

Creating a Dashboard

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Conteúdo

- 1 What is Power BI
- 2 Case study
- 3 Power BI interface
- 4 Power BI phases
- 5 Connect and Update Data
- 6 Introduction to *Query Editor*
- 7 Query Editor tools
- 8 Relationships between tables
- 9 Introduction to DAX
- 10 Create Views
- 11 View Data - Interactions and Filtering
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What is Power BI

Power BI is a visualization tool

created by **Microsoft**

Main functions or purposes:

- Transformation and extraction of valuable data (*insights*)
- Creating interactive *dashboards* with *business intelligence*
- Make analytics available on multiple platforms



Power BI Desktop vs. Service

Power BI Desktop

Download and use on Windows PC (free)
Complete report creation (no account required)
Focus on personal use



Power BI Desktop

Power BI Service / Mobile App

View report from any device (free)
Share and collaborate with other users (Pro account)
Pro account \$ 10 USD/month per user



Power BI Service / Mobile App

Considerations

Power BI account registration

- Currently you need a professional or academic account to use Power BI Service (which serves to view reports online from any device).
- To use the "Power BI Desktop" app you don't need an account.

Tip: Use the Power BI Desktop version in English

- Most of the information/documentation that can be consulted on the web is in English.
- Power BI is constantly updated and both updates and announcements are made in English.

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Case Study: Introduction to Power BI



In this session we will use data from The World Bank to build an interactive *dashboard*.

Our **objective** is to build an interactive *dashboard* that allows comparing member economies of OECD into categories like:

- Economy
- Public Policy
- Health

Databases can be found here:
GitHub.com

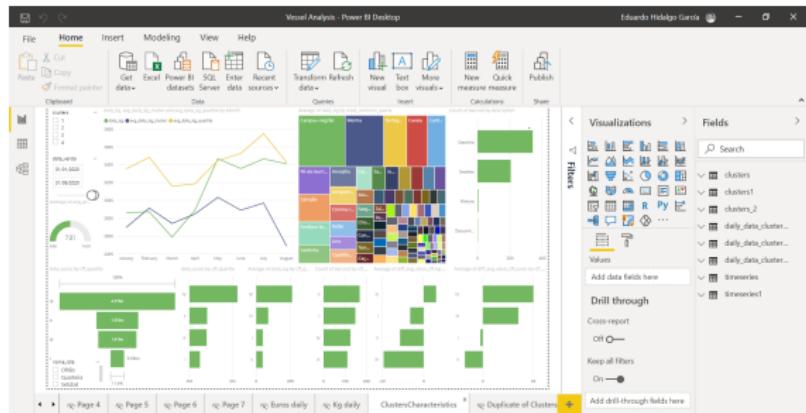
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Much like other Microsoft packages

Main components:

- Toolbar;
- Reports, Data and Template;
- Report Sheets;
- Panels: Fields, Views and Filters.



Open Power BI and let's try it together!

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General Business Intelligence Steps

1. Get the Data (GD)

Some most used sources: Excel, CSV, Databases...

2. Prepare the Data (PD)

Based on imported *raw* tables - clean and organize data in *Query Editor*.

3. Modeling the Data (MD)

From imported data tables - Create structures (models) to relate them.

4. View Data (VB)

Representations of data in the form of graphs, matrices...

5. Report Data (RD)

Structure and format views.

General Business Intelligence Steps - Considerations

The different steps do not need to be used in every project

For example, a properly structured table may not require *Prepare Data* (PD) or *Model Data* (MD) steps.



Phases are iterative

In any report we will need to switch from one phase to another, regardless of the order or frequency of use.



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OD - Connect and Update Data

- It is the function we use at the beginning of each project.
- With it we integrate the data that will be used in our report.
- This function is not exclusive to project start. It is used whenever more data sources need to be integrated.
- After data has been retrieved or connected to Power BI, the sources or routes will be stored in the report. This allows Power BI to update new records to be viewed in the report.



Files

Databases

Online services

Others

Examples of Power BI Compatible Data Sources

OD - Considerations

- **Data source:** Any route or destination that has records. They can be from digital files (eg Excel), Websites, Databases/Servers, etc.
- Sometimes information sources contain **elements that are not part of the data table** that we want to import or contain inconsistencies that require modification. It is at this stage that we must correct these types of problems.
- **Data Update:** Since Power BI is connected to data sources, the update can be done directly from the Power BI interface.

Note: Changing the structure of data sources or the route name may affect the retrieval process.

Tip: Arrange an effective structure, for example: assign consistent names and routes that do not change over time.

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PD Introduction to textit Query Editor

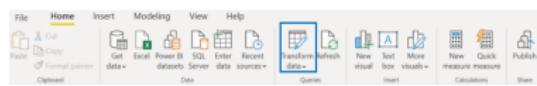
The *Query Editor*, is the resource we use to make the corresponding adjustments to tables and their records.

This tool is generally used for correcting and cleaning data, not for performing calculations or operations.

How to get to *Query Editor*?

To open the *Query Editor*:

- Click *Transform Data* from *Home*.
- A new Power BI window opens.



A screenshot of the Microsoft Power BI desktop application. The ribbon at the top has 'Home' selected. The main area shows a data preview grid with columns 'Country Name' and 'Year'. The data consists of 20 rows of Australia and 20 rows of 2000. On the right side, there's a 'Properties' panel showing 'Source' and 'Transformed Headers' under 'Data' tab. A 'REFRESH TIPS' panel is also visible. The bottom of the screen shows the Windows taskbar with several pinned icons.

PD - Elements of the *Query Editor*

The screenshot shows the Microsoft Power Query Editor interface. The title bar reads "Untitled - Power Query Editor". The toolbar at the top includes buttons for File, Home, Transform, Add Column, View, Tools, and Help. Below the toolbar are several groups of buttons: Close & Apply, New Source, Recent Sources, Enter Data, Data source settings, Manage Parameters, Refresh Preview, Advanced Editor, Properties, Manage, Choose Columns, Remove Rows, Keep Rows, Sort, Data Type (set to Text), Use First Row as Headers, Split Column, Group By, Replace Values, Manage Columns, Reduce Rows, and Transform.

The main area displays a preview of a table titled "Country Name" with columns "Country Name", "Country Code", and "Year". The table contains 23 rows, mostly for Australia with some for Austria. A tooltip "ARI treatment (% of children under 5 taken to a health pro" is visible over the last row. The left sidebar lists "Queries [3]" with "DataClean" selected, and "Tables" below it. The right sidebar shows "Query Settings" with "Name" set to "DataClean", and "Applied Steps" which includes "Source", "Navigation", "Promoted Headers", and "Changed Type".

At the bottom, a message says "Preview of the table for the report". The status bar indicates "243 COLUMNS, 987 ROWS".

Download the excel file here and let's go to Power BI!

PD - Considerations (I)

- **Data type:** It is important to review to ensure that each field has the correct data type. Usually Power BI assigns automatically, but sometimes it may not do it correctly.
- **Steps performed:** Each change is registered and saved in the *Query Editor* and each of these steps is performed in the same order when updating the report.



Note: The *Query Editor* changes the structure used in Power BI, but **does not affect the structure of data sources**.

Conteúdo

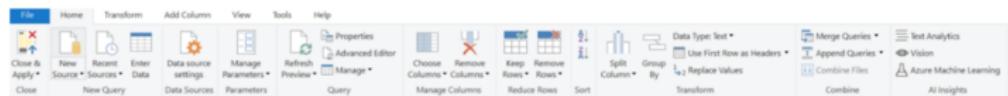
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PD - *Query Editor Tools*

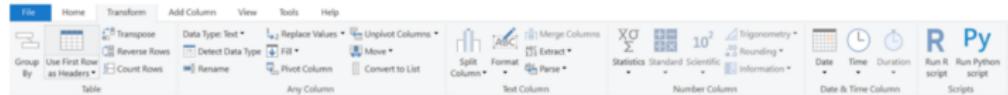
In *Query Editor* we can make changes to data tables.

To make changes and adjustments, we can use the three toolbar windows.

Home: folha principal onde é possível fazer ajustes gerais e transformações comuns (mudar fontes de dados, remover linhas ou colunas, combinar tabelas, etc.)



Transform: os ajustes feitos desde esta folha ficam refletidos nas colunas selecionadas (substituir valores, extraír caracteres, pivot/unpivot, etc.)



Add a Column: para agregar novas colunas no geral com referência aos dados de uma outra coluna (índices, extrair mês/ano, condições, etc.)



PD - Considerations (II)

Difference between Transform and Add Column

- *Transform*: It is generally used to modify the data or to eliminate the data that is not needed from a given column.
- *Add column*: Allows you to extract data from a column, or view the data in a column from another perspective.

Steps between steps performed

The *Query Editor* allows you to make new intermediate steps between steps that have been performed. It is important to remember that the order of steps is very relevant, as it is in this order that the steps will be taken again when the data is updated in the future.

Tip: Look for efficiency in the application of steps.

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MD - Relações entre tabelas

Na **Modelação dos Dados** uma das principais tarefas é a criação de relações entre tabelas ou, de forma mais específica, entre os campos de cada uma delas.

Há muitas formas de relacionar e propósitos para o fazer.

Um exemplo comum poderá ser:

Vendas

Produto	Quantidade	Valor
Maçã	5	10
Laranja	4	16
Banana	7	28
Ananás	6	12
Cenoura	6	12
Alho	9	36
Alface	3	6
Cebola	3	3
Manga	10	10
Total	53	133

Inventários

Produto	Categoria
Maçã	Fruta
Laranja	Fruta
Banana	Fruta
Ananás	Fruta
Cenoura	Legume
Alho	Legume
Alface	Legume
Cebola	Legume
Manga	Fruta

Relação das tabelas

Categoria	Quantidade	Valor
Fruta	32	76
Legume	21	57
Total	53	133

As duas tabelas têm uma coluna comum

Após relacionar as tabelas, podemos ver os resultados resumidos por Categoria.

MD - Exercício prático - relações entre tabelas

Abra o Power BI! Nesta secção vamos a fazer um exercício para entender a importância das relações entre tabelas.

The screenshot shows the Microsoft Power BI desktop interface. On the left, the 'Data' view displays two tables: 'Country Code First 2019 [#R2019]' and 'Three_Letter_Country_Code'. The 'Three_Letter_Country_Code' table contains columns: Country Code, Name, and Continent. A relationship is visible between the 'Country Code' column in the first table and the 'Country Code' column in the second. The 'Relationships' tab is selected at the bottom left. The main workspace shows a visual representation of the data, and the 'Fields' pane on the right lists various data sources and models used in the project.

Country Code	Name	Continent
AUS	Oceania	Asia
AUT	Europe	Europe
BEL	Europe	North America
CAN	North America	Oceania
CHE	Europe	South America
CHE	South America	Total
CHN	Asia	10267.50017
COL	South America	
CZE	Europe	
DEU	Europe	
DNK	Europe	

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DAX: Data Analysis Expressions

We can understand DAX as the process equivalent to writing formulas in an Excel file. DAX are expressions that allow you to do from simple arithmetic operations to more complex calculations.

Note: It will not always be necessary to perform DAX, as Power BI generates operations or measurements in an automated way. In Power BI there are two types of measures:

- **Implicit Measures:** They are generated simply by dragging the column in the view (it only generates basic arithmetic operations).
- **Explicit Measures:** Generated by the user using DAX expressions.

To create a DAX it is important to know the difference between using the functions of:

- New measure
- New column

MD - New Measure vs New Column

Produto	Vendas	Inventário	Vendido
Maçã	4	10	6
Maçã	10	17	7
Maçã	3	7	4
Total	17	34	?

Queremos conhecer o número de maçãs restantes. O total restante pode ser feito de duas formas: 1) Somar o restante por linha ou 2) Calcular o restante dos totais por colunas

DAX Nova Coluna

Total	17	34	$6+7+4=17$
-------	----	----	------------

Realiza a operação por linha e depois o representa num somatório (implícita)

DAX Nova Medida

Total	17	34	$34-17=17$
-------	----	----	------------

Realiza a operação após ter feito o somatório de todas as linhas

MD - New Measure vs New Column (ex. 2)

Produto	Vendas	Inventário	Vendido
Maçã	4	10	40%
Maçã	10	17	59%
Maçã	3	7	43%
Total	17	34	?

Queremos conhecer o número de maçãs restantes. O total restante pode ser feito de duas formas: 1) Somar o restante por linha ou 2) Calcular o restante dos totais por colunas

DAX Nova Coluna

Total	17	34	$40\% + 59\% + 43\% = 142\%$
-------	----	----	------------------------------



Realiza a operação por linha e depois o representa num somatório (implícita)

DAX Nova Medida

Total	17	34	17/34=50%
-------	----	----	-----------

Realiza a operação após ter feito o somatório de todas as linhas

MD - New Measure vs New Column (ex. 3)

Workshop/Reply/Stop - Power BI Desktop

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File Home Insert Modeling View Help

Manage relationships
measure measure column table
New Quick New New
Change detection
New parameters
Manager roles as
setup Q&A
Glossary Language Logistic schema+
Security

Country Name Average of (GDP per capita) (constant 2010 USD) Average of Population, total Average of GDP (constant 2010 USD) Average of PIB per capita column PIB per capita metrica

Country Name	Average of (GDP per capita) (constant 2010 USD)	Average of Population, total	Average of GDP (constant 2010 USD)	Average of PIB per capita column	PIB per capita metrica
Belgium	\$43,773.20	62,003,085.35	\$466,768,220,243.40	\$43,775	\$43,885
Germany	\$42,773.50	82,003,085.35	\$466,768,220,243.40	\$42,773	\$42,269
France	\$40,974.70	64,571,168.15	\$449,855,428,209.60	\$40,975	\$41,030
United Kingdom	\$40,465.00	62,610,464.15	\$324,526,915,945.30	\$40,467	\$40,329
High income	\$37,863.30	1,711,600,000.00	\$4,464,058,545,19.80	\$37,863	\$39,148
Sweden	\$35,860,284.15	9,640,000.00	\$33,640,458,545,19.80	\$35,863	\$35,889
Italy	\$34,019.05	59,614,061.50	\$2,125,097,710,033.50	\$34,019	\$34,075
GEOID members	\$35,470.20	1,280,350,440.00	\$45,443,827,032,287.00	\$35,470	\$35,490
New Zealand	\$34,406.60	4,142,075.00	\$150,174,623,637.00	\$34,407	\$34,590
European Union	\$33,332.00	498,428,988.00	\$15,050,000,547.00	\$33,330	\$33,525
Iceland	\$30,502.00	7,959,000.00	\$3,000,715,081.00	\$30,502	\$30,502
Spain	\$30,728.00	45,007,197.20	\$3,084,716,479,747.40	\$30,728	\$30,755
Greece	\$25,130.00	10,931,189.60	\$277,102,326,917.90	\$25,130	\$25,350
Slovenia	\$23,088.15	2,034,401.40	\$47,035,888,901.00	\$23,088	\$23,118
Korea, Rep.	\$22,357.80	49,472,172.00	\$1,112,004,420,014.95	\$22,358	\$22,477
Portugal	\$20,332.00	10,833,000.00	\$2,033,000,000.00	\$20,332	\$20,397
Czech Republic	\$18,036.20	10,400,226.95	\$204,760,642,130.45	\$18,036	\$19,073
Slovak Republic	\$15,955.00	5,400,018.15	\$86,231,026,317.80	\$15,955	\$15,960
Estonia	\$15,757.70	1,341,144.50	\$21,069,045,222.00	\$15,758	\$15,710
Hungary	\$13,687.55	9,985,554.00	\$136,249,796,925.75	\$13,687	\$13,640
China	\$12,426.25	17,250,000.00	\$2,175,000,000.00	\$12,427	\$12,595
Central Europe and the Baltic	\$12,497.00	55,433,306.35	\$3,206,133,674,239.65	\$12,498	\$12,498
Ukraine	\$12,675.80	3,129,187.20	\$18,911,864,244.55	\$12,676	\$12,493
Poland	\$12,343.50	38,096,329.40	\$409,979,197,573.95	\$12,343	\$12,337
Lithuania	\$12,251.90	2,122,984.45	\$25,640,118,131.20	\$12,252	\$12,077
Turkey	\$11,935.00	79,020,000.00	\$946,000,000.00	\$11,935	\$11,975
Russian Federation	\$10,987.60	143,981,141.05	\$1,460,827,272,233.35	\$10,984	\$11,146
World	\$9,557.40	6,885,576,705.55	\$66,224,079,792,876.55	\$9,557	\$9,618
Mexico	\$9,779.55	113,223,693.95	\$1,000,000,072,521.05	\$9,780	\$9,610
Colombia	\$6,361.60	44,897,138.10	\$208,800,797,753.70	\$6,362	\$6,432
China	\$4,156.00	1,333,400,760.00	\$6,137,302,257,237.85	\$4,156	\$4,618
Latin America	\$4,833.00	5,828,234,000.00	\$93,833,000,000.00	\$4,834	\$4,830
Middle Income	\$6,095.20	527,483,816.65	\$373,479,389,293.70	\$6,095	\$4,709
Total	\$32,461.60	397,607,641.78	\$1,520,568,938,768/397,607,641	\$32,463	\$13,884

Filters

Visualizations

Fields

Add data fields here

Filters on this page

Filters on all pages

Values

Drill through

Close report

Off

Keep all filters

On

Add drill-through fields here

5,520,568,938,768/397,607,641

Relaciones

Explorando datos

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Difference between New Columns and New Measures

- **New Columns:** In most cases, creating a new column to perform a calculation is not recommended. New columns are generally used to aggregate static data or a category based on a series of conditions from other columns.
- **New Measures:** It is recommended for operations or calculations that can be analyzed from the values field in the visualizations. There may also be other complex purposes where it is better to consider measures rather than new columns.
- **Relate Tables:** Allows you to filter based on the value of a column in another table in the views area.

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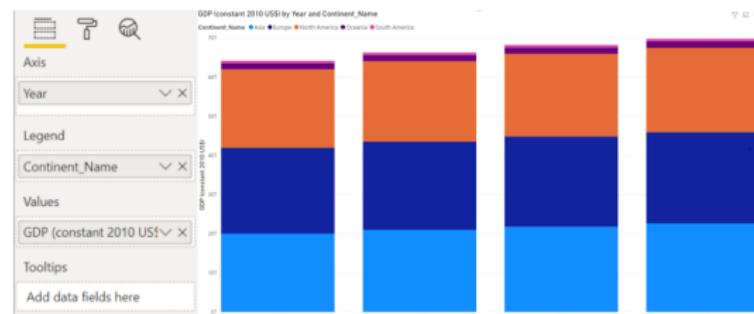
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DV Create Views

Visualization: It is all the data representation in the form of a graph, diagram, matrix or table.

Create visualization in Power BI: A basic visualization consists of a value that we can segment by category or categories of different columns. In general, views have the following fields:

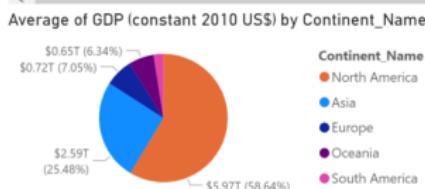
- Segment by axis field (Axis).
For example location, category, details, etc...
- Legend to differentiate the colors of the different categories of the placed field
- Field of values to represent with an operation (sum, count, etc.)
- It serves to display more information by placing the mouse cursor



DV Create Views

Open Power BI! In this section we will create the following views:

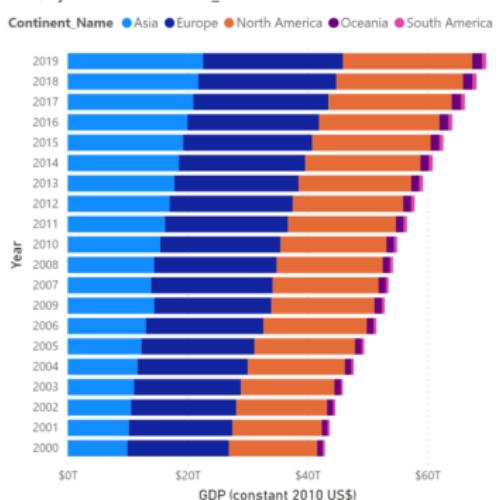
Continent_Name	Average of GDP (constant 2010 US\$)	Average of Gross savings (% of GDP)	Average of Military expenditure (% of GDP)	Average of Mineral rents (% of GDP)	Average of Tax revenue (% of GDP)
North America	\$5,968,589,344,306.37	20.75	1.65	0.33	11.5C
Asia	\$2,594,030,504,508.18	30.37	2.90	0.30	16.05
Europe	\$717,738,219,225.45	23.48	1.45	0.05	21.04
Oceania	\$645,049,185,186.30	20.74	1.55	2.13	25.55
South America	\$253,292,624,174.35	19.48	2.75	6.95	15.82
Total	\$5,520,568,938,786.88	23.87	1.72	0.53	19.51



Average of GDP (constant 2010 US\$) and Population, total by Country Name



GDP (constant 2010 US\$) and Avg. Central government debt, (% of GDP) by Year and Continent_Name



Average of GDP (constant 2010 US\$), Average of Air transport, passengers carried and Average of Air transport, freight (million ton-km) by Country Name and ...



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DV - Interactions and Filtering

In Power BI there are three types of filters (or interactions between views):

- **Filter:** Displays only the data for the selected element.
- **Highlight:** Displays the data for the selected element in proportion to all the data.
- **None:** No interactions.

The screenshot displays a Power BI interface with several visualizations and filter contexts:

- Top Navigation:** File, Home, Insert, Modeling, View, Help, Format, Data / Drill.
- Left Sidebar:** Interactions, Fields.
- Visual 1 (Table):** Shows data for North America and Total across various economic indicators.

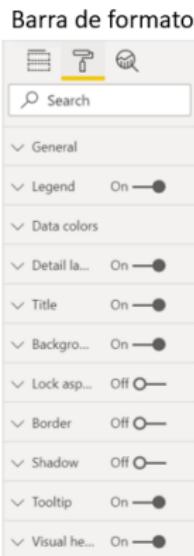
Continent_Name	Average of GDP (constant 2010 US\$)	Average of Gross savings (% of GDP)	Average of Military expenditure (% of GDP)	Average of Mineral rents (% of GDP)	Average of Tax revenue (% of GDP)
North America	\$5,960,589,344,306.37	20.75	1.65	0.33	11.5C
Total	\$5,968,589,344,306.37	20.75	1.65	0.33	11.5C
- Visual 2 (Pie Chart):** Average of GDP (constant 2010 US\$) by Continent.
 - United States: \$0.65T (6.34%)
 - China: \$0.72T (7.05%)
 - Japan: \$2.59T (25.48%)
 - United Kingdom: \$5.97T (58.64%)
- Visual 3 (Bar Chart):** GDP (constant 2010 US\$) and Avg. Central government debt (constant 2010 US\$) by Year and Continent_Name.
 - Legend: Asia (Blue), Europe (Purple), North America (Orange), Oceania (Green), South America (Pink).
 - Data shows a general upward trend in GDP from 2000 to 2019.
- Visual 4 (Map):** Average of GDP (constant 2010 US\$). Average of Air transport, passengers carried and Average of Air transport, freight (million ton-km) by Country Name and ...
 - Map highlights North America.
- Visual 5 (Treemap):** Average of GDP (constant 2010 US\$) by Country Name.
 - United States: \$0.65T (6.34%)
 - China: \$0.72T (7.05%)
 - Japan: \$2.59T (25.48%)
 - United Kingdom: \$5.97T (58.64%)

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- 12 Views Format**
- 13 Report Format
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DV - Views Format

The **view formats** are all the elements that we can modify, remove or add to the views (element colors, titles, backgrounds...)



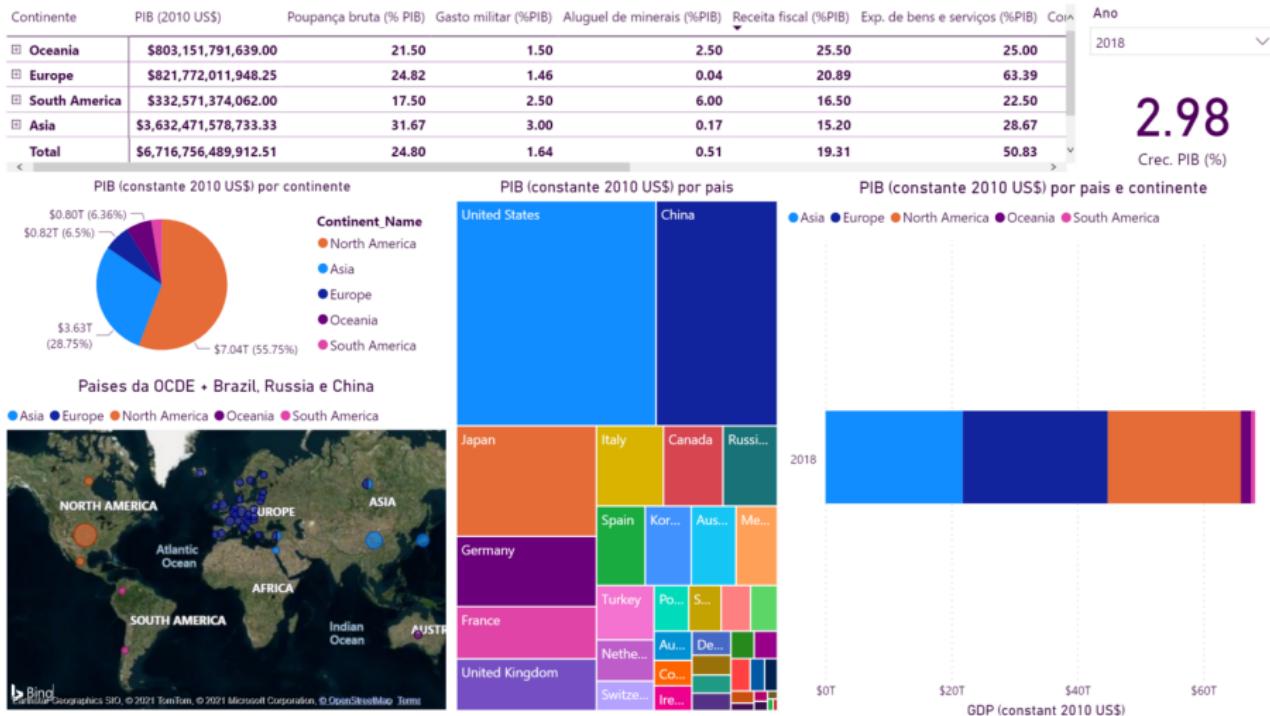
Tips for formatting views:

- Simplicity - Ideally, a visualization should be easily understood, ie it shouldn't take more than a few seconds to realize the content and its purpose.
- Consistency - Fonts in same style and size, colors/captions according to categories, outlines, borders. The goal is to maintain a consistent look for any user.
- Not focusing on interactions - One of the main functions of a *dashboard* is to allow the visualization of the necessary information instantly. Features like filtering and searching with multiple interactions should take a back seat.

Open Power BI and let's try it together!

DV - Views Format

Let's do the following exercise:



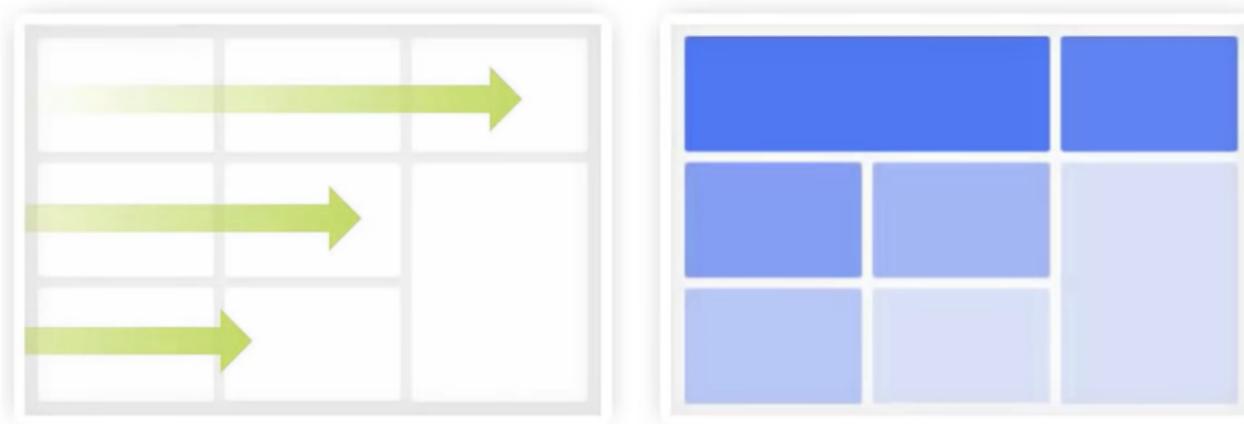
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RD - Report Format

The format of the report is linked to the format of the views, but is focused on the general structure: Organization of views, buttons and elements that help the user navigate through the document. **Tips on report format**

- **Report interface:** Clean and simple. With colors related to the organization's logo or the theme of the categories. Use titles or tags to guide the user to navigate through the document. Use consistent margins and element distribution.
- **Reading the report:** From general to specific. Try to use the sense of presentation of the information in the way we read it (from right to left, from top to bottom). Put key indicators in the upper left quadrant and from there, break down to lower levels.



RD - Report Format

Let's do the following exercise:

 THE WORLD BANK
WB | WORLD BANK GROUP

 OCDE

Ano
2018

2.98 Crec. PIB (%)

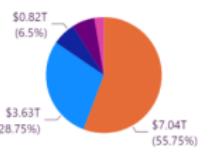
\$36.52K PIB per capita

Análise dos países membros da OCDE

Detalhe por continente

Continente	PIB (2010 US\$)	Poupança bruta (% PIB)	Gasto militar (%PIB)	Alugu...
Oceania	\$803,151,791,639.00	21.50	1.50	
Europe	\$821,772,011,948.25	24.82	1.46	
South America	\$332,571,374,062.00	17.50	2.50	
Asia	\$3,632,471,578,733.33	31.67	3.00	
North America	\$7,043,812,663,264.67	21.00	1.33	
Total	\$6,716,756,489,912.51	24.80	1.64	

PIB (constante 2010 US\$) por continente



● North America ● Asia ● Europe ● Oceania

PIB (constante 2010 US\$) por país



United States China
Japan Spain Kor... Aus...
United Ki... Italy Mexi... Turk... N...
Germany Canada Swit... Pola...
France Russian F...

Paises da OCDE + Brazil, Russia e China



● Asia ● Europe ● North America ● Oceania ● South America

PIB (constante 2010 US\$) por país e continente



● Asia ● Europe ● North America

2018
\$0T \$50T

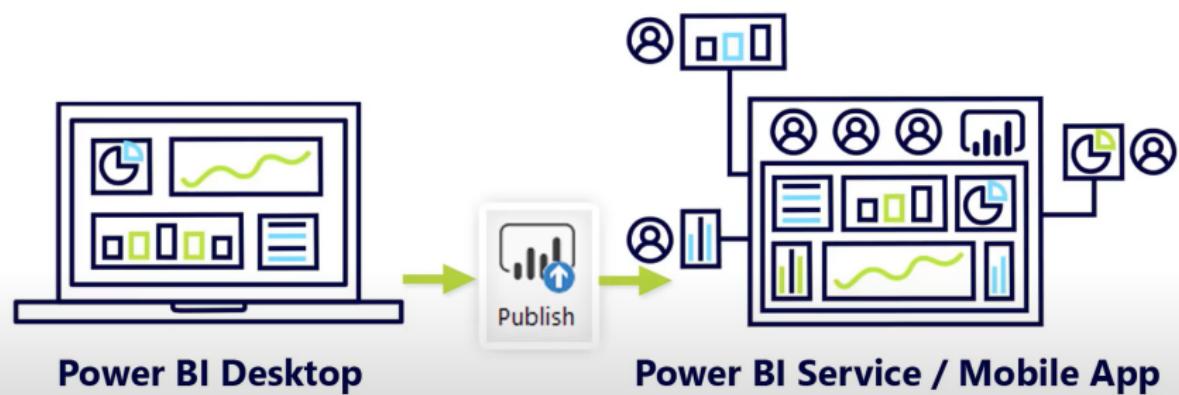
GDP (constant 2010 US\$)

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RD - Publish the Report

Publish online: This feature will allow the report created in *Power BI Desktop* to be accessed online on any device. The report is published on *Power BI Service* and generates a public access link.



References I



datdata (2020).

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<https://www.youtube.com/watch?v=hKe7bHPiSPU&t=6089s>.

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Lab, T. O. (2019).

How to create beautiful dashboard background and tile design.

<https://www.youtube.com/watch?v=NfEqCdf123k&t=300s>.

Formato do relatório.

Creating a Dashboard

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