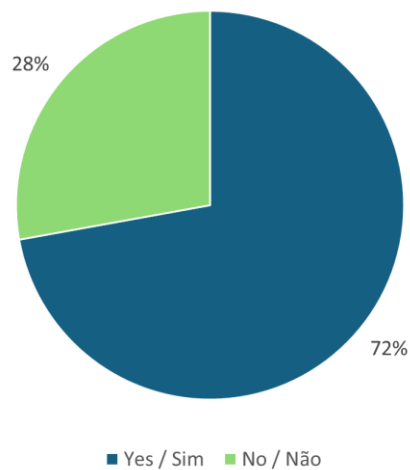
Appendix 4. Current Activity Status



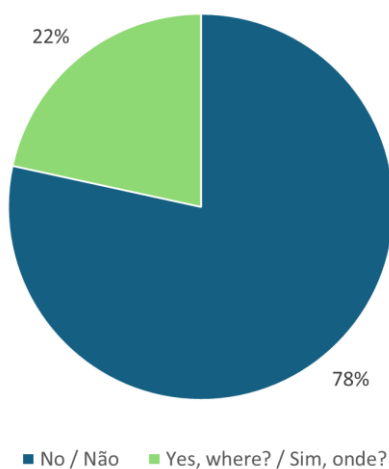
Appendix 5. Monthly Salary Range Distribution



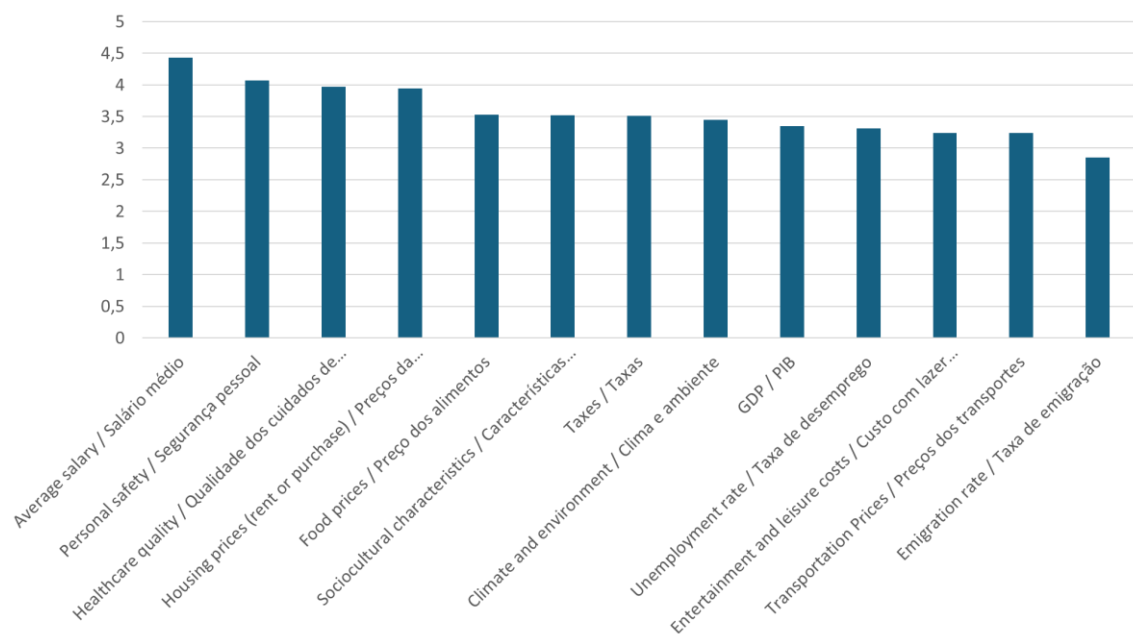
Appendix 6. Highest Level of Education Completed



Appendix 7. Responses on "Have you ever considered emigrating to another country?"



Appendix 8. Responses on "Are / were you an emigrant?"



Appendix 9. Classification of key factors in the decision-making process of emigration.

