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Business Intelligence Solution to Analyze Angola's Foreign Trade

Data Driven Insights into Angola's Trade (2021-2023)

Faustino Francisco Quindala

Master Thesis

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

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

Universidade Nova de Lisboa

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By:

Faustino Francisco Quindala

Master Thesis presented as a partial requirement for obtaining master's degree in information management, with specialization in knowledge management and business intelligence.

Supervised by

Bruno Jardim, PhD, NOVA Information Management School

July, 2024

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.

Faustino Francisco Quindala

Lisbon, July 15, 2024.

DEDICATION

*Dedico este trabalho à mim / I dedicate this research to myself: **Faustino Francisco Quindala**.*

*Pelo meu esforço, dedicação e perseverança. Posso apenas dizer que não foi fácil, principalmente conciliar entre o trabalho, mestrado e ainda sim ter finalizado no período regular, porém, a vontade de vencer gritou
mais alto*

For my effort, dedication, and perseverance. I can only say that it wasn't easy, especially balancing work, master's degree and still finishing in the regular period, however, the desire to win screamed louder.

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"Há dois anos, vinha para Portugal com o sonho, ser Mestre na área de dados, especificamente em Business Intelligence, e terminar a formação dentro do período regular (2 anos) e feliz pude concretizar este objectivo, com bastante esforço e dedicação. Contudo, não consegui alcançá-lo sozinho, são muitas as pessoas que contribuíram tornar este sonho realidade e por isso quero agradecer:

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ABSTRACT

Every country has always been dependent on every other nation in the international arena. Every nation needs to rely on other nations to some extent even after reaching the pinnacle of development to pursue its own goals. Foreign trade refers to the exchange of products and services between two countries on the global market. It contributes to the availability of raw materials/finished products in countries where they are either scarce or unavailable. This study aims to develop a business intelligence solution to analyze Angola's import and export database between 2021 and 2023, focusing on both import and export aspects. The research will include various data sources such as Excel files from those years published annually by Angola's Finance Minister to provide insight into the country's trade performance and identify potential areas for improvement. The proposed BI Solution will involve data collection, data cleaning, and data analysis using the visualization tool Microsoft Power BI. The goal of the present study is as well explore Angola's foreign trade focusing on the growth of export and import volumes, and the trade balance, and identify the main trading partners for Angola in that specific period highlighting their contribution. In that context, the impact of Angola's foreign trade on its economic growth and development will also depends on its connection with other country.

KEYWORDS

Business Intelligence; Foreign Trade Solution; Import; Export; Angola; Database

Sustainable Development Goals (SDG): <https://sdgs.un.org/goals>

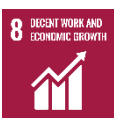


TABLE OF CONTENTS

1. Introduction.....	9
2. Literature review	11
2.1. Overview of BI and its popularity among organizations.....	11
2.2. Benefits of using Business Intelligence within the organization.....	11
2.3. Applying BI on foreign trade development.....	12
2.3.1. Business Intelligence Solution.....	12
2.3.2. Decision Making	13
2.3.3. Data Analytics.....	13
2.3.4. Key Performance Indicators (KPI)	14
2.3.5. Reporting.....	14
2.4. Related Work.....	15
2.4.1. Foreign Trade in Angola	15
2.4.2. Works of BI in Foreign Trade.....	15
2.5. Conclusions and Gaps of literature	17
3. Data & Methodology.....	18
3.1. Kimball Lifecycle Methodology	18
3.1.1. Business Requirements Definition	19
3.1.2. Data Understanding	19
3.1.3. Data Track	20
3.1.4. Dimensional modeling.....	20
3.1.5. Physical Design	23
3.1.6. ETL Design & Development.....	24
4. RESULTS & DISCUSSION	25
4.1. Reporting developments.....	25
4.1.1. Import analysis dashboard.....	25
4.1.2. Export analysis dashboard	26
4.1.3. Product analysis dashboard	27
4.2. Discussion.....	28
5. conclusions, LIMITATIONS AND future works.....	30
5.1. Conclusions.....	30
5.2. Limitations and Future works	30
Bibliographical References.....	31

LIST OF FIGURES

Figure 1: Conceptual BI Framework.....	13
Figure 2: Kimball Lifecycle Diagram	18
Figure 3: Star Schema	20
Figure 4: Physical design	23
Figure 5: ETL Design	24
Figure 6: Deleting duplicated records.....	24
Figure 7: Load Dimensions and fact tables.....	24
Figure 8: Import analysis dashboard.....	25
Figure 9: Export analysis dashboard	26
Figure 10: Product analysis dashboard	27

LIST OF TABLES

Table 1: Data Understandig 19

Table 2: Metrics and its analysis 22

Table 3: Dimensions tables 22

Table 4: Fact tables 23

Table 5: Business needs and their answers 29

LIST OF ABBREVIATIONS AND ACRONYMS

BI	Business Intelligence
BIS	Business Intelligence Solution
IBM	International Business Machine
KPI	Key Performance Indicator
U. S	United States
OLAP	Online Analytical Processing
IDSSDM	Intelligent Decision Support System based on Data Mining
INE	Institute of Statistics
DW	Data Warehouse
GPD	Gross Domestic product
ETL	Extraction Transformation and Load
AGT	Administration General Tax of Angola

1. INTRODUCTION

1.1 Motivation

In generally, organizations currently have difficulty in assessing a wide range of useful information due to large data quantities and complexity (Abusweilem & Abualoush, 2019). Business intelligence solutions allow organizations to access, analyze, and share information and knowledge, which helps them, and other people measure, understand, and manage their business to improve overall performance. In particular, the analysis of Angola's foreign trade database will help to interpret it and discover patterns to which solutions can be applied that will benefit the ministry responsible for this sector, based on the knowledge generated in this proposed solution. Since data is made public without any information, this project particularly proposes the analysis of this database with a focus on insights and the discovery of patterns.

1.2 Foreign Trade

Foreign trade is defined as trade beyond borders with the rest of the world. It has been contended that it plays an important role in encouraging economic growth and productivity, and the discussion has been ongoing for several decades. Historical validation has proven that internationally active countries are more productive than those that simply produce for the home market. As a result of liberalization and globalization, a country's economy has grown significantly more intimately tied with external characteristics such as openness (Kehinde et al., 2012).

Objectives and Methodology

The lack of academic literature on this topic represents a critical research gap, given the potential impact of trade analysis on economic strategies and policymaking (Mahmood et al., 2020).

This research aims in general terms:

- ✓ Undertesting the patterns of Angola's foreign trade data and turn the analysis public to inform citizens.
- ✓ Explore KPIs that can help compare Angola with other countries.
- ✓ Create a template for other researchers to follow in their analysis of other countries.

Moreover, uncovering valuable insights into import-export dynamics and market trends, focusing on the following business needs:

1. Which products are exported most?
2. Which are the countries that Angola have imported most from?
3. What seasons in months of the year does Angola import the most products?
4. What are the products that Angola imports and exports most?
5. Do we have more imported or exported products?
6. Which country had the most revenue and during which period?
7. In which periods of the year should we export best?
8. To which countries should we increase exports?
9. What percentage of products do you import and export annually and monthly?
10. Which countries will be able to import more products in the coming years analyzing the patterns among others.

The remaining portions of this thesis provide a full explanation of each of the topics: **Background** outlines the key ideas and a survey of the relevant literature that serve as the project's foundation; **Related work**, we talk about previously completed projects with comparable scopes and case studies; **Data & Methodology** This section includes all the data that has been studied regarding Angola's foreign trade over the specified period. We also go over the primary processes that were taken to accomplish the project's overall goal, which included defining and assessing the metrics that were used to extract insights. **Results and Discussions** summarizes and talks about the project's experiments and outcomes; **Conclusions** provide an overview and a conclusion of the work that has been done during this research; and **Limitations and recommendations for future works** for upcoming projects are addressed.

2. LITERATURE REVIEW

2.1. OVERVIEW OF BI AND ITS POPULARITY AMONG ORGANIZATIONS

Business intelligence (BI) is a critical decision-making process that hinges on the integration and analysis of an organization's data assets. With information being recognized as a company's most valuable asset and a fundamental resource for its growth, BI plays an increasingly indispensable role across various types of firms (Tavera Romero et al., 2021). Regarding BI within organizations, many experts believe that failure to embrace BI in an organization is due to a misalignment between an organization's BI and its features and aims. A company that has made strides in its Business Intelligence (BI) implementation aims to ensure that its BI initiatives are aligned with its corporate objectives. Research on BI success often emphasizes the importance of aligning BI with business goals. However, there is limited understanding of the role that BI capabilities play in achieving this alignment. Various success stories in BI underscore the importance of utilizing BI with the appropriate skills and for the relevant purposes to drive BI progress. These instances emphasize the significance of leveraging BI capabilities effectively to achieve organizational objectives (Heang & Mohan, 2021).

2.2. BENEFITS OF USING BUSINESS INTELLIGENCE WITHIN THE ORGANIZATION

Benefits of Business Intelligence: Data vendors and users save time thanks to BI's more effective data delivery. When analyzing the significance of historical data, end users ask queries such as "What has happened?" This type of study generates tangible benefits, such as headcount reduction, that are easier to quantify; however, these benefits are often local in nature. Organizations evolve to ask questions like, "Why has this happened?" and even, "What will happen?" As business users evolve into undertaking analysis and prediction, the amount of benefits becomes more global in scope and difficult to quantify (Watson & Wixom, 2007). For example, the most developed applications of business intelligence may support a strategic choice to join a new market, shift a company's focus from product-centric to customer-centric, or assist in the introduction of a new product line.

Keys to BI Success: For BI to be useful on an enterprise scale, it must be pushed from the top. Senior management should have a vision for BI, give the necessary resources, and insist on data-driven decision making. The utilization of information and analytics is built into the organization's culture. *There is alignment between the business and BI strategies.* When there is alignment, BI can be a powerful enabler of business strategy, including new business models that bring about organizational transformation. *There is effective BI governance.* People, committees, and processes must be in place to manage and support BI. Governance addresses many important issues, including alignment, funding, project prioritization, project management, and data quality.

There is a strong decision to support data infrastructure. Data warehouses help solve perhaps the most common cause of BI failure—a lack of high-quality data. Users will not accept or rely on data they do not trust (Watson & Wixom, 2007).

Pervasive BI: Business Intelligence (BI) is increasingly widespread, reaching a larger user base and equipping them with the necessary insights to enhance their job performance. The availability of real-time data and user-friendly dashboards is pivotal in fostering information democracy, alongside other factors. Web-based systems enable data access from any location with an Internet connection. Event-based triggers are utilized to prompt alerts, like notifying the sales team when an item is out of stock, prompting suggestions for alternative items. BI is also integrated into business processes such as call center operations and campaign management applications, enhancing organizational performance, often in ways that seamlessly incorporate analytics for users (Watson & Wixom, 2007).

2.3. APPLYING BI ON FOREIGN TRADE DEVELOPMENT

Business intelligence (BI) application is crucial for comprehending the decision-making processes of small and medium-sized enterprises (SMEs) as they endeavor to expand globally. According to the State Administration of Foreign Exchange and Customs' 2020 ranking of the top 50,000 enterprises by total import and export value, the total import and export value was found to be at the median. Small firms (1-100 people) have nearly three times the penetration rate of big data business intelligence analysis for large enterprises (81% or more) (Bai et al. 2021). When applying Business Intelligence technologies to credit or non-credit businesses, it is necessary to collect a large amount of business data from enterprises or individuals, including structured data such as transaction flow, historical records and accounts, and the ins and outs of funds. Standardized data gathering is becoming increasingly vital, including social information, company registration information, credit information, and other traditional information resources that cannot be measured or stated (Bai et al., 2021).

2.3.1. Business Intelligence Solution

Business Intelligence Systems (BIS) can be defined as a comprehensive set of methods, processes, computer tools, and procedures designed to transform data into valuable information, accumulated experience into knowledge, and accumulated knowledge into actionable intelligence. These systems enable departments to make strategic, tactical, and operational decisions effectively. BIS serves the purpose of gathering data from both internal and external sources, aggregating information, identifying significant patterns within diverse datasets, and converting them into the essential knowledge required for making accurate and high-quality judgments (Abusweilem & Abualoush, 2019).

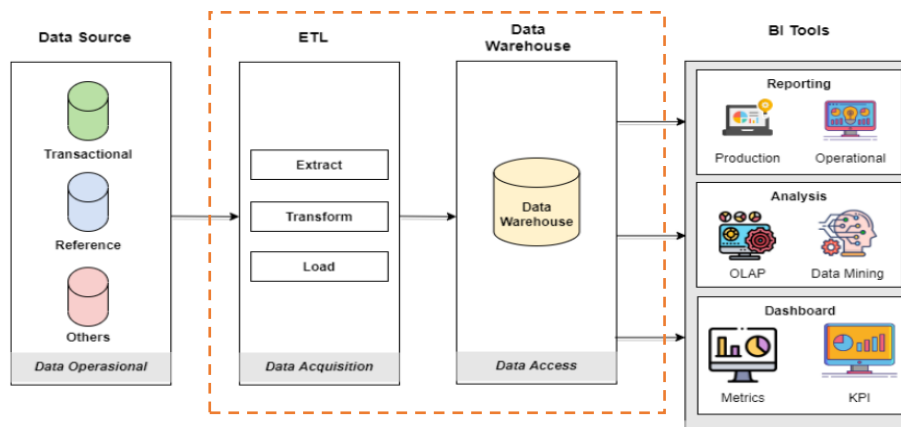


Figure 1: Conceptual BI Framework

Source: [https://www.researchgate.net/profile/Ghifari-](https://www.researchgate.net/profile/Ghifari-Munawar/publication/365071178/figure/fig1/AS:11431281094633410@1667524393203/Conceptual-BI-Framework.png)

[Munawar/publication/365071178/figure/fig1/AS:11431281094633410@1667524393203/Conceptual-BI-Framework.png](https://www.researchgate.net/profile/Ghifari-Munawar/publication/365071178/figure/fig1/AS:11431281094633410@1667524393203/Conceptual-BI-Framework.png)

Regarding figure 1 (Conceptual-BI-Framework, 2019) shown above is considered as BI traditional framework, this study will focus on data source and BI tool's part, as the part within the frame for this solution is not necessary, the most focus will be getting and explain insights from data visualization part.

2.3.2. Decision Making

The advancement of business intelligence (BI) has constituted the majority of worldwide business expenditures in the realm of information technology (Ransbotham & Kiron, 2017). It possesses an intricate systematic capability to gather and analyze data, transforming it into insights or knowledge about potential opportunities and risks, thereby offering intelligent solutions for corporate operations (Chen & Lin, 2021). Decision making, might be described as the concepts, tactics, procedures, and tools utilized to achieve a decision point and the context in which they are selected. (Helou et al., 2020).

2.3.3. Data Analytics

The significance of Data Analytics has experienced a considerable surge in recent years, both in its importance and its utilization across various business functions and applications. These applications encompass a wide range of areas such as market campaigns, fraud detection, credit assessment, defect identification in assembly lines, healthcare services, and more. Notably, the domain of analytics has expanded to encompass diverse fields including major league sports and even U.S. election campaigns (Arinze, 2023). Data Analytics constitutes a collection of transformative techniques, models, and technologies employing software to derive valuable, actionable insights from data, facilitating organizational decision-making. It spans from fundamental descriptive and diagnostic analytics, focusing on what occurred and why, to more intricate predictive and prescriptive analytics, which delve into forecasting what might happen and recommending optimal courses of action (Arinze, 2023).

2.3.4. Key Performance Indicators (KPI)

In the current competitive landscape, organizations have recognized that monitoring enterprise processes and factory operations is essential for enhancing efficiency, performance, and overall oversight.(Kaganski et al., 2017). Key Performance Indicators (KPIs) assist in defining and measuring organizational goals, which are critical to the success/sustainability of any business (Elias et al., 2013). KPIs are significant for businesses that want to build a performance management system based on quantifiable features of organizational activities (Asih et al., 2020).

Export and Import have been used in many studies to measure trade and to examine the impact of trade on income inequality. The total values of exports and imports to GDP are collected from the National Bank of Angola (BNA). The data for the Short-Term Debt Stock of GDP is obtained from World Bank Development Indicators (WDI). (Özcan, 2021).

To show the impact of the international trade on income inequality in Angola, Ozcan has employed two models. The first model is the relationship between the Gini with export and import values of Angola is analyzed. In the second model, other macroeconomic variables such as unemployment and total debt service along with export and import are added to the first model. The second model is used to assure the relationship between Gini and foreign trade variables. Base on that for this specific project we'll be using **Export and Import Amount** (3.1.3) as mains measures to analyze the patterns of trade's behavior through those years, in the context of project, otherwise in the trade field there are others many metrics to help better the decision makers even for other countries. Some were cited in the research called Angola by Africa gearing up: Population size, Population growth, GDP, GDP growth forecast, GDP per capita (US\$, 2012), Global competitiveness index, Corp Income Tax rate, Logistics Performance Index, Global Competitiveness Index, Infrastructure (Africa gearing up, 2023).

2.3.5. Reporting

Business intelligence (BI) reports heavily emphasize visual elements, with minimal text for explanations. Clients, such as company managers, prefer concise, one-page reports that offer an "at-a-glance view" of project status. This format accommodates the frequent review of numerous reports throughout the day (Elias et al., 2013). Power BI is software that transforms diverse data sources into interactive, coherent insights. It connects data sources like Excel spreadsheets or hybrid data warehouses, allowing users to easily visualize key information, uncover critical insights, and share findings with specific individuals or broader audiences (davidiseminger, 2024). For this project Power BI will be used in the data visualization and analytics part to help us to get insights and make analysis.

2.4. RELATED WORK

In this part, we go through several studies related to BI solutions around foreign trade (import and export). The main idea is to focus on their approaches, methodologies and applications, their main findings and results.

2.4.1. Foreign Trade in Angola

Angola demonstrates the evolution of export and import from 2000 to 2020 (Özcan, 2021). According to Yunus ÖZCAN (Özcan, 2021) after the civil war that covered all the national territory at the end of 2002 and the global crisis from 2008-2009, Angola could achieve positive and negative results, either in export and import or even in the trade balance. With exports reaching 71.873 billion USD in 2012, it was the highest level of export attained due to the fast recovery of the world from the crisis which reduces in mid-2010 due to the focus on the main product demands. Still, the trade balance registered a trade deficit, notwithstanding a decrease of 11.6% from 2012 to 2013 because of the increase in imports and reduced export.

Yunus ÖZCAN was deeper in his research *Impact of Trade Flows on Income Distribution in Angola* by saying that the exports depreciated from 72 billion dollars in 2008 to 41 billion dollars in 2009 due to the global economic crisis. Alternatively, with this decline imports also decrease with a margin of around 10% from 23 billion dollars to 21 billion dollars, causing the total trade and trade balance with large declines but remaining positive (Özcan, 2021). Angola's trade surplus was 4,933 million USD in the third quarter of 2019, with export decrease 24.6% to 8,140.9 million USD because of lower shipments of oil while the diamond sales rose 13.3% and import fell 13.8% to 3,207.9 million USD (United Nations, 2020).

2.4.2. Works of BI in Foreign Trade

While there is a lot of study on BI applications in trade analysis for industrialized nations, there are not too many studies on African countries including Angola specifically, but there are some few that we go through them. The first picked one of Yunus ÖZCAN (2021), the research has aimed to analyze Angola's trade flow during between 2000 and 2017 mainly using import and export as variables. The research main findings are based on Ordinary Least Squares (OLS) Regression to analyze the relationship between trade flows and income inequality in Angola. Also uses Gini Coefficient as an indicator to measure income distribution. Negative impact on Gini, suggesting that increasing exports helps reduce income inequality, positive impact on Gini, indicating that increasing imports may increase helps reduce income inequality. The study finds also that exports help reduce income inequality in Angola, while imports and unemployment tend to increase it. Multiple social and economic factors contribute to inequality, and addressing these requires coordinated policies to build a knowledge-based economy and improve human capital retention.

Other relevant research for was (Kahuika, 2003) the study has done basically a huge investigation in several fields of relation between Angola and Namibia achieving some important findings showing that Trade with Angola shows potential as peace consolidates, but Namibia must adapt its manufacturing structure and shift towards service exports to sustain its market presence (Kahuika et al., 2003). Angola, rich in diverse resources, faces infrastructure and economic management challenges, but its revival could reduce Namibia's export market there. Strategic efforts, including SME support, market development, and targeted investments, especially in central and southern Angola, are essential for Namibia to capitalize on emerging opportunities and mitigate the risks of its concentrated trade dependencies.

This study (Golestanizadeh et al., 2023) sought to investigate the influence of implementing business intelligence on export growth and the internationalization of brands. Utilizing a descriptive-correlation methodology, a questionnaire was distributed to 161 randomly chosen employees at the Mobarake Steel Company headquarters in Isfahan. Findings indicated that the utilization of business intelligence has a notable impact on both export expansion and brand internationalization. The data suggests that fostering export development opens avenues for international trade and significantly contributes to brand global recognition. Moreover, executing these strategies requires a profound comprehension of consumer needs, effective control, meticulous planning, thorough evaluation, and timely responses tailored to those demands (Torgo et al., 2009).

The study (Kehinde, 2008) delves into the relationship between international trade and Nigeria's economic growth spanning from 1970 to 2010. Employing the Phillips Peron unit root test and the Johansen (1988) methodology, the study examines the data's stationarity. Findings reveal that exports, foreign direct investment, and exchange rates significantly contribute to real GDP growth. Despite the coefficient of openness, heightened engagement in global commerce yields both static and dynamic advantages for Nigeria (Kehinde et al., 2012). The nature and scale of foreign trade, particularly high-technology exports, *contribute significantly to strengthening the nation's economy* (Kehinde et al., 2012). Consequently, the paper suggests that the government embark on strategies to diversify the economy through export promotion, attract foreign direct investment, and uphold exchange rate stability to enhance productivity and elevate the living standards of its populace.

The Portuguese Institute of Statistics (INE) provides monthly data on transactions between Portuguese firms and other EU countries, which are usually inaccurate (Torgo et al., 2009). These mistakes harm official statistics and demand manual verification. This study describes a data mining method for detecting erroneous international commerce transactions in INE data. The approach identifies transactions that are highly likely to include errors, which are then manually examined by skilled professionals. The approach's generality has yet to be validated in other areas with comparable restrictions, such as fraud detection (Torgo et al., 2009).

2.5. CONCLUSIONS AND GAPS OF LITERATURE

According to the literature assessment and all concepts presented above, Business Intelligence Solutions might be used in foreign trade markets as showed in one the literature that, the usage of business intelligence impacts the expansion of exports and a brand's internationalization, as well on data errors detection as the study in Portuguese companies showed, the use of BI can reduce significantly the time consuming-task and others, as well BI tools were used in the second study to uncover hidden relationships among different attributes. As a result, the goal of this paper is to demonstrate a business intelligence solution that focuses on data visualization and metrics for analyze Angola's foreign trade database between 2021 and 2023.

This gap highlights the need for Angola-specific BI models that consider the country's economic, political, and infrastructure background. Many studies highlight the use of BI technologies but fail to effectively address the issues of trade databases, and international trade organizations. In the context of Angola's trade data, research on methodology and best practices for smooth data integration is required.

3. DATA & METHODOLOGY

3.1. KIMBALL LIFECYCLE METHODOLOGY

The concepts were originally conceived in the 1980s by members of the Kimball Group and several colleagues at Metaphor Computer Systems. When the first published of the methodology was done in *The Data Warehouse Lifecycle Toolkit* book in 1998 (Ross, 2009). Successful DW/BI implementations depend on the appropriate amalgamation of numerous tasks and components; it's not enough to have a perfect data model or best of breed technology. The Lifecycle diagram is the overall roadmap depicting the sequence of tasks required for effective design, development, and deployment (Ross, 2009). Kimball Lifecycle provides an overall framework that cumulates various Data Warehouse or business intelligence activities (Kimball et al., 2008). Kimball Lifecycle has several stages, as shown in figure 2 (Kimball-Core-Concepts, 2009) , which we will go through them and apply in this chapter.

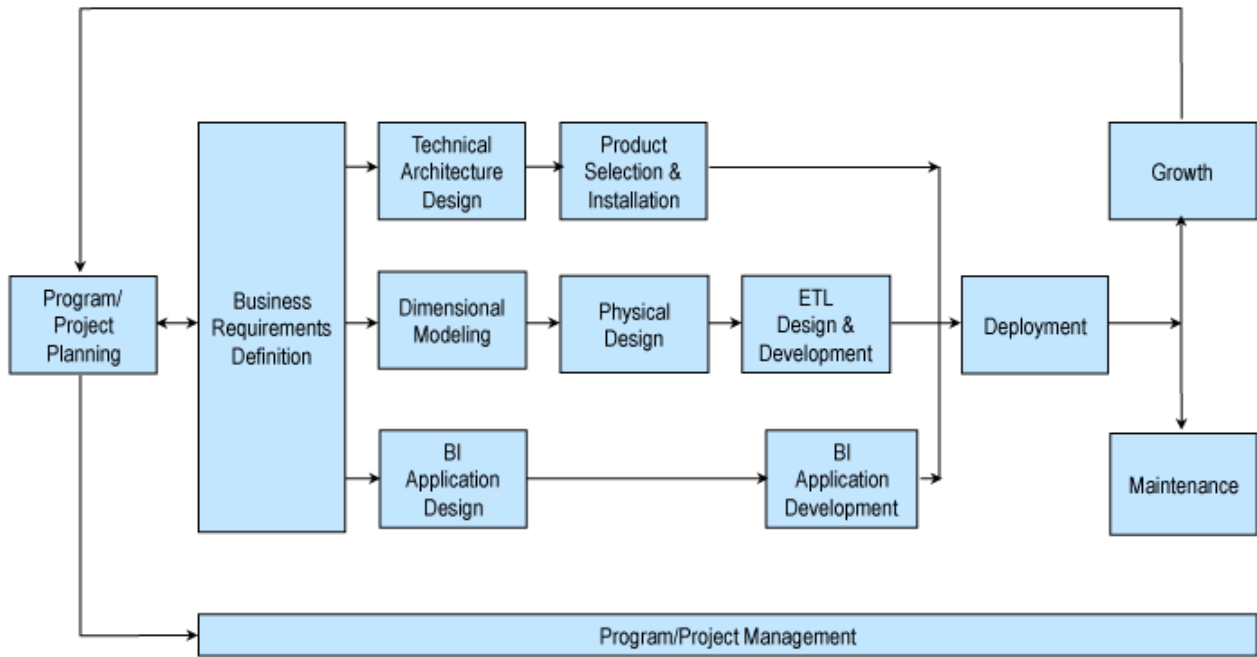


Figure 2: Kimball Lifecycle Diagram

Source: <https://www.kimballgroup.com/wp-content/uploads/2012/06/kimball-core-concepts-021.png>

3.1.1. Business Requirements Definition

The case study for this search is the (Administração Geral Tributária - AGT) General Tax Administration an entity within of Finance Ministry of Angola. The General Tax Administration aims to “ensure greater efficiency in the execution of tax and customs policies and a more efficient allocation and use of existing resources”, “simplifying and rationalizing the management structure of Tax Administration Services, in order to optimize tax revenue and adapt it to a new paradigm of relationships with taxpayers” (Presidential Decree no. 324/14, of 15 December). (*Mensagem Do PCA / Portal Da Administração Geral Tributária*, n.d.). In this case study, we examine how AGT’s can leverage BI solutions to optimize processes and unlock opportunities for growth. By analyzing real data and applying best practices, we aim to provide actionable recommendations for AGT to maximize the benefits of BI and achieve sustainable competitive advantage in its industry.

3.1.2. Data Understanding

The primary sources typically involve data from operational systems, but may also encompass unstructured data, such as emails and information obtained from external suppliers (Heang & Mohan, 2018). For this specific study for example, all data sources will be several excel files that were generated by any management system from Angola Finance Ministry Database.

Exploring data and visualizing it play crucial roles in uncovering patterns, identifying anomalies, and gaining insights from datasets. Moreover, visual representations often present information in a manner that is easier for the audience to grasp and interpret (Owda et al., 2023). As was mentioned in the previous chapter (3.1.1) for this study is about import and export database between 2021 and 2023 of Angola’s AGT, in that order will have dived them in both parts to explore and known it, the data basically consist in six excel files (3 from import and 3 from export database) with huge records from transactional systems. For all import/import excel files as they have the same structure, below in the *table 1* we have quick explanation of them:

Columns	Description
Código pautal:	Is the unique identifier for each import/export operation.
Descrição pautal:	Refers to a quick description of product that has been imported/exported.
Pais de origem:	Refers to the country that the product is imported from.
Pais de destino:	Refers to the country that the product will be import to.
Peso liquido:	Refers to the product’s weight.
Fob_(usd):	
Cif_(usd):	Refers to product import/export amount in usd.
Cif_(akz):	Refers to product import/export amount in akz (Angolan currency)
Data de submissão:	Is the date that imported/exported was requested
Mês:	Refer to the month of <i>data de submissão</i>

Table 1: Data Understanding

3.1.3. Data Track

The data track begins with the creation of a target dimensional model that addresses business requirements while considering the underlying data realities. At this stage, there are 3 activities carried out, first, **dimensional modeling** is the process of forming dimensions and facts as well as the Data Warehouse schema. Second, **physical design** is the process of forming metadata in the database, by detailing all the attributes of each dimension and facts that have been designed in the previous stage. And the third is **ETL Design & Development**, which is the process of extracting, transforming and loading from the source to the target environment (Ramadhani et al., 2021).

3.1.4. Dimensional modeling

The word Kimball is synonymous with dimensional modeling where data is divided into either measurement facts or descriptive dimensions. Dimensional models can be instantiated in relational databases, referred to as star schemas, or multidimensional databases as shown in figure 3 (Smart, 2023), known as OLAP cubes. (Ross, 2009). At this stage, dimensional modeling is carried out by referring to the four-step Kimball method.

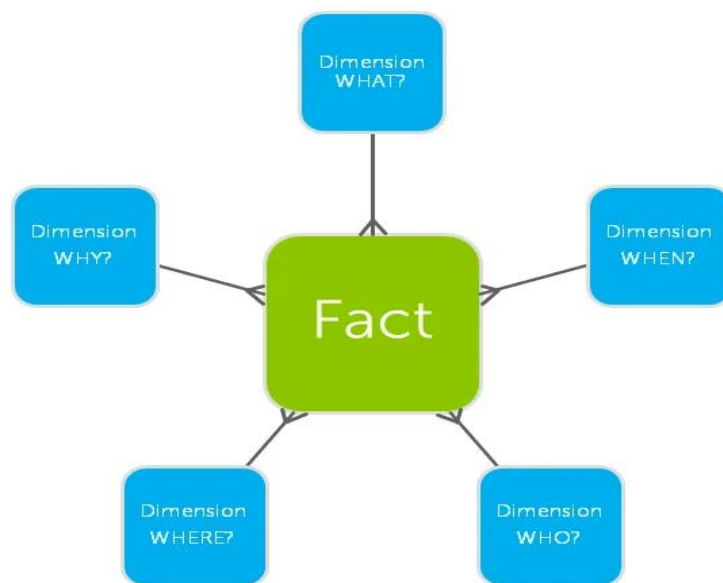


Figure 3: Star Schema

Source:

https://res.cloudinary.com/endjin/image/upload/f_auto/q_80/assets/images/blog/2023/09/star-schema.png

Planning for this BI project involved strategizing and organizing the necessary steps to achieve the proposed goals effectively. In this phase, we establish the purpose of the BI project, define its specific objectives, and scope, and develop an initial approach to address the information requirements. During this task, it's essential to gather insights about the business, industry, the business users and propose what the BI project is developed for. For this project we have defined ten specific business questions in the objectives and methodology section, that will be answered during the analytics or reporting phase.

1. Which products should be exported most?
2. Which are the countries that we have imported most from?
3. What seasons in months of the year does Angola import the most products?
4. What are the products that Angola imports and exports most?
5. Do we have more imported or exported products?
6. Which country had the most revenue and during which period?
7. In which periods of the year should we export best?
8. To which countries should we increase exports?
9. What percentage of products do you import and export annually and monthly?
10. Which countries will be able to import more products in the coming years analyzing the patterns among others.

Discovering and comprehending potential, along with reaching goal, becomes achievable when you consistently track and analyze the correct metrics within your enterprise. Performance measurements clarifies issues, enables comparison of the status against goals, and offers precise steps for resolving any challenges (Kaganski et al., 2017). The approach for each metric will be used for import and export analysis. Based on the previous literature (2.3.4) those all metrics were created in the table 2 to help analyze the behavior and discover the Angola's foreign trade data patterns.

Metrics	Analysis
1. Amount of Product import/export	Looks at the product with the highest demand internationally.
2. Value of product import/export	Analyze import data to find the total from which the most value of products has been imported or exported.
3. Distinct product import/export	Analyze the amount of distinct imported or exported.
4. Avg of import/Export	Calculate the percentage of total imports and exports compared to the total of products.

5. Export and Import Growth Rates	Identify countries with growing markets where the country has potential to increase exports
6. Perc of import/export	Calculate the percentage of total imports and exports compared to the total of products.

Table 2: Metrics and its analysis

During this stage, we select the business process and determine the level of detail for the dimensions and facts tables as is shown in table 3 and 4.

Dimensions tables	
Dimension	Description
Dim Import country	Dimension which describes and stores all the information regarding the import process, such as <i>Código pautal</i> (bk_import) which is unique cod of product transaction, <i>descrição pautal</i> (imp_descricao_pautal) and <i>país de origen</i> (imp_pais_origem) which identify the country where the product came from.
Dim Expport country	Dimension which describes and stores all the information regarding the export process, such as <i>Código pautal</i> (bk_export) which is unique cod of product transaction, <i>descrição pautal</i> (exp_descricao_pautal) and <i>país de destino</i> (imp_pais_origem) which identify the country where the product is shipped to.
Dim Date	Dimension which describes and stores all the information regarding the dates within the business process. Contains <i>proper_date</i> and <i>sk_date</i>

Table 3: Dimensions tables

Fact Tables	
Fact Import Country	This table contains the information centralized regarding import process. Such as, <i>imp_cif_usd</i> and <i>imp_cif_akz</i> , which describes the amount in USD and AKZ.
Fact Export Country	This table contains the information centralized regarding export process. Such as, <i>exp_cif_usd</i> and <i>exp_cif_akz</i> , which describes the amount in USD and AKZ.

Table 4: Fact tables

3.1.5. Physical Design

After carrying out the dimensional modeling stage, the physical design stage is carried out, namely the process of forming metadata in the Data Warehouse database, by detailing all the attributes of each dimension and facts that have been designed in the previous stage (Ramadhani et al., 2021). This step involves translating the conceptual dimensional model into an actual database schema, as shown in figure 4, that will be implemented in a specific database management system (DBMS). It includes defining tables, indexes, views, partitions, and another database if necessary.

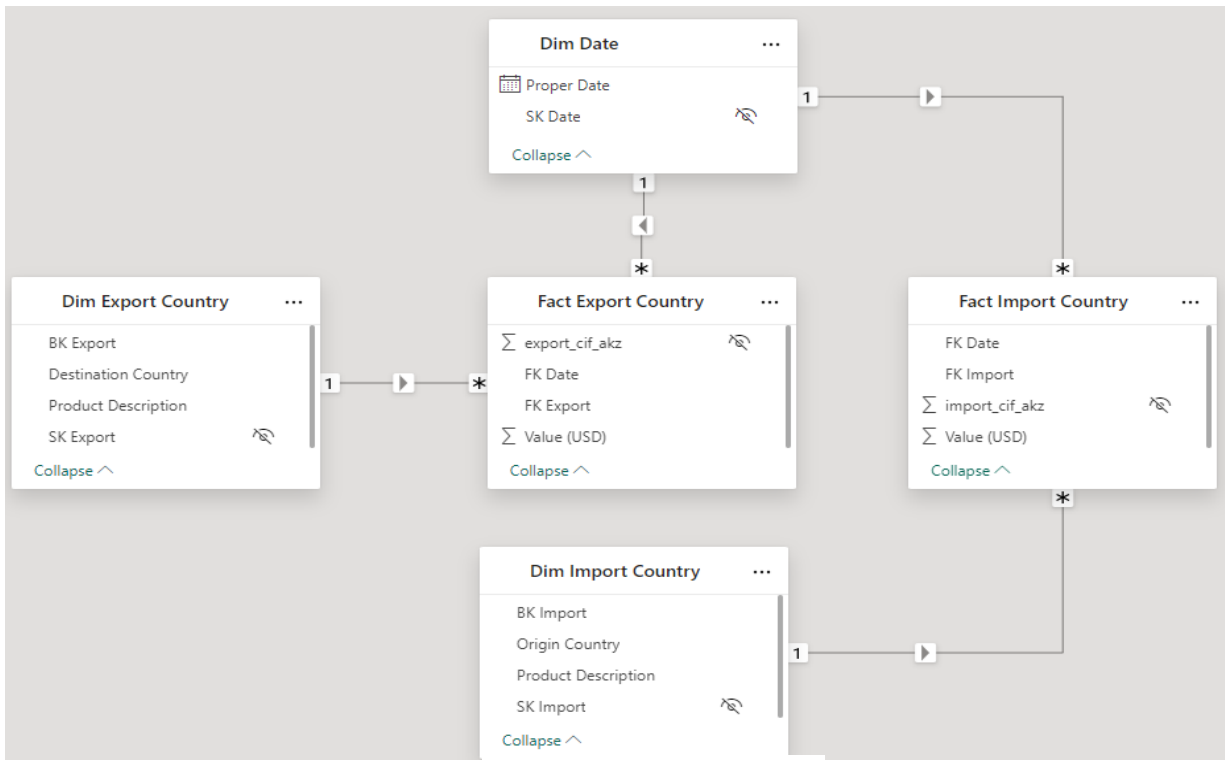


Figure 4: Physical design

3.1.6. ETL Design & Development

ETL is a process that is generally carried out to move data from one data source to another, including manipulation of the data. In this project the ETL process has been done by using SQL Server Integration Service (SSIS), with a Microsoft tool for standalone integration project. The series of ETL carried out are data extraction, data transformation, and data loading (Ramadhani et al., 2021). The figure 5 below represents the ETL process for this project.

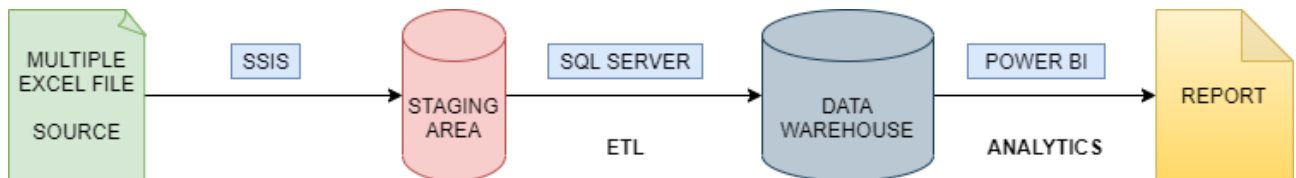


Figure 5: ETL Design

At this stage mainly two transformations have been applied, one of them is deleting duplicated record. It has been applied before loading data into staging area to ensure once the data is loaded into DW is already cleaned. This specifically operation is used inside of *sort* as shown in figure 6, transformation operator on SSIS.



Figure 6: Deleting duplicated records

Another transformation that has been applied was lookup. Which consists of match the foreign key in each column in the table that has foreign key relations with other tables. The lookup transformation was doing by SQL statement instead of applying SSIS operator directly. Loading data into the data final tables is the last step ETL process, once data extraction and transformation have been carried out. To load both dimensions and fact tables, first is loaded all dimensions, then all fact tables are loaded to ensure that the data in the fact tables, which contain de measurements of business, can be properly joined with the dimensions tables which provide context and additional information about the facts as shown in the figure 7. In that order make sure the referential integrity of the data, the consistency and follow data warehouse design principles.

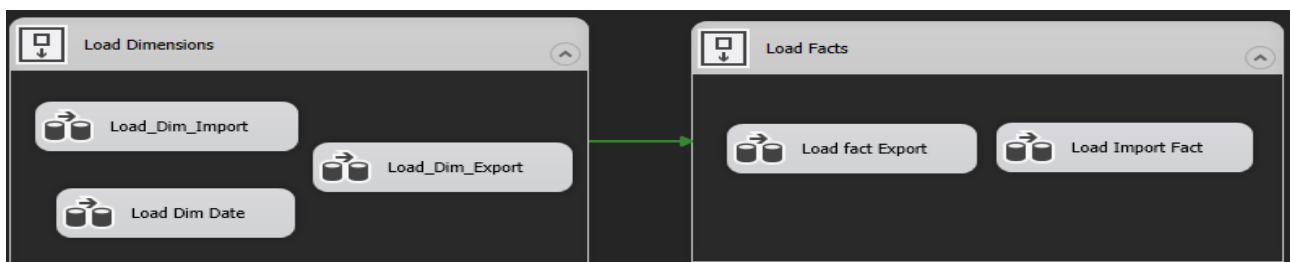


Figure 7: Load dimensions and fact tables

4. RESULTS & DISCUSSION

In this session, we will be analyzing the performance, results and discussion about the BI solution that was developed during the search. Conducting a business needs analysis through metrics already defined.

4.1. REPORTING DEVELOPMENTS

Once created all needed metrics and apply them to answer the business questions, the visualization development part has been employed by using Power BI tool to facilitate the comprehension by stakeholders to analyze the metrics and behavior of the data. The visualization was developed in three main dashboards: import analysis, export analysis and product analysis dashboard. Each of them was designed with various filters to ensure flexibility, while also featuring shared general information, consistent across all dashboards. However, the primary visuals are unique to each dashboard, tailored specifically to the respective.

4.1.1. Import analysis dashboard

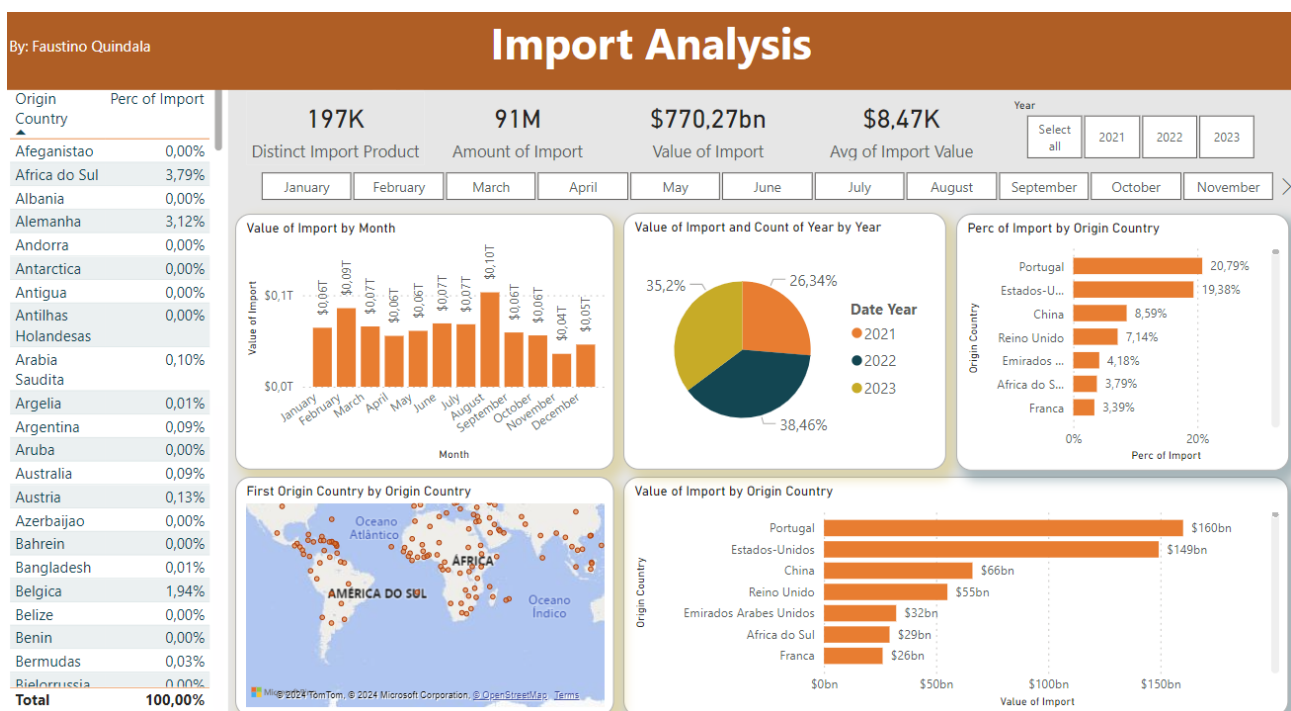


Figure 8: Import analysis dashboard

The report shown in figure 8, has information about all the import data. It has information about the value of import amount of import, distinct import product, those were the metrics mainly analyzed on this report. The objective of this dashboard was to understand all the data regarding import processes summarized in one report. To make easier the stakeholders to understand how the import is in progress or have been made. As the main criteria for analyzing this research is the date, to design this was necessary to filter the data between the three main years that is covered in this research, for that, we use just two basic filter by year and running among its months.

For the same the period the countries that Angola have imported most was Portugal with 20,79%, USA: 19,38, China representing 8,59%, United Kingdom with 7,14% and United Arab Emirates representing 4,18, the same order maintains when distinct imported metrics is analyzed, which means that's the order of the countries that Angola spent more money imported product from. The season of the year where most of product were imported most, in 2021 was between August and September, same behavior has been noted in 2022 that August to October were imported most of products, that behavior was different in 2023 where the month with most imported product was February, but in the same way were constantly in the middle of the year which was between June and August, witch answer the third business question. The country spends around 200 million dollars a month to import food, especially rice, sugar, chicken, wheat and cooking oil, depending on the level of supply and financial availability, among others. The information was provided, by the Minister of State for Economic Coordination, José de Lima Massano, in Luanda June 27, at the opening of the "Angola Economic Outlook 2024" (grxnet.com, 2024). Information that we can confirm based on import analysis report going by months, Angola has imported on average 160K just importing distinct product and spent USD 15bn in last three years, taking in count that 2024 is not included.

4.1.2. Export analysis dashboard



Figure 9: Export analysis dashboard

The figure 9, Export analysis dashboard report has the information regarding all export data. To understand what the countries are who export most from Angola and in which period of it happened regularly, the total amount of each year and a comparison in different periods. It has information about the value of import amount of export, distinct export product, those were the metrics mainly analyzed on this report. This consolidation aims to simplify the stakeholders' understanding of the status and history of exports. The analysis in this report does not differ to much from previous one, was applied basically the same approach, primarily based on date criteria, necessitating a design filters data across the three main years covered by this research.

When analyzing the countries that Angola export most we have China in first place representing 55,68%, India with 10,23%, France, Spain, Netherlands, USA around 2%, the same behavior pass through the year. Differently by imports transactions, here when analyzing the distinct product metrics we don't obtain the same order, we Democratic Congo Republic, Cuba, Congo Republic, Portugal. In the line chart we can see that in the middle of the year is the season where Angola does more exported transactions between march and august.

4.1.3. Product analysis dashboard

The main goal of this report, shown below in figure 10, would be to make an analysis on products perspective.

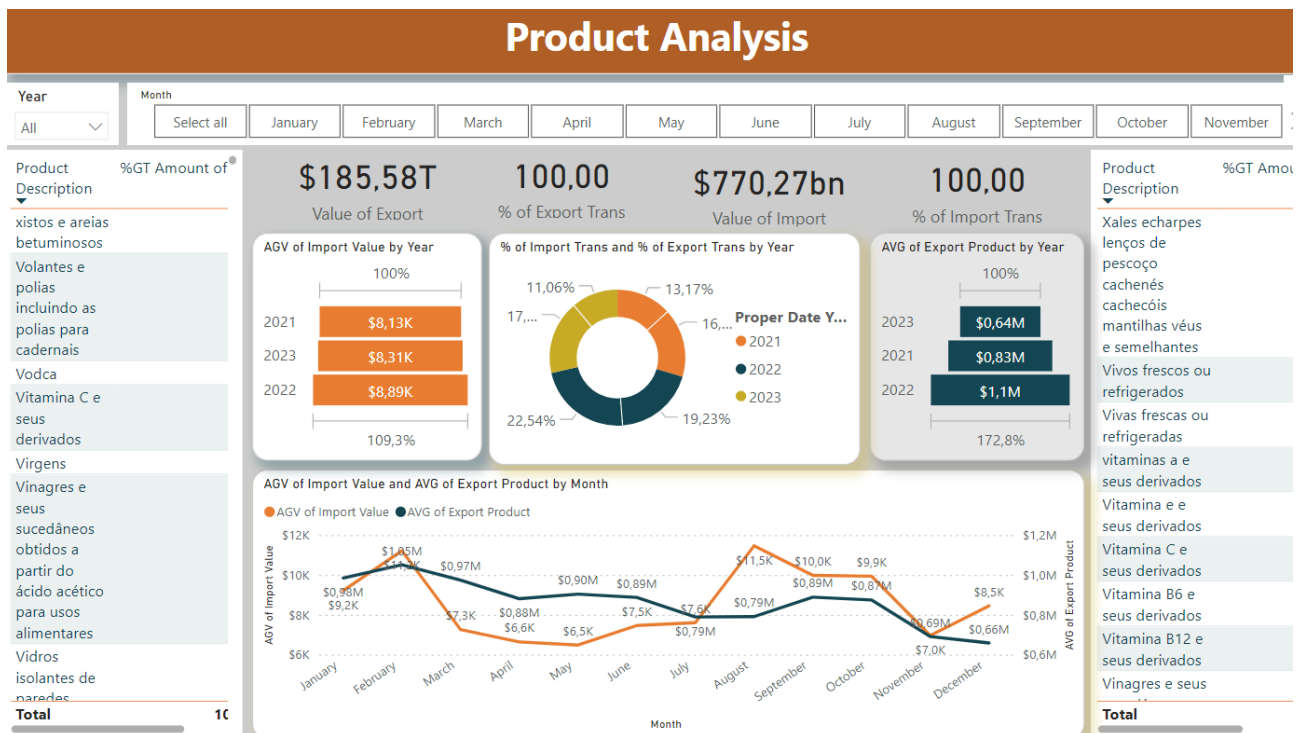


Figure 10: Product analysis dashboard

Analyzing the results provided by the above report in summarized way shown from product perspective going through mainly by AGV of Import/Export Value and Percentage of Import/Export Value metrics in general. There is an oscillation between import and export transactions, moreover, going by months during the analyzed period in the line chart it's possible see the orange line (value of import) is above in of orange line (import value) in some periods of the year in terms of AVG of import/export in USD. In terms of values spent, in 2021 the total value spent with exportation was around USD 60T in 2022, USD 83T and 2023 USD 41T less that the two years before (which is a benefit), exporting in total around 190K products export transaction. In importation transactions Angola has spent in terms of values (USD) 770.89bn during those three years by importing around 197K products import transaction among them. Around USD 202bn in 2021, USD 296, in 2022 and USD 271bn which is a large amount of money spent for a country that a goal to reduce its import dependence.

4.2. DISCUSSION

Based on business needs, we've conducted an analysis to devise a strategy for comparing the foreign a trade of Angola to know the market behavior. After applying the analysis phase some key findings were found. Through meticulous research, we've pinpointed in the table 5 below several products with robust export potential, these products exhibit strong demand and competitive advantages in target markets by maximizing their exportation.

<p>What are the products that Angola imports and exports most?</p>	<p>The result from data shown that is there a category <i>outra</i> "other" that represent 27,9% surely here is included different products category mainly oil product, but there a following list product that come right next that could be exported most: <i>Textile, Mechanical and electrical materials</i>.</p>
<p>Which are the countries that Angola has imported most from?</p>	<p>Angola have imported most from Portugal with 20,79%, USA: 19,38, China representing 8,59%, United Kingdom with 7,14% and United Arab Emirates representing 4,18.</p>
<p>What seasons in months of the year does Angola import most products?</p>	<p>The season of the year where Angola has imported most of were, in 2021 was between August and September, in 2022 was August to October, that behavior was different in 2023 where the month with most imported product was February.</p>
<p>Does Angola have more imported or exported transactions?</p>	<p>In term of import transactions during the all period was 91M and (USD) 770.89bn around, regarding the exporting was 214M.</p>

Which country had the most revenue and during which period?	Regarding importation section was Portugal representing 20,79% of total revenue, from other hand is China in first place representing 55,68%, this occurs during all periods.
In which periods of the year has Angola exported most?	In the line chart of import analysis dashboard shown the season where Angola does more exported transactions between was march and august.
To which countries should Angola increase its exportation?	The good approach is to maintain those who have great percentage as China India, France and increase in others as UK, Portugal, USA, South Africa, increase the counties where are most transactions from.
What percentage of products does Angola import and export?	For import transactions in 2021: 26,34%, 2022:38,46% and 2023: 35%, regarding export in 2021:32,79%, 2022: 38,46% and 2023: 22,12.
Which countries import more products in the coming years analyzing the patterns.	Following the Portugal USA, United Kingdom and United Arab Emirates, will maintain in top of the list this occurs during all three years.

Table 5: Business needs and their answers

To reduce its dependence on crude oil exports, Angola should focus on diversifying its economy and increasing the exportation of various goods. This can be achieved through several key strategies. First, invest in agriculture by adopting modern farming techniques, irrigation systems, and better crop varieties to boost the export of products like coffee, sisal, and fish. Second, expand mining activities beyond oil by developing the extraction and processing of other minerals. Third, enhance manufacturing by establishing industries to produce and export value-added products, such as refining crude oil into petroleum products and processing agricultural produce. Lastly, Angola should expand trade partnerships and explore new markets for these diversified exports, ensuring a more stable and resilient economic future.

5. CONCLUSIONS, LIMITATIONS AND FUTURE WORKS

5.1. CONCLUSIONS

The project was developed to build a real business solution framework that could help to analyze Angola's foreign data in the three last years. By leveraging BI tools and methodologies, we have effectively transformed raw trade data into meaningful and actionable intelligence. This comprehensive analysis has revealed key trends, patterns in Angola's import and export activities, providing valuable insights for policymakers and stakeholders.

The data sources used was generated through Administration General Tax system published AGT's on official web site and was useful to develop the solutions by applying Kimball methodology as the solution approach, the ETL part has been done using SSIS and Power for dashboards, we used all these combined Microsoft's tools in order build a great BIS and answer all the business needs questions successfully. The solution will facilitate quicker decision-making and more informed strategic planning. Trade Patterns: Through detailed analysis, we identified significant trade partners, top and down countries exporters and importers, and seasonal trends by month. This information could be important for better negotiation of trade agreements and targeting new market opportunities.

Overall, the BI solution for analyzing Angola's foreign trade database can be an important solution in enhancing efficiency, and strategic planning of the country's trade activities. Moving forward, continuous refinement and expansion of this BI system will further empower Angola to navigate the complexities of global trade, optimize its economic performance, and achieve its long-term developmental goals.

5.2. LIMITATIONS AND FUTURE WORKS

Regarding limitations, especially within the data and metadata of the data sources, there is a significant lack of information, particularly in product descriptions. To develop a robust solution, more data is needed not only about the trade but also with more detailed information about the product categories. There are too many products categorized under generic labels like "outros" (other), which necessitates more granular information to improve the quality of reporting. Additionally, another critical limitation is the lack of conversations with AGT's personnel, which could provide valuable insights and contextual understanding that are essential for addressing these data gaps and refining the solution.

For future works, implement features that allow better collaboration and sharing of insights among stakeholders, enabling more coordinated and effective trade strategy development closely to AGT. Link the solution with policy development tools to directly influence and shape trade policies based on real-time data. and analysis and incorporate predictive analytics for forecasting trade trends based on historical data.

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