

Retail of Climate Control Equipment

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1 - Contextualization

This project was developed as part of the **Data Analyst course at CESAE Digital**, aiming to consolidate knowledge in Power BI through data analysis and visualization.

The proposed challenge involved analysing the **sales performance of climate control equipment** for a major retailer, combining internal data, such as sales volume and operational costs, with external data, such as climate conditions and purchasing power by region.

Throughout the project, techniques for data injection, transformation, and combination were applied, along with the creation of measures to support data analysis and interpretation. The final goal was to understand which factors most influence sales success across different locations.

The original report was written in **European Portuguese**, as was the **Power BI project**, where table names, columns, and measures were kept in the original language. However, for portfolio purposes, the **report** has been **restructured and translated into English**.

2 – Proposed Statement

A major home appliances retailer aims to analyse the performance of its stores in the sale of climate control equipment, cross-referencing this data with contextual factors such as regional climate conditions and purchasing power.

The goal of the analysis is to determine whether more extreme weather conditions favour the sale of items in certain locations or if purchasing power and population size are the primary factors influencing sales success or failure.

Internal data sources provided by the company:

- Store table – [Excel file “Lojas”](#)
- Sales volume of climate control equipment per store – [Excel file “VolumeVendas”](#)
- Quantities of products sold per store – [Excel file “quant_vendida”](#)
- Fixed costs per store related to the maintenance of sales spaces for these products – [Excel file “custosfixos”](#)
- Indication that the selling price is always 33% above the cost price.

External data sources available:

- Climate conditions by region: [Source](#)
- Purchasing power table (2021): [Excel file "pordata"](#)
- Municipality-to-region mapping table: [Source](#)
- Resident population table (2021): [Excel file "população residente \(em 2021\)"](#)

Note: The Excel files were extracted from the Pordata website. However, one of the links is no longer active, so I have included the extracted files from the site for reference.

Suggestions:

There are multiple approaches to this analysis, so the following recommendations may apply in some cases but not all:

- Import all data sources into the same Power BI project
- Rename all tables, columns, and transformations to ensure project clarity
- Remove unnecessary columns and rename others
- Transform and structure the data correctly (e.g., climate table, region and municipality tables, etc.)
- Relate all data sources and apply necessary transformations to establish meaningful connections.

Possible analytical approaches:

- Summing values by store may be useful
- Note that the Purchasing Power Index is based on a scale where 100 represents the national average. A value above 100 means the municipality has a purchasing power above the national average. How can this scale be adapted to other variables?
- Which variables should be considered in a regional analysis? And at the municipal level?
- How would you calculate the profit margin for these products in each store?
- How would you incorporate it into comparisons with other variables?

Reporting Considerations:

- What tables should be included in the report to facilitate data interpretation?
- How many report pages should be created? For what purpose?
- What types of charts would be most useful?

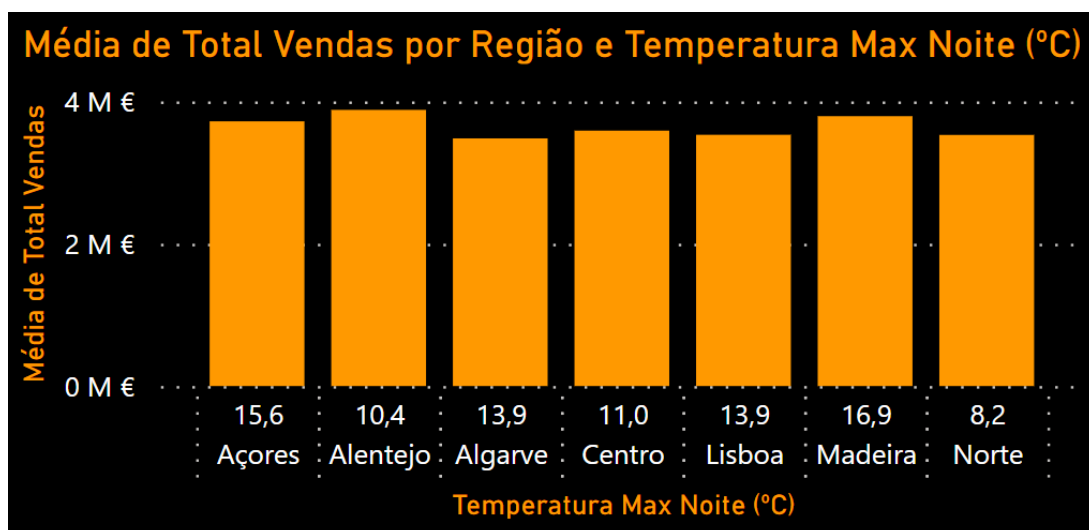
3 – Key Factors in Sales Success: Climate, Purchasing Power, or Population?

3.1 – Do harsher climate conditions promote item sales in each location, or are purchasing power and population the sole determinants of sales success or failure?

Influence of Climatic Conditions on Sales by Region:

- Maximum Night Temperature:

The region with the highest average sales is Alentejo, which has the second-lowest night temperature (10.4 °C). However, the second and third regions with the highest average sales are Madeira and the Azores, which have the highest night temperature values (16.9 °C for Madeira and 15.6 °C for the Azores). Therefore, it is concluded that the maximum night temperature does not influence sales volume, as the temperature difference between the first and second regions with the highest average sales exceeds 6°C.

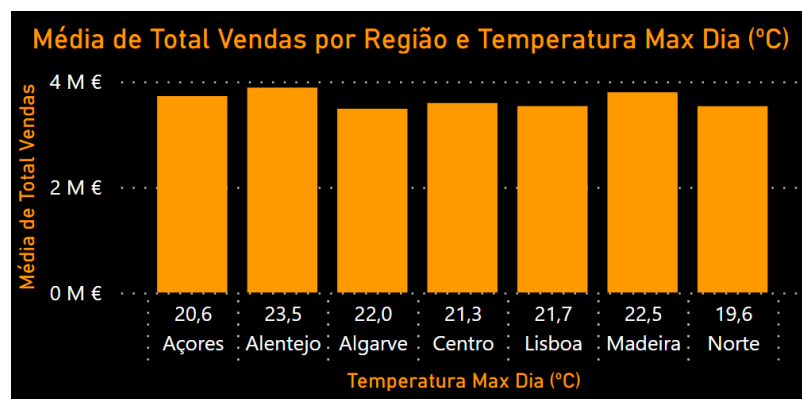


- Maximum Daytime Temperature:

The two regions with the highest sales volume are Alentejo and Madeira, which also have the highest daytime temperatures (23.5°C in Alentejo and 22.5°C in Madeira).

Even considering that the third region with the highest average sales volume, the Azores, has the second lowest daytime temperature, the data from Alentejo and Madeira suggest that the higher the maximum daytime temperature, the greater the sales volume.

It is observed that the best-selling equipment in Alentejo is the Split Air Conditioner, which makes sense given that it is the region with the highest maximum daytime temperature. In Madeira, the best-selling equipment is fans, which is also logical as Madeira has the second highest maximum daytime temperature.



- Humidity:

As previously observed, the region with the highest average sales volume is Alentejo, followed by Madeira. It is verified that these are the regions with the lowest humidity percentages (Alentejo has 70% humidity and Madeira 71% humidity).

Even considering that the third region with the highest average sales volume is the Azores, which has the highest humidity percentage. Based on the data from Alentejo and Madeira, it is observed that the lower the humidity percentage, the higher the sales volume.

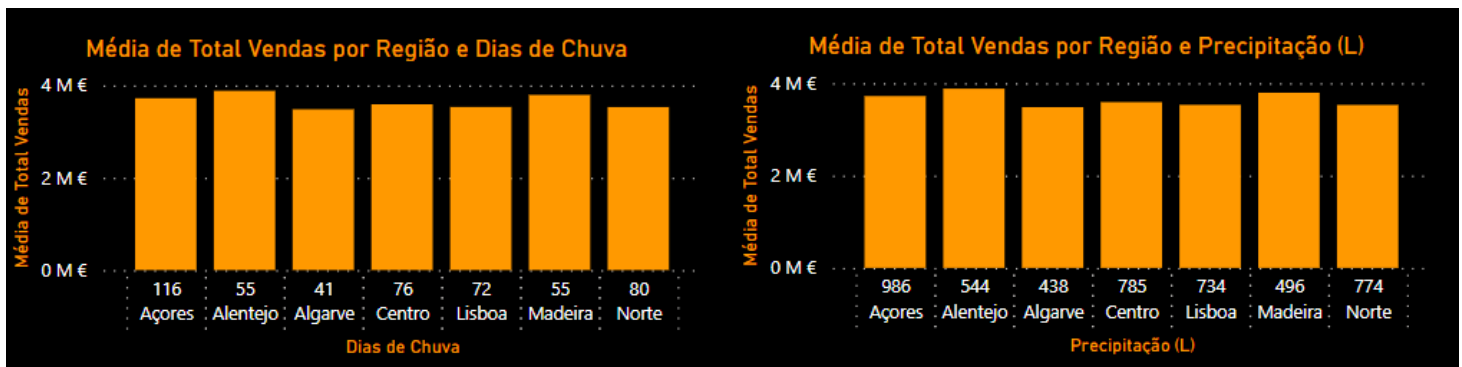
It is noted that the second most-sold equipment in Alentejo is dehumidifiers, which does not make sense as it is the region with the lowest percentage. Furthermore, Alentejo is the region with the highest average sales of dehumidifiers, despite being the region with the lowest humidity percentage.



- Rainy Days and Precipitation:

The regions with the lowest number of rainy days and precipitation are Algarve, Alentejo, and Madeira. Given that the latter two are the regions with the highest average sales volume, it is verified that the fewer the rainy days and the lower the precipitation, the higher the average sales volume. Even considering that the third region with the highest average sales volume is the Azores, which has the highest number of rainy days and the highest precipitation value.

It is verified that there is no influence of rainy days and precipitation on the type of equipment sold. This is because Madeira, despite having low precipitation values and rainy days, has a high average value of heat pump sales, and Alentejo, despite having low values of rainy days and precipitation, shows high average sales values for fireplaces, stoves, and dehumidifiers.



- Sunlight Hours:

The region with the fewest sunlight hours is the Azores, with 1971 hours, and the region with the most sunlight hours is the Algarve, which has 3212 hours. The referenced regions are not the ones with the highest average sales volumes. However, since the Algarve has the highest sunlight hours and the lowest average sales values, it can be concluded that the more sunlight hours there are, the lower the average sales volume.

Regarding the influence of the number of sunlight hours on the average sales of each type of equipment, it is not conclusive. This is because the Algarve, despite having the highest number of hours, has a heating device as the best-selling equipment, namely fireplaces and stoves. However, in the Azores, which has the fewest sunlight hours, the best-selling equipment is multi-split air conditioners, which makes sense due to the lack of sunlight.

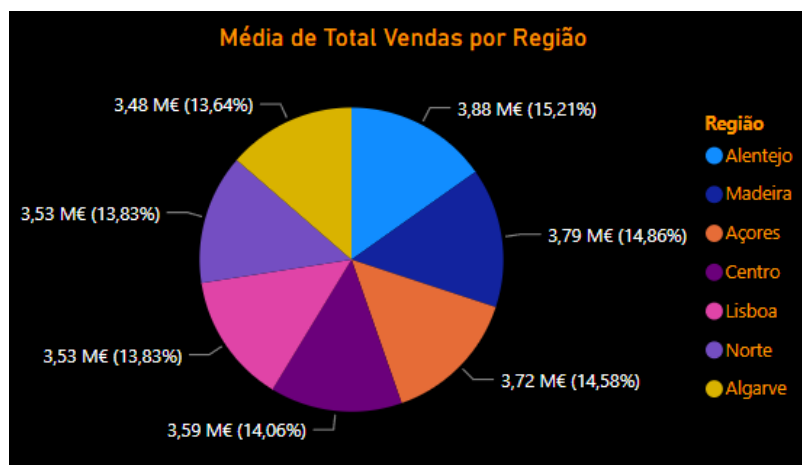


Influence of Purchasing Power on Sales by Region

The purchasing power reference is the national average (100). When analysing the data, it is verified that the only region with above-average purchasing power is the Lisbon region. However, it is not the region with the highest average sales volume.

Thus, higher purchasing power does not necessarily mean a higher average sales volume. However, looking at the data from the regions with the lowest purchasing power, which are Madeira (87.20%) and the Azores (87.40%), it is verified that these regions are the second and third highest in average sales volume. Therefore, this further reinforces the conclusion that higher purchasing power is not related to a higher average sales volume.

Regiões	Poder Compra (Percentagem)
Açores	87,40%
Alentejo	90,60%
Algarve	99,50%
Centro	89,90%
Lisboa	121,40%
Madeira	87,20%
Norte	92,90%

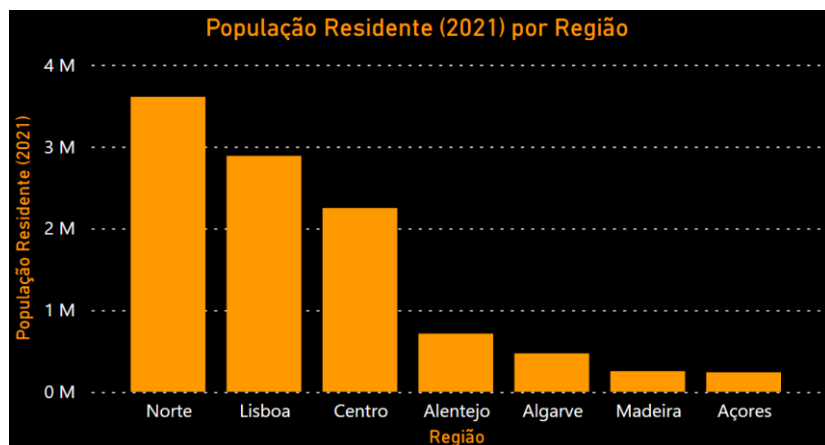


Influence of Resident Population on Sales by Region

When analysing the data, it is verified that the region with the highest resident population is the North. However, it is not the region with the highest average sales volume. However, the North having the highest resident population justifies being the region with the highest number of stores (22) and consequently, as expected, having the highest total sales.

It is important to highlight that for parameter comparisons between regions, average sales values were used, as it would not make sense to use total sales values when the number of stores per region is not equal.

Analysing the regions with the lowest resident population, which are Madeira and the Azores, and relating the fact that these same regions are the second and third with the highest average sales value, it further reinforces the conclusion that a higher resident population does not mean a higher average sales volume.



Região	População Residente (2021)
Açores	238205
Alentejo	711225
Algarve	469938
Centro	2246167
Lisboa	2884170
Madeira	252297
Norte	3605706

3.2 – Note that the Purchasing Power scale is based on the index 100. In other words, a value above 100 indicates that the municipality has a purchasing power higher than the national average (100). How can this scale/measurement be applied to other variables?

To apply this scale/measurement to other variables, the following procedure should be followed:

1. Select the variable of interest for analysis (e.g., fixed cost per store).
2. Calculate the total average of the variable – this corresponds to the index 100 (e.g., average fixed costs per store).
3. Perform a simple rule of three (example for fixed costs):
Average fixed costs \leftrightarrow 100%
Fixed costs of the store \leftrightarrow X
$$X = (\text{Fixed costs of the store} * 100) / \text{Average fixed costs}$$
4. Draw conclusions, considering that values below 100% are below the average and vice versa. Therefore, the further the percentage value is from 100%, the greater the deviation. In this example, a store with fixed costs above 100% will need to reduce expenses, while a store below the average value has greater financial flexibility in terms of fixed costs.

3.3 – What variables can you include in a regional analysis? And at the municipal level?

For this report, I focused the analysis on regions rather than municipalities, as my basis was the initial question regarding the possible influence of variables (climate, purchasing power, and resident population) on sales by region.

Nevertheless, I included a list of municipalities for the variables of purchasing power and resident population. This can be useful when deciding about where to open a new store within a region. It allows for identifying which municipality within a region has a higher or lower population and where purchasing power is stronger or weaker.

Even within a region, it is interesting to observe the differences in variables (fixed costs, sales) by store in each municipality, allowing for comparisons and conclusions that can support decision-making and the implementation of specific measures.

3.4 – How would you calculate the profit margin of these products for each store?

To calculate the profit margin, I followed these steps:

1. Calculate the total sales/selling price (sum of all sales of various products for each store).
2. Calculate the cost price of the product (selling price divided by 1.33), as we know that the selling price is always 33% above the cost price.
3. Calculate fixed costs (sum of store rent, materials, other expenses, and HR salaries).
4. Calculate profit:

$$\text{Profit} = \text{Selling price} - \text{Cost price} - \text{Fixed costs}$$

3.5 – And how would you include it in the comparison with other variables?

In the comparison with variables, it is through profit that it is possible to verify which stores are generating revenue (by presenting a positive profit value) and which ones will need possible restructuring (by presenting a negative profit value).

It is important to verify the factors associated with certain stores presenting negative profits. These being the selling price, the cost price, and fixed costs.

Regarding the selling price, the possibility would be to increase the percentage of 33%, but a calculated increase, taking into consideration that this price increase could lead to a decrease in the number of sales.

In the cost price, the possibility would be to change suppliers that offer lower prices, taking into consideration that the quality of the sold equipment remains the same. If there is a possibility of a quality change, it would be necessary to analyse the sales strategy. Whether it would be more profitable to sell lower-quality products at lower prices and attract more customers or to have good quality, higher prices, and fewer customers.

Analysing fixed costs, we would verify parameters such as store rent, materials, salaries, and others (which are not described in this example). In store rent, the possibility would be relocating the store to a place where rent is lower. But this location change would have several factors that might not be beneficial (renovations in the new space, loss of customers accustomed to the old location, and in the new location, there might be more competitor stores). In materials, it would be the reduction of quality or buying cheaper materials. In human resources, it would be the reduction of salaries or the reduction of the number of store employees.

Therefore, the management should focus on stores with negative profit and verify the referenced factors above that can be changed.

3.6 – What tables in report format would you include to facilitate data understanding?

Tables are not the easiest elements to interpret, especially when they have many rows or columns. However, they are great for containing data that complement the information in graphs. Additionally, one of the ways to make tables more visible and useful is by applying filters according to the variable being analysed.

Considering the multiple line card as tables, in this work I used:

- On the first page, 5 multiple line cards showing the total sales, total quantities sold, total fixed costs, total profit, and total stores per region. Since there are only 7 regions under study, this type of visual element is easy to analyse and demonstrates the variation of parameters by region.
- On the second, third, and fourth pages, I used the table of average equipment sales by region. On these pages, the variable being studied is sales, where we analyse which factors may have an influence. As such, I used this table to demonstrate how the average sales of equipment vary by region depending on climate (second page), purchasing power (third page), and resident population (fourth page).
- On the third page, I used a table of regions with their respective purchasing power values, even though there is a corresponding graph for the same parameters. On the fourth page, I applied the same reasoning for the resident population parameter. If I placed the corresponding values on each bar, the graph would become less readable.
- On the third and fourth pages, I included a multiple line card of the parameter to be analysed by the municipality. On the third page, it is purchasing power by municipality, and on the fourth page, it is the resident population by municipality. These cards are in list format, as they are useful for checking information from various municipalities within each region.
- On the fifth page, which refers to profit by region and by stores, I used two multiple line cards. One of the cards shows the stores and respective municipalities where profit was greater than €350000 (applying a filter so that this type of table does not become unreadable), to get an idea of the stores with the highest profit. The second card shows all stores and their respective municipalities where profit was negative, meaning stores that may need restructuring.

Thus, I find that the use of tables or graphs varies depending on the ease of interpretation for each person. Some people find it easier to interpret graphical representations, while others prefer detailed and organized data in tables. The most important thing is that the information and its interpretation reach the target audience effectively.

3.7 – How many report pages would you create? For what purpose?

I created 5 report pages, with the first being a summary and the other 4 focusing on the influence of certain parameters on variables.

On the first page, my goal was to summarize total sales, quantities sold, fixed costs, profit, and stores in each region, as well as the sum of these totals. This way, the target audience gains an understanding of the number of stores, sales, costs, and associated profits in each region.

On the second page, I included the parameters with the objective of answering whether sales are influenced by climatic conditions. To do this, I inserted the 6 climate condition parameters according to the average sales, along with a table to analyse the influence of climate on sales for each type of equipment.

The third page aims to determine whether purchasing power in each region and municipality influences sales. The fourth page presents elements to assess the possible influence of the resident population on sales in each region and municipality.

The fifth page aims to show stores with negative profit, stores with the highest profit, and profit variation by region. This allows for identifying which regions and stores may require restructuring decisions.

3.8 - What graphs would you use?

Graphs are highly useful visual elements as they make data interpretation easier. However, they can become unclear when too many variables are included, or when the chosen type of graph is not the most appropriate for the parameter being analysed.

On the second page, about climate, I used 6 graphs, one bar chart for each climate condition variable, where the average total sales varied according to the region and the climatic condition of that region.

On the third page, I used a bar chart showing purchasing power by region to identify which region has the highest purchasing power, as well as a pie chart for the total average sales by region.

On the fourth page, I also used a bar chart showing the resident population per region to see which region has the largest resident population, along with another pie chart for the total average sales by region.

On the fifth page, I used a pie chart for profit by region.

When only a few parameters were analysed, I used a pie chart, as it allows for quick interpretation.

When I had to introduce more variables, I used bar charts.

Ultimately, whether using a single graph with multiple parameters or multiple graphs for each parameter, the goal is for the interpretation of the analysed data to remain the same.

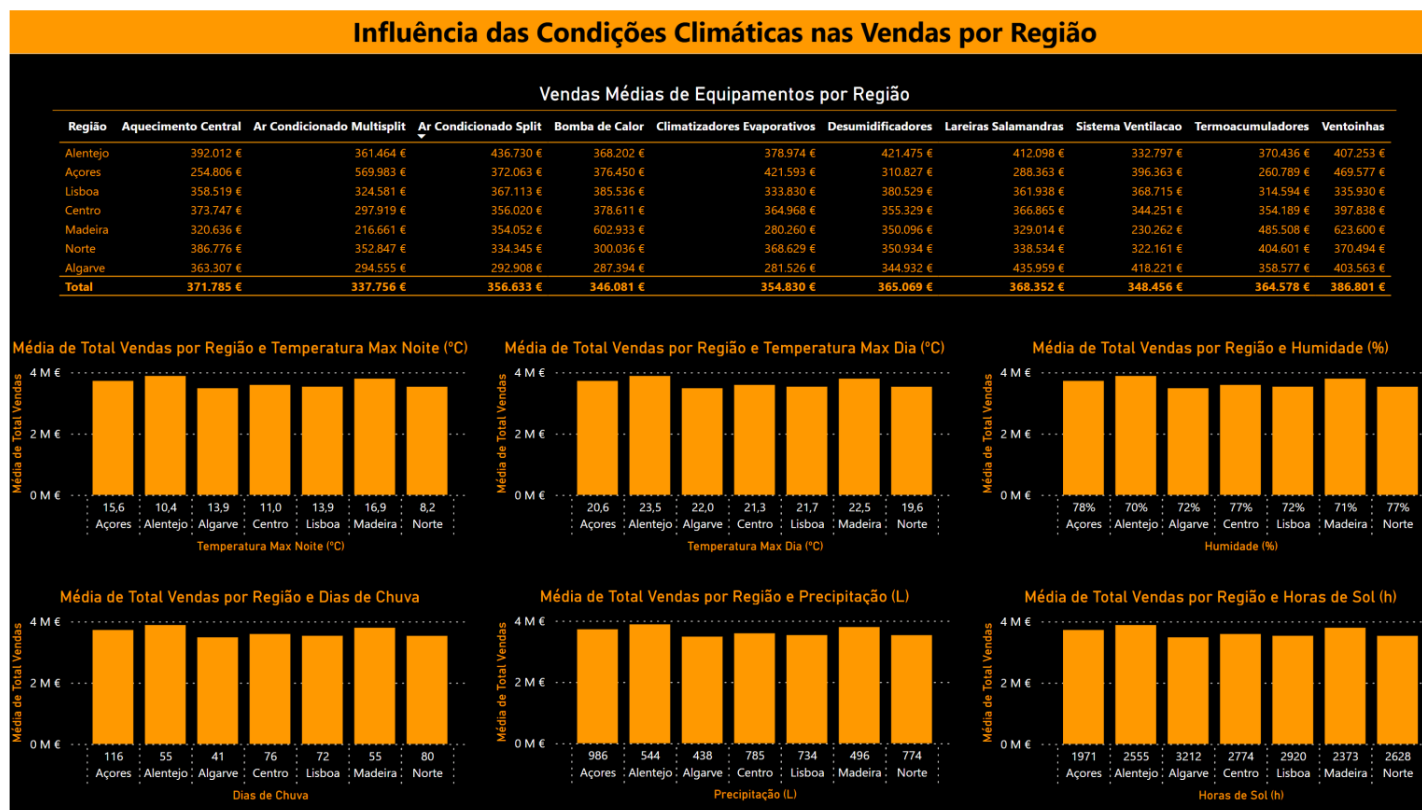
4 – Share

Below is a preview of the report pages:

Page 1 - Summary of Totals (sales, costs, profit, and stores by region).

Resumo - Totais por Região				
Total de Vendas	Total de Quantidades Vendidas	Total de Custos Fixos	Total de Lucro	Total de Lojas
Norte 88.233.919,18 € Total de Vendas	Norte 138499 Total de Quantidades Vendidas	Norte 17.974.074,00 € Total de Custos Fixos	Norte 3.918.552,56 € Total de Lucro	Norte 25 Total de Lojas
Centro 61.025.540,43 € Total de Vendas	Centro 97385 Total de Quantidades Vendidas	Centro 13.420.181,00 € Total de Custos Fixos	Alentejo 3.595.198,25 € Total de Lucro	Centro 17 Total de Lojas
Alentejo 46.577.290,19 € Total de Vendas	Alentejo 72351 Total de Quantidades Vendidas	Lisboa 10.055.628,00 € Total de Custos Fixos	Algarve 2.063.702,14 € Total de Lucro	Lisboa 13 Total de Lojas
Lisboa 45.906.696,86 € Total de Vendas	Lisboa 67216 Total de Quantidades Vendidas	Alentejo 7.961.573,00 € Total de Custos Fixos	Centro 1.721.494,45 € Total de Lucro	Alentejo 12 Total de Lojas
Algarve 31.328.468,95 € Total de Vendas	Algarve 51069 Total de Quantidades Vendidas	Algarve 5.709.527,00 € Total de Custos Fixos	Lisboa 1.334.755,43 € Total de Lucro	Algarve 9 Total de Lojas
Açores 11.162.441,52 € Total de Vendas	Açores 18756 Total de Quantidades Vendidas	Açores 1.505.063,00 € Total de Custos Fixos	Açores 1.264.565,35 € Total de Lucro	Açores 3 Total de Lojas
Madeira 3.793.022,69 € Total de Vendas	Madeira 7678 Total de Quantidades Vendidas	Madeira 903.447,00 € Total de Custos Fixos	Madeira 37.678,93 € Total de Lucro	Madeira 1 Total de Lojas
288,03 M€ Total de Vendas	453 K Total de Quantidades Vendidas	57,53 M€ Total de Custos Fixos	13,94 M€ Total de Lucro	80 Total de Lojas

Page 2: Influence of Climate on Sales

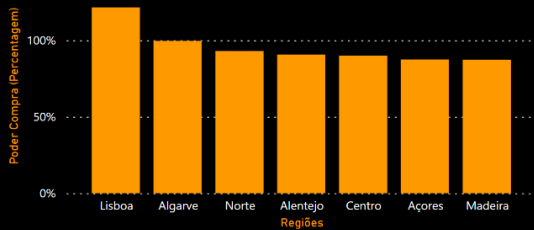


Influência do Poder de Compra nas Vendas por Região

Vendas Médias de Equipamentos por Região

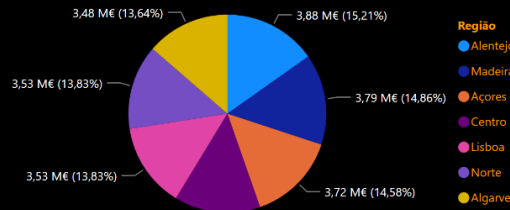
Regiões	Aquecimento Central	Ar Condicionado Multisplit	Ar Condicionado Split	Bomba de Calor	Climatizadores Evaporativos	Desumidificadores	Lareiras Salamandras	Sistema Ventilacao	Termoacumuladores	Ventoinhas
Alentejo	392.012 €	361.464 €	436.730 €	368.202 €	378.974 €	421.475 €	412.098 €	332.797 €	370.436 €	407.253 €
Açores	254.806 €	569.983 €	372.063 €	376.450 €	421.593 €	310.827 €	288.363 €	396.363 €	260.789 €	469.577 €
Lisboa	358.519 €	324.581 €	367.113 €	385.536 €	333.830 €	380.529 €	361.938 €	368.715 €	314.594 €	335.930 €
Centro	373.747 €	297.919 €	356.020 €	378.611 €	364.968 €	355.329 €	366.865 €	344.251 €	354.189 €	397.838 €
Madeira	320.636 €	216.661 €	354.052 €	602.933 €	280.260 €	350.096 €	329.014 €	230.262 €	485.508 €	623.600 €
Norte	386.776 €	352.847 €	334.345 €	300.036 €	368.629 €	350.934 €	338.534 €	322.161 €	404.601 €	370.494 €
Algarve	363.307 €	294.555 €	292.908 €	287.394 €	281.526 €	344.932 €	435.959 €	418.221 €	358.577 €	403.563 €
Total	371.785 €	337.756 €	356.633 €	346.081 €	354.830 €	365.069 €	368.352 €	348.456 €	364.578 €	386.801 €

Poder Compra (Porcentagem) por Regiões



Regiões	Poder Compra (Porcentagem)
Açores	87,40%
Alentejo	90,60%
Algarve	99,50%
Centro	89,90%
Lisboa	121,40%
Madeira	87,20%
Norte	92,90%

Média de Total Vendas por Região



Poder Compra (Porcentagem) por Municípios

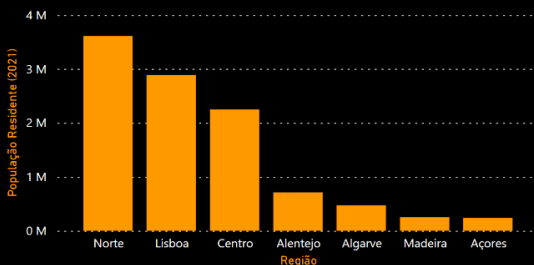
Lisboa	186,30	Poder Compra (Porcentagem)
Oeiras	165,50	Poder Compra (Porcentagem)
Porto	147,60	Poder Compra (Porcentagem)
Cascais	121,80	Poder Compra (Porcentagem)
Sines	120,30	Poder Compra (Porcentagem)
Coimbra	119,80	Poder Compra (Porcentagem)

Influência da População nas Vendas por Região

Vendas Médias de Equipamentos por Região

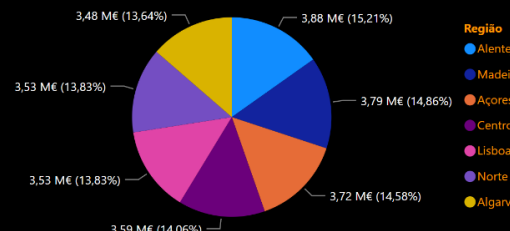
Regiões	Aquecimento Central	Ar Condicionado Multisplit	Ar Condicionado Split	Bomba de Calor	Climatizadores Evaporativos	Desumidificadores	Lareiras Salamandras	Sistema Ventilacao	Termoacumuladores	Ventoinhas
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População Residente (2021) por Região



Região	População Residente (2021)
Açores	238205
Alentejo	711225
Algarve	469938
Centro	2246167
Lisboa	2884170
Madeira	252297
Norte	3605706

Média de Total Vendas por Região



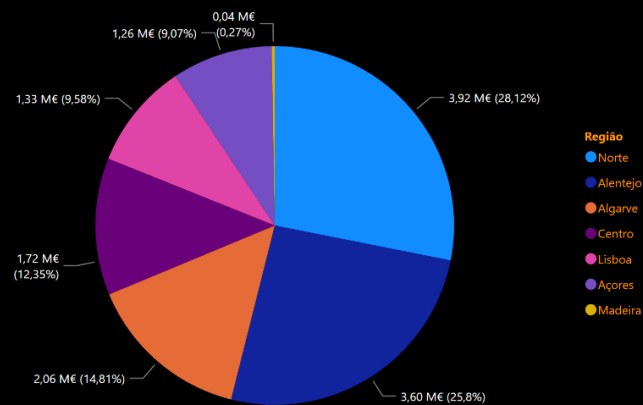
População Residente (2021) por Municípios

Lisboa	547010	População Residente (2021)
Sintra	387196	População Residente (2021)
Vila Nova de Gaia	305429	População Residente (2021)
Porto	234438	População Residente (2021)
Cascais	214462	População Residente (2021)
Loures	202660	População Residente (2021)

Lucro

Lucro por Região

LojaID	Lucro	Município
41	773.916,46 €	Lagoa
47	739.145,46 €	Angra do Heroísmo
58	709.731,69 €	Braga
53	683.358,68 €	Lisboa
33	644.545,70 €	Ponte de Sor
32	613.833,26 €	Beja
48	547.102,06 €	Évora
63	543.507,76 €	São Brás de Alportel
49	523.356,84 €	Lisboa
37	511.975,48 €	Évora
50	483.803,22 €	Porto
76	481.599,78 €	Melgaço
19	477.670,97 €	Coimbra
15	467.107,24 €	Leiria
75	466.748,17 €	Torres Vedras
44	464.135,05 €	Guimarães
45	459.018,94 €	Vila Real
79	450.143,57 €	Porto
68	399.481,88 €	Vila Franca de Xira
28	367.650,99 €	Sines
Total	10.807.833,20 €	



LojaID	Lucro	Município
30	-494.304,91 €	Covilhã
55	-419.579,26 €	Lisboa
21	-322.601,64 €	Guimarães
27	-322.271,37 €	Setúbal
16	-277.164,83 €	Caldas da Rainha
17	-275.920,74 €	Figueira da Foz
73	-247.317,13 €	Santa Maria da Feira
72	-240.210,34 €	Cabeceiras de Basto
67	-231.523,09 €	Póvoa de Varzim
38	-200.200,02 €	Chaves
80	-194.871,22 €	Viana do Castelo
24	-188.147,32 €	Amadora
60	-185.426,53 €	Faro
29	-178.350,91 €	Tomar
64	-137.665,37 €	Torres Vedras
54	-87.447,24 €	Lisboa
51	-85.796,73 €	Porto
4	-52.589,34 €	Lisboa
26	-49.700,10 €	Seixal
11	-44.833,82 €	Beja
77	-38.596,65 €	Pombal
65	-29.052,64 €	Valença
59	-18.574,89 €	Coimbra
23	-18.227,06 €	Bragança
Total	-4.340.373,15 €	

The Power BI file used in this project can be downloaded here:

- [Click here to download the Power BI file](#)

Additionally, the full report with all analyses and insights is available for download:

- [Click here to download the PDF report](#)

5 – Conclusion

The analysis indicates that climatic conditions, particularly daytime temperature and humidity, have a significant impact on sales. However, purchasing power and the resident population are not determining factors. The evaluation of profit margins allows for the identification of stores that require adjustments to improve their financial performance.