DATA VISUALISATION

COS30045

SITUATION OF AUSTRALIAN FOOD WASTE PROBLEM

(Semester 1, 2021).

Group LA7_B4

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Website:
https://mercury.swin.edu.au/cos30045/s103111154/DataVis/FoodWasteVisualisation.html

Executive Summary

The aim of this process book is to guide the public in the processes in which was partaken for this visualisation product. This process book highlights the process of each individual aspect that went into the visualisation, from the data that was used and how it was processed, to the first and finalized designs of the visualisations themselves.

The introduction introduces the background information alongside the motivations for the creation of the visualisations, alongside the purpose and the project schedule. The second talks about data. In particular, the data sources that was used for the visualisations and how the data was processed. The third section mentions the requirements for the visualisations, whilst the last discusses the visualisation's designs, starting from the initial design to the final one for each visualisation created.

Table of Contents

I. Introduction

1.1. Background and motivation

This visualisation is made to provide information about Australian food waste problem for researchers as well as the general population. The reason for our choice of food waste as the topic for this project is because food waste cause major economic and environmental impacts not only for Australia but also for the world, for example 8% of the world greenhouse gas emissions is attributable to this type of waste (Food Waste Facts, n.d.) and until now the true scale of food waste problem has not been well researched (UNEP, 2021).

To accomplish this mission, our group will visualize the amount of food waste thrown in Australia each year and make the website accessible via Internet. This infographic could be important for the audience to understand the size and scale of the food waste problem in Australia, as well as its impact on the environment, so that they could take appropriate action to reduce the amount of food scraps being thrown to the environment each day.

1.2. Visualisation purpose

The primary objective of this visualisation is to show the following data to the users:

- The amount of food waste disposed of in Australia during the last 10 years (**the national tonnage or the amount per capita**).
- **The amount of food garbage per capita** in all states and territories of Australia based on process method (for example: disposal, recycling).
- The comparison between the **amount of food waste** that the average Australian household throws to the environment and the **average food waste per capita i**n other developed countries, **for each household** (such as Japan, France, United States or New Zealand).

These visualisations could be helpful for scientists as well as people who are interested in environmental problems to answer the following questions:

- **What is the Australia's current situation when it comes to food waste, compared with other developed countries as well as the global average?**
- **How is food waste treated in each of Australia's major states and territories?**
- **What are the changes overall to the food waste landscape in Australia as a whole?**

1.3. Project schedule

To finish the visualisation as well as the Process Book on time, our group has come to this agreement on the project's schedule:

- Week 1 – Week 6: Brainstorming the ideas for the infographics, beginning to sketch the design ideas.
- Week 7: Beginning to create the Process Book and processing the databases needed for the infographic.
- Week 8: Finishing the search of database, beginning the programming of the visualisation.
- Week 9 – Week 11: Creating the necessary visualisation for the project, doing the user validation (if needed, in Week 11).
- From Week 12 to the due date: Finishing the Process Book and the infographics.

II. Data

2.1. Data source

To create the visualisation needed, our group must use these databases:

- National Waste Report 2020, Department of Agriculture, Water, and the Environment: https://www.environment.gov.au/protection/waste/national-waste-reports/2020

This database is a table mentioning the amount of waste in all distinct types being thrown to the environment in Australian states and territories, from 2006 to 2019. It consists of the following attributes:

Attributes	Definition	Type
Year	The financial year that is reported and analysed in the waste report (for example: 2006-2007, 2008-2009).	Interval.
Jurisdiction	The jurisdiction where the waste is managed and processed (including Australia as a whole and its states/territories).	Nominal
Category	The origin and characteristics of waste (agriculture and fisheries, organics, etc.)	Nominal
Type	The detailed type of waste (food organics, oil, inorganic chemicals, etc.)	Nominal
Classification	How the waste data could be observed (in total or in diverse types)	Nominal
Total type	The type of total amount of waste (for example: agricultural and fishing total,	Nominal

	organics total). It could be chosen if the classification is “total.”	
Stream	The source of food waste (including municipal solid waste (MSW), commercial and industrial(C&I), construction and demolition (C&D)). A “Total” choice is used to combine all three types.	Nominal
Management	How the waste is managed (for example: energy from waste facility, landfill, recycling.)	Nominal
Fate	The treatment for waste (Disposal, energy recovery, recycling, etc.)	Nominal
Tonnes	The tonnage of waste in each of mentioned categories.	Ratio (quantitative)

To create the visualisation, we must filter the database so the “Category” and “Type” columns could be “Organics” and “Food organics” respectively. Also, the stream column is fixed on “Total,” so we could have the total amount of waste treated from different sources and less distraction when cleaning the dataset. All other parts of the dataset are not included since they are not related to the topic of the visualisation.

Year	Jurisdicti	Category	Type	Classificati	Total type	Strear	Management	Fate	Tonnes	Sub-stream
2018-2019	ACT	Organics	Food organics	Type		Total	Energy from waste facility	Energy recovery	0	08 Total
2018-2019	ACT	Organics	Food organics	Type		Total	Landfill	Disposal	29,737	08 Total
2018-2019	ACT	Organics	Food organics	Type		Total	Landfill	Energy recovery	22,618	08 Total
2018-2019	ACT	Organics	Food organics	Type		Total	Recycling	Recycling	0	08 Total
2018-2019	NSW	Organics	Food organics	Type		Total	Energy from waste facility	Energy recovery	43,968	08 Total
2018-2019	NSW	Organics	Food organics	Type		Total	Landfill	Disposal	635,040	08 Total
2018-2019	NSW	Organics	Food organics	Type		Total	Landfill	Energy recovery	219,684	08 Total
2018-2019	NSW	Organics	Food organics	Type		Total	Recycling	Recycling	383,290	08 Total
2018-2019	NT	Organics	Food organics	Type		Total	Energy from waste facility	Energy recovery	0	08 Total
2018-2019	NT	Organics	Food organics	Type		Total	Landfill	Disposal	49,976	08 Total

Figure 1: A part of the final dataset of National Waste Report, showing how the information is filtered for the infographic.

- National, state and territory population, Australian Bureau of Statistics: https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/sep-2020/310104.xls.

This database is a table about the population changes in Australia, in terms of gender. It contains data for estimated resident population for male, female, and the total population in Australia, as well as in all states and territories. All these data are quantitative (ratio) and were collected for every quarter of a year, from June 1981 to September 2020.

For the topic of the visualisation, we use the data for estimated total resident population for both genders in June of 2007, 2009 to 2011, and from 2013 to 2019. That is because the data in

National Waste Report were only for these financial years (like 2006-2007), so we choose the end of each financial year as the benchmark, and there are missing years in the dataset (in 2007-2008 and from 2011 to 2013). Also, for the comparison between food waste per capita of states and territories, their columns for estimated population for both genders are needed, but only for June 2019.

- UNEP Food Waste Index Report 2021: https://wedocs.unep.org/bitstream/handle/20.500.11822/35355/FWD.xlsx

This is a report of food waste situation worldwide. It includes three main tables for household, food service and retail estimates on amount of food waste per capita in each country. In this report, the table for household estimate will be used, with these attributes:

Attributes	Definition	Type
M49 code	The code assigned by researchers for each country for statistical use.	Nominal
Country	Country's name	Nominal
Household food waste estimate (kg/per capita/year)	Food waste per capita form household.	Ratio (quantitative)
Household food waste estimate(tons/year)	Total amount of food waste from household	Ratio (quantitative)
Confidence in estimate	The confidence for the data received in each country (High/Medium/Low/Very low/No estimate)	Nominal

For the comparison between Australia and other developed countries, the "country" and "household food waste estimate (kg/per capita/year)" for Australia and these nations: Austria, Denmark, Netherlands, New Zealand, Norway, Sweden, United Kingdom, USA, Japan, Poland, Finland, Italy, France, Belgium will be used, because:

+ These are all developed countries with the socio-economic development being relatively similar to Australia, so there would be less influence from economic conditions to the amount of food waste, making the comparison more meaningful.

+ These mentioned countries have a high or medium confidence in estimate, therefore the comparison could give more accurate results.

We would also compare these countries to the world average (74 kg/capita/year), that could be found in the PDF file of the report (https://wedocs.unep.org/bitstream/handle/20.500.11822/35280/FoodWaste.pdf , p.70)

	Global average food waste (kg/capita/year)	2019 total (million tonnes)
Household	74	569
Food service	32	244
Retail	15	118
Total	121	931

Figure 2: The average amount of food waste per capita worldwide. Only the household food waste will be used in this analysis.

- Australia GeoJSON map, Gerardo Furtado: https://gist.githubusercontent.com/GerardoFurtado/02aa65e5522104cb692e/raw/8108fbd4103a827e67444381ff594f7df8450411/aust.json

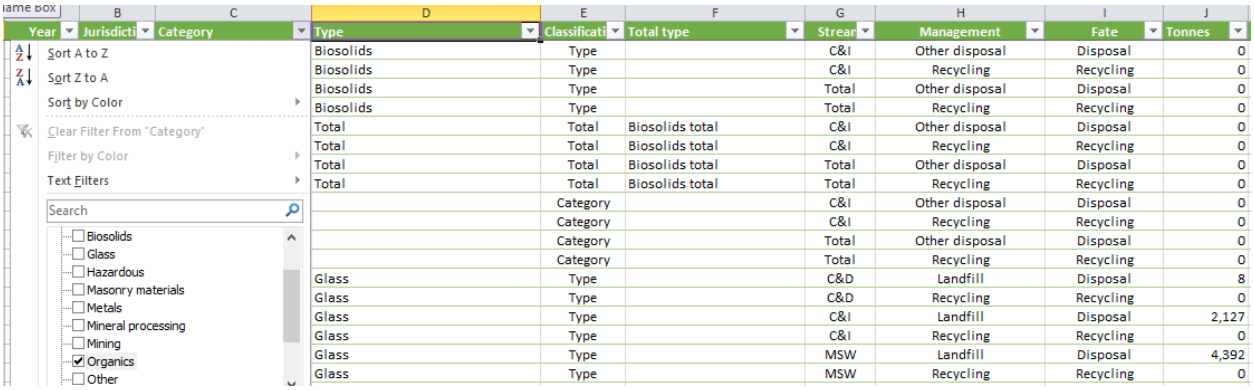
This is a GeoJSON file containing the name, the geometric type, and the coordinates of all Australian states and territories. Due to the demand for all components of this file to be loaded in a choropleth, nothing from this file will be filtered or need to be processed.

Figure 3: A part of the GeoJSON map of Australia (put in a JSON viewer).

2.2. Data processing

2.2.1. For National Waste Report

To extract the data needed for the chart, first we need to filter the data to meet the criteria mentioned in 2.1. By choosing in the dropdown “Organics,” “Food organics” and “Total” in the columns of “Category,” “Type” and “Stream” respectively, the dataset will be processed to return the result like Figure 3.



Year	Jurisdicti	Category	Type	Classificati	Total type	Strean	Management	Fate	Tonnes
			Biosolids	Type		C&I	Other disposal	Disposal	0
			Biosolids	Type		C&I	Recycling	Recycling	0
			Biosolids	Type		Total	Other disposal	Disposal	0
			Biosolids	Type		Total	Recycling	Recycling	0
			Total	Total	Biosolids total	C&I	Other disposal	Disposal	0
			Total	Total	Biosolids total	C&I	Recycling	Recycling	0
			Total	Total	Biosolids total	Total	Other disposal	Disposal	0
			Total	Total	Biosolids total	Total	Recycling	Recycling	0
				Category		C&I	Other disposal	Disposal	0
				Category		C&I	Recycling	Recycling	0
				Category		Total	Other disposal	Disposal	0
				Category		Total	Recycling	Recycling	0
			Glass	Type		C&D	Landfill	Disposal	8
			Glass	Type		C&D	Recycling	Recycling	0
			Glass	Type		C&I	Landfill	Disposal	2,127
			Glass	Type		C&I	Recycling	Recycling	0
			Glass	Type		MSW	Landfill	Disposal	4,392
			Glass	Type		MSW	Recycling	Recycling	0

Figure 4: An example of the processing method for National Waste Report.

The total amount of food waste in Australia is also necessary for the visualisation, so to find it, for each financial year mentioned in the report, it is important to calculate the sum of food organics waste in all Australian states and territories. (While as mentioned in 2.1, Australia is in the “jurisdiction” column, the report contains the national waste data only for mining, mineral

processing, and agriculture and fisheries). Then the food waste per capita for each category is found by this formula:

Amount of food waste per capita (kg/year) = Amount of food waste (tonnes) / Population (people) × 1000.

The result of the calculation could be seen in Figure 3.

Years	Energy Recovery	Disposal	Recycling	Total
2018-2019	41	109	24	174
2017-2018	46	111	24	181
2016-2017	47	120	24	191
2015-2016	49	117	20	186
2014-2015	43	127	21	191
2013-2014	44	150	7	201
2010-2011	41	167	2	210
2009-2010	38	180	2	220
2008-2009	40	189	1	230
2006-2007	44	190	2	236

Figure 5: The data after being put in CSV file (rounded to the nearest kilogram).

The last step is pasting the data into the code as an array containing years and the amount of food waste per capita used for energy recovery, disposal, and recycling, since the total value could be calculated in the code when the website is running. The result is displayed in Figure 5.

```
let dataset = [{Year:'2006-2007',Energy_Recovery: 44, Disposal : 190, Recycling: 2},
               {Year:'2008-2009',Energy_Recovery: 40, Disposal : 189, Recycling: 1},
               {Year:'2009-2010',Energy_Recovery: 38, Disposal : 180, Recycling: 2},
               {Year:'2010-2011',Energy_Recovery: 41, Disposal : 167, Recycling: 2},
               {Year:'2013-2014',Energy_Recovery: 44, Disposal : 150, Recycling: 7},
               {Year:'2014-2015',Energy_Recovery: 43, Disposal : 127, Recycling: 21},
               {Year:'2015-2016',Energy_Recovery: 49, Disposal : 117, Recycling: 20},
               {Year:'2016-2017',Energy_Recovery: 47, Disposal : 120, Recycling: 24},
               {Year:'2017-2018',Energy_Recovery: 46, Disposal : 111, Recycling: 24},
               {Year:'2018-2019',Energy_Recovery: 41, Disposal : 109, Recycling: 24}];
```

Figure 6: The final processed dataset in the code.

2.2.2. For the national, state and territory population report

In this report, it is necessary to filter the data needed for the visualisation (population of Australian states and territories in June 2019, as well as number of Australian residents in June

2007, 2009, 2010, 2011 and from 2013 to 2019). For these data, we only need to copy them and paste in another CSV file.

Another derived data that is needed to be created is amount of food waste per capita. To calculate that, it is important to use the same formula as in the visualisation for food waste in Australia per year.

After applying the formula in Excel, the data will be created like in Figure 6:

States	Energy Recovery	Disposal	Recycling	Total
ACT	53	70	0	123
NSW	28	80	48	156
NT	34	203	0	237
QLD	50	143	10	203
SA	36	75	7	118
Tas	47	138	0	185
Vic	51	108	14	173
WA	29	163	29	221

Figure 7: The result after calculating the amount of waste per capita (rounded to the nearest kilogram).

The last step is to convert this table to a JSON file and change the states' names so that they are the same with name of states in the GeoJSON file for Australia (as seen in Figure 3).

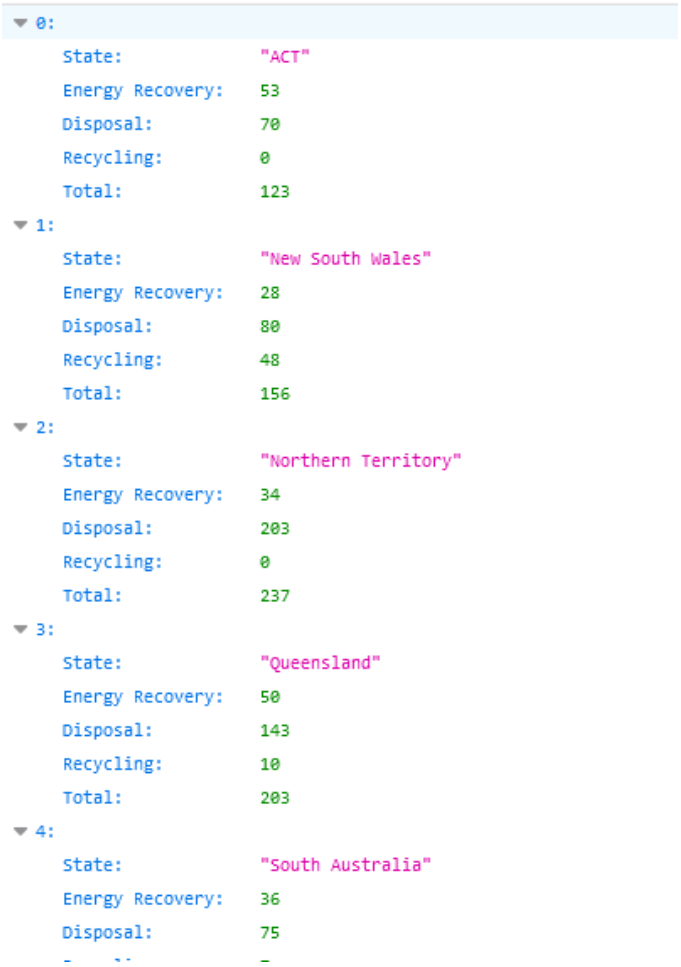


Figure 8: The final JSON file used for the visualization.

2.2.3. For the UNDP Food Waste Index Report

It is necessary to search for countries needed (in 2.1) and copy the data of each country, then pasting it in a new CSV file (as shown in Figure 9):

Country	Household_Food_Waste
Australia	102
Austria	39
Denmark	81
Netherlands	50
New Zealand	61
Norway	79
Sweden	81
United Kingdom	77
United States of America	59
Japan	64
Poland	56
Finland	65
Italy	67
France	85
Belgium	50

Figure 9: The household food waste per capita for countries used in the visualisation, in a CSV file.

Then, these data will be put on the code as two different arrays: third_countries and third_data (since this is the third file on the visualisation). It should be noted that because our data are already for the food waste per capita, therefore the unit of measurement using in this chart is kg/year.

```
const third_countries = ["Australia", "Austria", "Denmark", "Netherlands","New Zealand", "Norway",
                         "Sweden", "UK","USA","Japan","Poland","Finland","Italy","France","Belgium"]
const third_data = [102, 39, 81, 50, 61, 79, 81, 77, 59, 64, 56, 65, 57, 85, 50];
```

Figure 10: The final data processed used for the chart.

III. Requirements.

3.1. Must-have features:

For this visualisation, there are several features that could be considered necessary and without them, the project could not be progressed:

1. A chart that describes the amount of food waste thrown into environment in all of Australia year by year, including how the waste was treated (recycling, disposal, energy recovery). There should be a colour legend to help readers figure out about what colour (or symbol) representing a type of waste treatment.

2. A chart that could describe the amount of food waste per capita in each state and territory, with the amount of food waste per capita being displayed (could use tooltip or not).
3. A graph for comparison between Australia and other developed countries (as mentioned in 2.1), as well with the average amount of food waste in the world. The amount of food waste per capita for each country should be displayed for the users when being hovered.

All these requirements have been met in the due date: the first chart has shown the amount of food waste per capita in Australia year by year, with the data for waste treatment; while the second and third charts have compared of food waste per capita between Australian states and depicted a comparison between Australia and other countries in the world, with necessary data on the tooltip. All these features are described in Part IV – Visualisation design.

3.2. Optional features:

Features cited below could be considered optional:

1. For the Australian food waste chart year by year:
- The amount of food waste could be mentioned directly in each year (or by hovering in the year).
- Users could find the amount of waste in different treatment methods directly by selecting different buttons.
- The column being hovered would have a different opacity (to highlight the year being compared).
2. For the chart depicting amount of food waste per capita in each Australian state and territory:
- The name of each state could be displayed directly or in the tooltip.
- The percentage or the amount of waste for each treatment method might be mentioned when hovering on each state/territory, being split into the three types of waste (alongside the total amount).
3. For the comparison between Australia and other countries:
- The world average amount of food waste thrown (using a dotted/dashed line) could be added.
- The amount of food waste of these countries could then be sorted (in ascending or descending order).
- Like the chart for food waste in Australia year by year, each bar for the country being hovered could being highlight by a different opacity.

All optional features have been added into our visualisation and could be seen in Part IV - Visualisation design (like must-have features above). The only optional feature that is not included is the percentage of each treatment in the second chart (comparing Australian states and territories in terms of food waste), since we have decided that using the amount of food waste for each treatment type would be more appropriate. The reason for our decision could be explained in 4.2.2.

IV.Visualisation design

4.1. The graph for Australian food waste (year by year)

4.1.1. Initial designs:

In the beginning, the idea chosen for the report was a line chart that included the amount of food waste in Australia per capita each year. For this purpose, year and the amount of food waste will be encoded as position in x-axis and y-axis, respectively. The more waste was thrown out, the higher its position in the y-axis. This design, like all the others for this chart, helps users to see the true amount of food waste by hovering in each data point. The amount for each year will be put as dots connecting to each other in the graph, like in Figure 11:

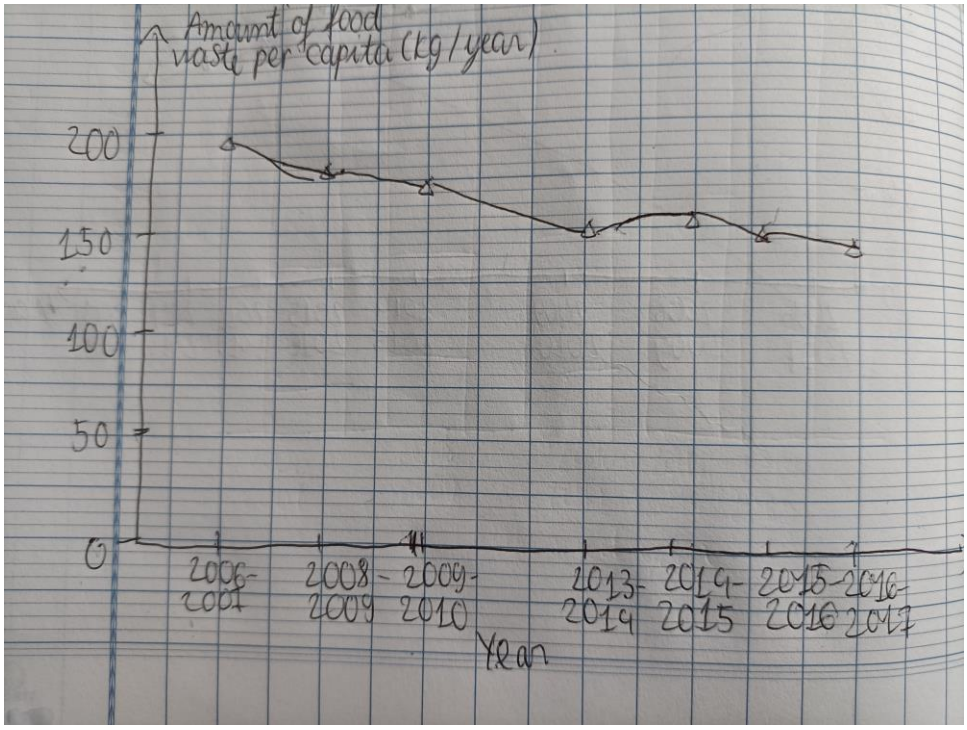


Figure 11: The sketch for the first design (Note: some years in the dataset are not displayed here).

While this design has some advantages (people could investigate the overall trend form the line, and using position in axes to indicate the amount of waste is highly effective, since the variable displayed is originally a quantitative data), there are some limitations:

+ Some of the years in the dataset are not consecutive (for example, 2006-2007 and 2008-2009 are two years apart), while others are (like 2015-2016), so displayed it in a line chart have a risk of misrepresenting the real trend.

+ The chart only provides information about the total food waste (regardless of treatment method), so users could not know about the situation when it comes to waste treatment.

As such, another design was considered: a stacked bar chart for the total amount of food waste in Australia, in which the data for recycling, energy recovery and disposal will be encoded with different colours (hues). The year and the total amount of food waste will be put in the x-axis and y-axis respectively, and data for each treatment method will be arranged from the lowest first in y-axis, up to the highest.

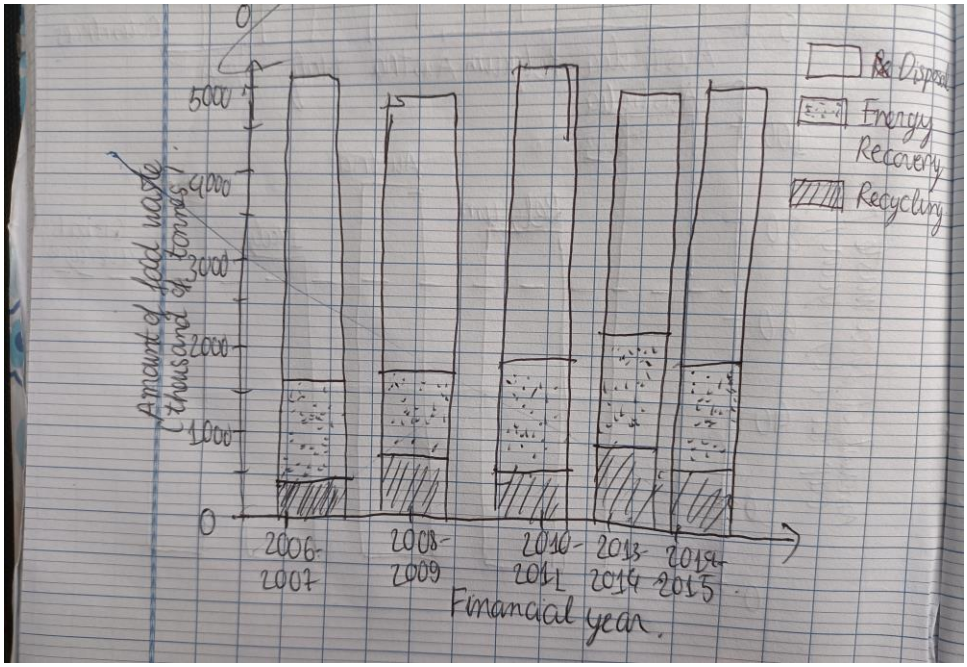


Figure 12: Second attempt on the chart's design. (Note: Each of these symbols indicates a different colour).

This design has also its own benefits (providing more information about the treatment method used, and visual encoding for qualitative data (treatments used) is effective), there are still some drawbacks:

+ This chart only showed the total amount of food waste without considering the number of people in Australia and its increase. So, while the visualisation could be helpful for scientific

purposes, it is less useful for supply information to the public, since they would not know how much food waste that each person on average thrown out, therefore they would understand less about their own action' impact on environment.

+ The arrangement of bars in the chart (from lowest to highest) does not follow the rules of thumb for the stacked bar chart (arranging values from largest to smallest) (Yi, 2019).

+ Because there is only one stacked bar chart, it is difficult for the users to compare the amount of waste in a particular treatment (like disposal or energy recovery).

Thus, the design must be changed to a final design in 4.1.2.

4.1.2. Final design:

The final design for the visualisation is a stacked bar chart displaying the amount of food waste per capita between years. Each type of treatment was encoded in a different colour, and the higher the bar, the higher the amount of food waste was treated in each method. As for the colours used in this chart, we choose a retro colour palette, with RGB encoding as: #9E9CC2 for recycling, #A17724 for energy recovery, and #383745 for disposal (as shown in Figure 13). This choice would ensure that people who are not colour-blind see a similar color to people with Deuteranopia (colour-blindness with green hues, which is the most common type of colour-blindness (Department of Health Australia, n.d.).) (Cravit, 2019), allowing for a similar experience between both types of people.

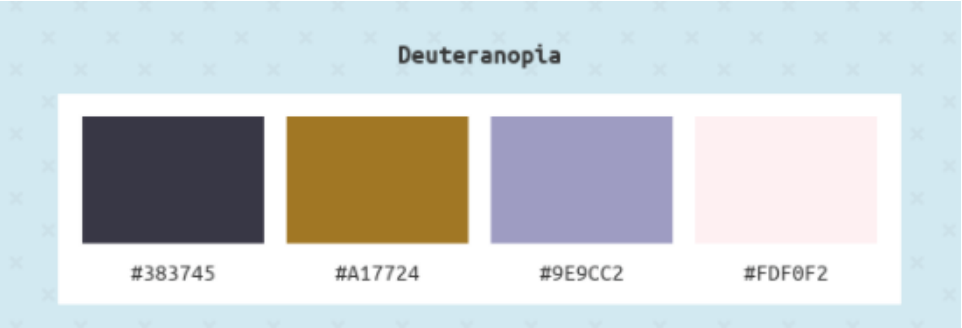


Figure 13: The colour scheme that is used in the stacked bar chart (Cravit, 2019).

The total value will be added on top of the bars, and the value on each year is also be arranged from the highest to lowest from 0 in y-axis (like in Figure 13).

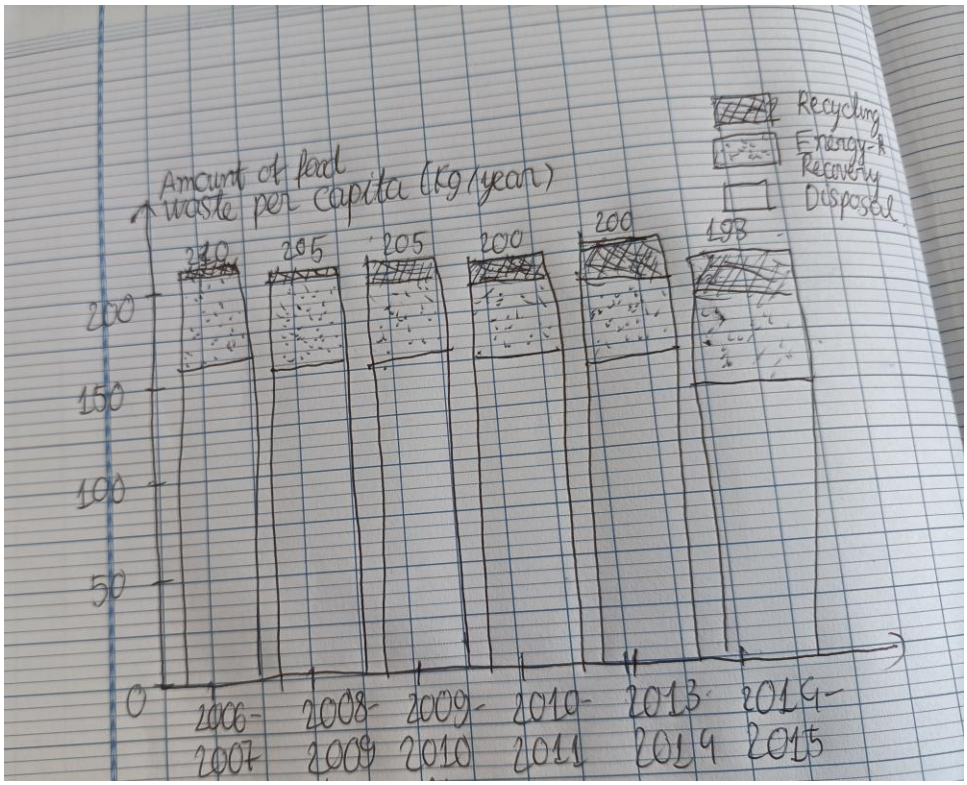


Figure 14: The final sketch for the stacked bar chart.

There would be four buttons after this chart, allowing users to look at the values for recycling, energy recovery, disposal and for all treatments. When users click on one of the “recycling,” “energy recovery,” or “disposal” buttons, a bar chart corresponding to the treatment type will be displayed, replacing the stacked bar chart. If the “all” button is clicked, then the stacked bar chart will appear, replacing the regular bar charts. Another feature worth noting is that the colour for each of these bar charts will be like the colour of its element in the stacked bar chart.

There is a transition created whilst clicking on the three buttons for the bar charts. Each of the bars would slowly speed up the change until it reaches the new value.

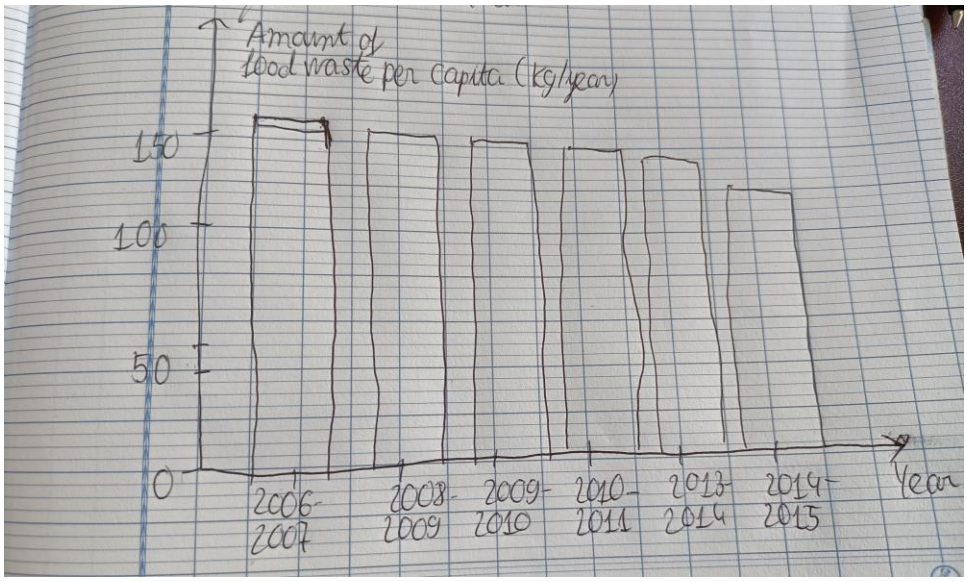


Figure 15: The bar chart displayed for food waste treated by disposal. (Note: The symbol (blank), or the colour, in this chart for disposal food waste is like in the stacked bar chart in figure 14).

This design is beneficial in many ways:

+ The visual encoding for qualitative data (the type of treatment) by colour is effective.

+ The public could understand about the impact of their actions, since all people know about the amount of food waste that they throw into the environment each year and how they are treated.

+ Users could compare the amount of food waste treated by different methods more easily by looking at their own bar chart for each method.

+ Using a transition would allow for a smooth change between the charts.

The results for this visualisation could be seen from Figure 16 to Figure 19 below.

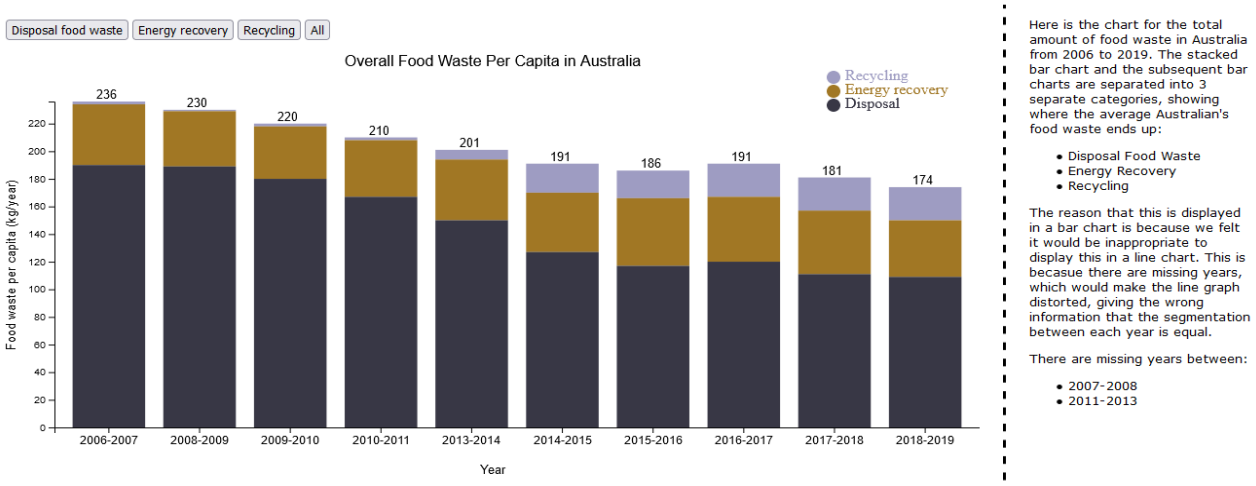


Figure 16: The final visualisation for the food waste per capita in different years in Australia (with caption).

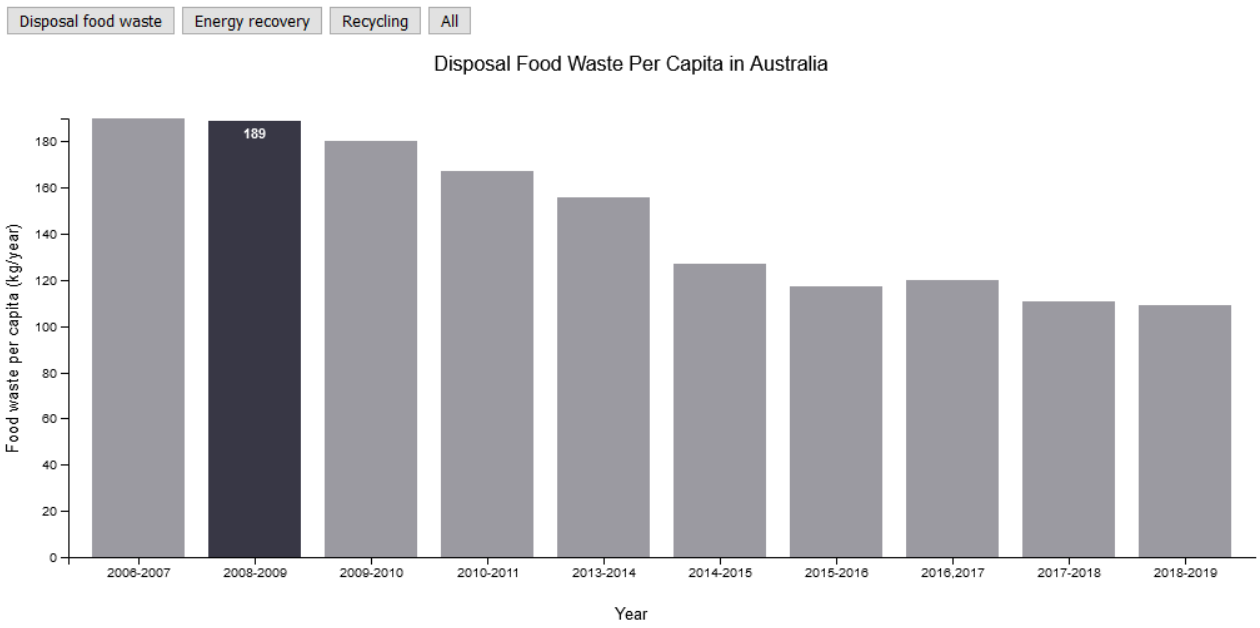


Figure 17: The result when users choose to see the amount of food waste being disposed of, per capita.

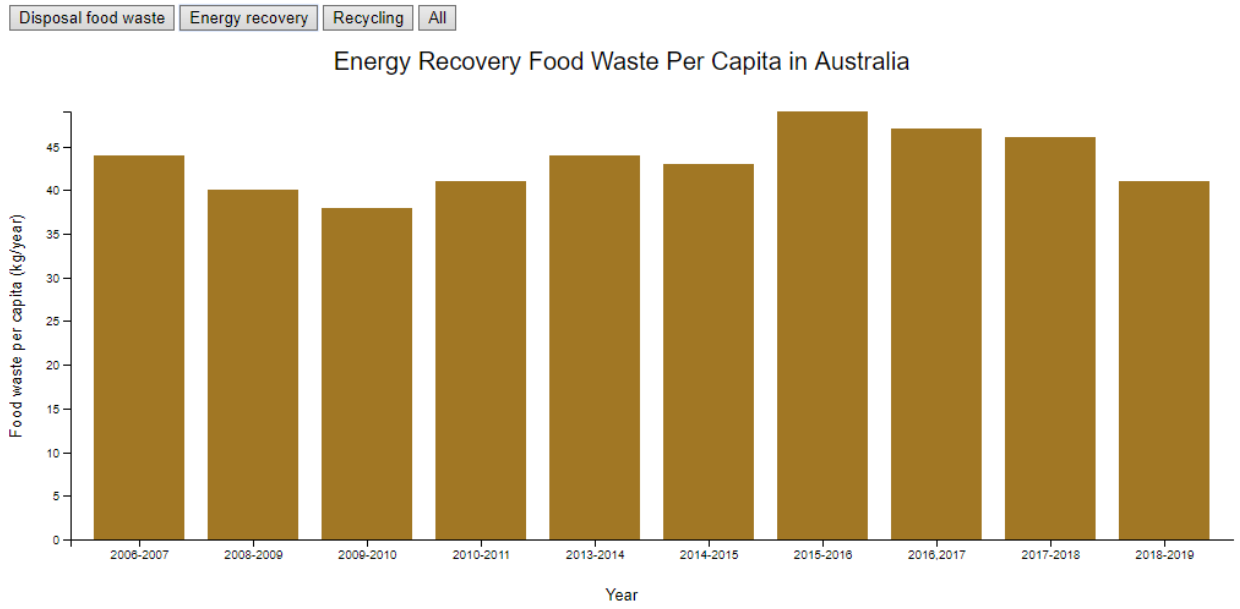


Figure 18: The result when users choose to see the amount of food waste being used for energy recovery, per capita.

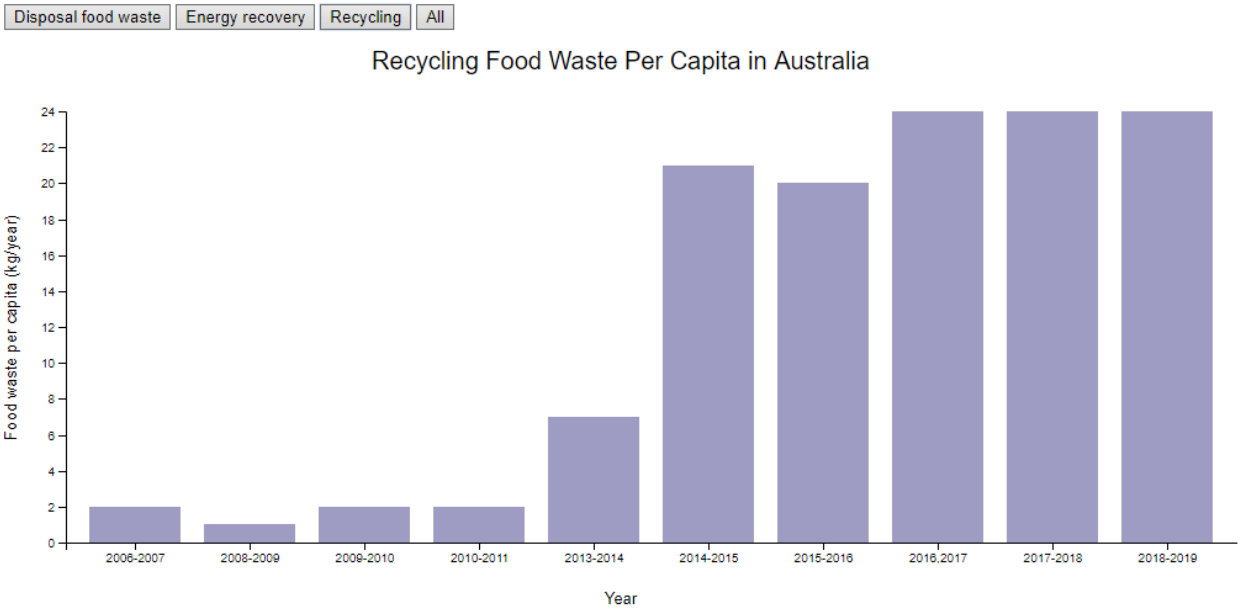


Figure 19: The result when users choose to see the amount of food waste being recycled, per capita.

4.2. The chart indicating the amount of food waste per capita for Australian states and territories

4.2.1. Initial designs

In the beginning, the idea for the chart is a series of 8 pie charts, each representing an Australian state or territory (New South Wales, Victoria, South Australia, Western Australia, Queensland, Tasmania, Northern Territory and Australian Capital Territory). Each pie chart would depict the percentage of food waste in each of three categories: recycling, energy recovery and disposal (which being encoded by hue). Meanwhile, each of the states would be encoded by its position in the chart (sorted using the amount of food waste per capita in descending order) and the higher amount of food waste per capita for a state, the larger the pie chart. In addition, when hovering in each part of the bar chart, users could see the exact percentage of each treatment type on the total amount of food waste per capita of a state. The real amount of food waste could also be seen below each of these states.

An example of what this idea could be look like is shown in Figure 20.

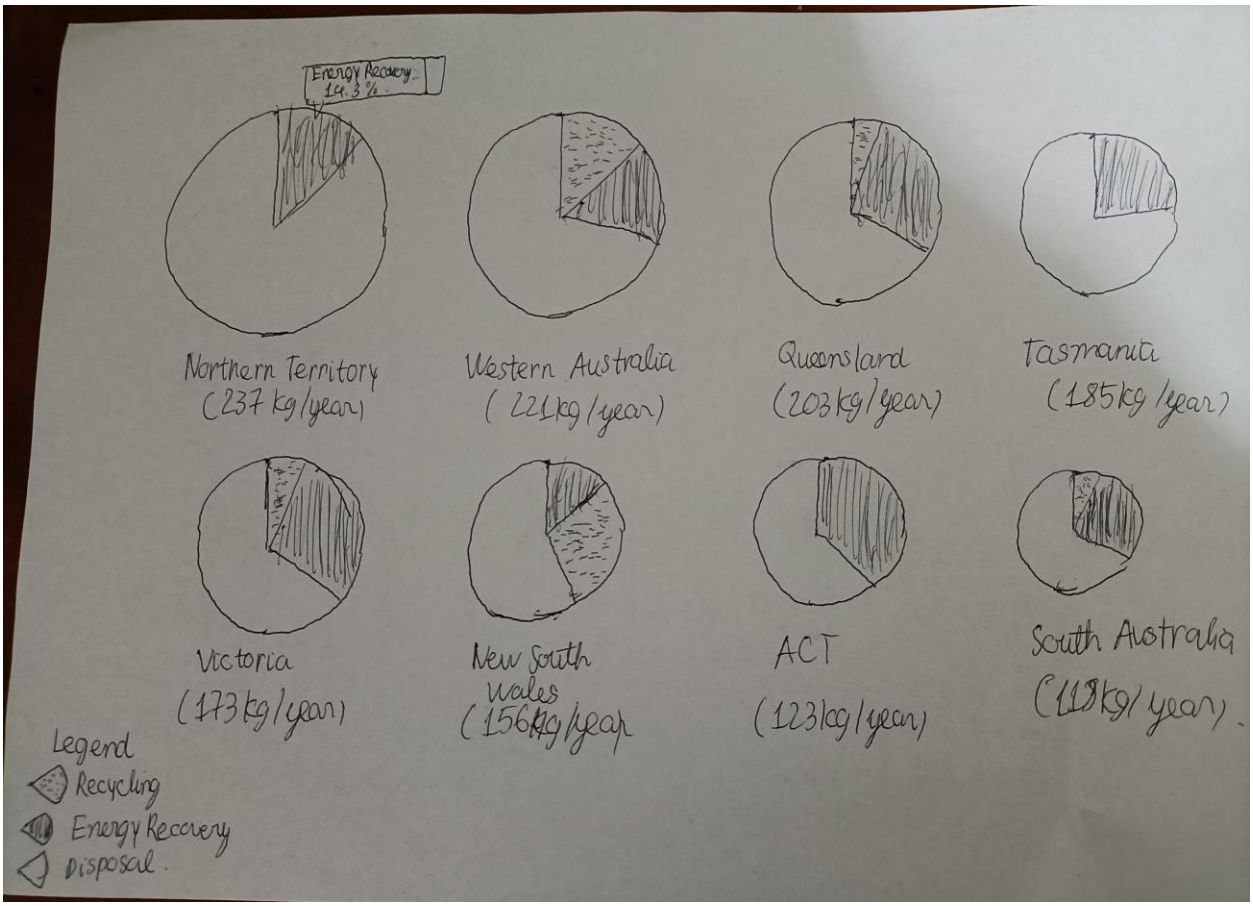


Figure 20: Draft Visualisation for the series of pie charts. (Note: Each of these symbols in the legend depicts a different colour.)

Whilst this approach has various advantages (size of pie chart is effective on encoding quantitative data like amount of waste treatment, so do hues and positions for qualitative data such as the treatment type and state, and users could know about the ratio for each treatment method), there are also numerous disadvantages:

+ Since each state and territory has a different amount of food waste per capita, comparing the percentage of food waste for each treatment type could not highlight the true amount of food waste that is used for different means.

+ This method requires the creation of 8 pie charts with a similar design, which could be time-consuming and repetitive.

Therefore, it is necessary to implement changes in this design, namely creating a chart with Australian states being at the right position and have ability to highlight both the amount of food waste for each person in total and for each treatment type. All of them have been used to create the final design in 4.2.2.

4.2.2. Final design

The final design for this chart is a choropleth which depicts an Australian map with all states and territories (borders for each state are marked as white, for a better separation between states). The amount of food waste for each state is marked by a sequential colour scale with different saturation of red colour (the colour scale is taken from ColorBrewer: https://colorbrewer2.org/#type=sequential&scheme=YlOrRd&n=6 using linear scale for state's food waste per capita, like in Figure 21). The higher the amount of food waste is, the darker the colour for each state.

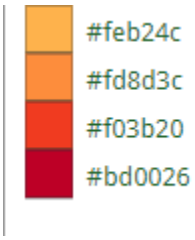


Figure 21: The colour scale (from ColorBrewer) using to encode the different amount of food waste per capita.

Moreover, similarly to the initial design in 4.2.1, users could hover in each state and territory to see the amount of food waste used for each treatment type displayed on a tooltip. In addition, there would be a colour legend beside the choropleth, with each colour hue representing an amount of food waste per capita. The final design could be seen in Figure 22.

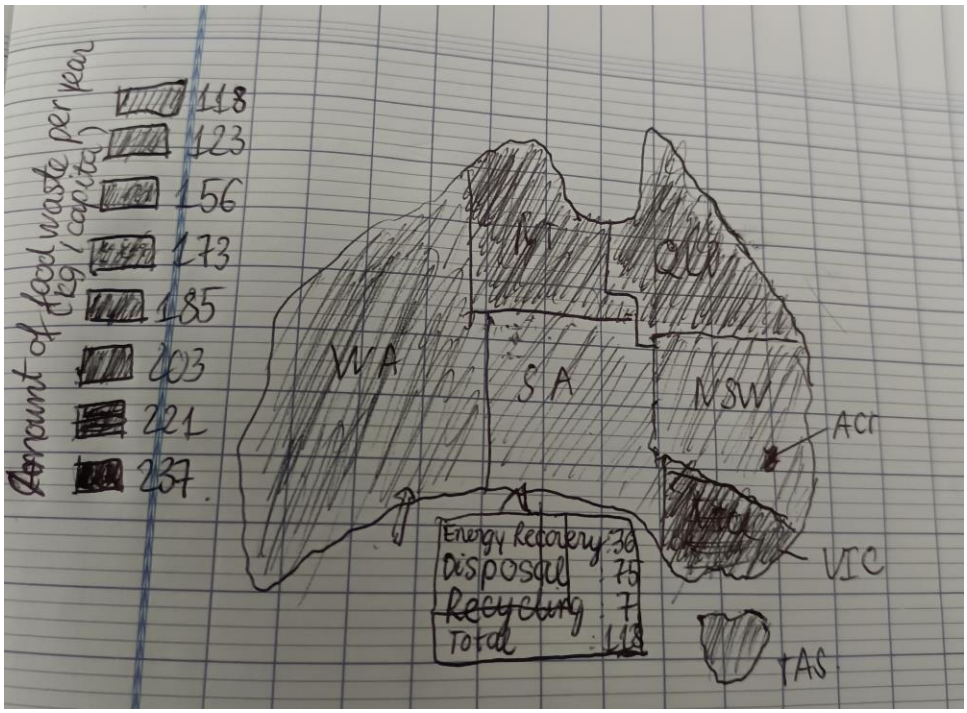


Figure 22: The final design of the visualisation (with tooltip when hovering, for example in South Australia).

Note: The legend's notice should be Amount of food waste per capita (kg/year), also there are differences between the sketch and the real choropleth on data, for example Victoria and ACT have the highest amount of food waste per capita in the sketch, rather than Northern Territory and Western Australia.

This approach has numerous benefits for both users and programmers:

+ The colour saturation could still be efficiently used to encode quantitative data (amount of food waste per capita), despite being less effective than the area of the pie chart (Munzner, 2015).

+ Showing the amount of food waste for each category (recycling, disposal, and energy recovery) could help users to compare how much food waste in capita is being processed by a state for all treatment types.

+ As for us (programmers), we need to create only a chart rather than a series of graphs like in 4.2.1, so the chart creation would require less time.

The result of this visualisation is displayed in Figure 25 and Figure 26.

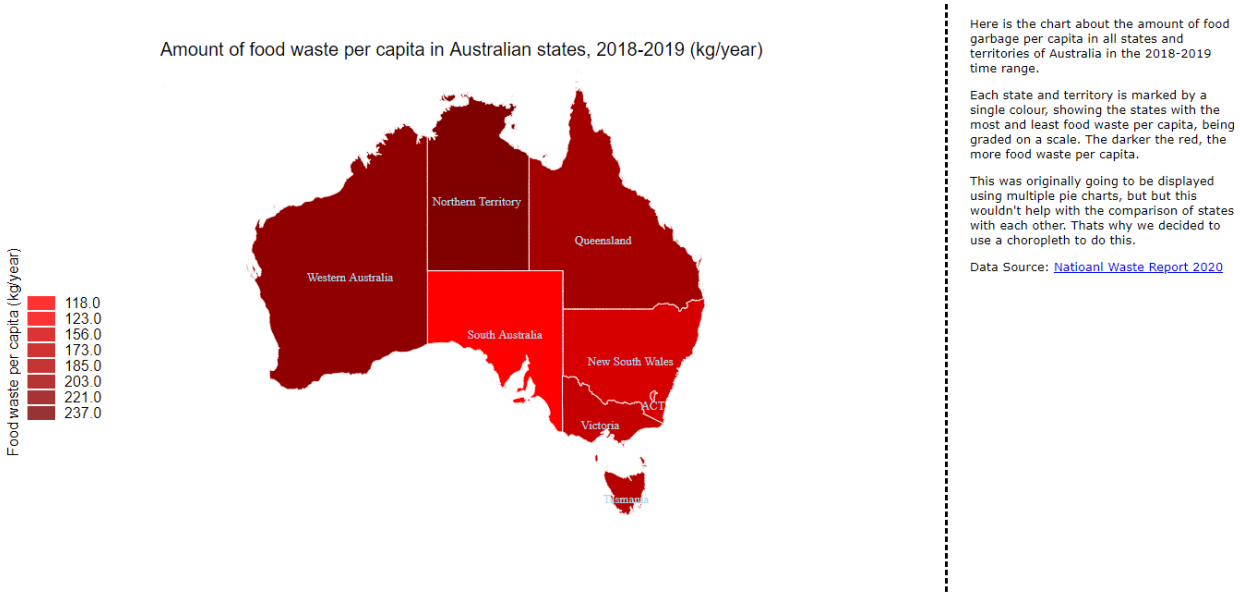


Figure 25: The final visualisation for food waste per capita in each Australian state (with caption).

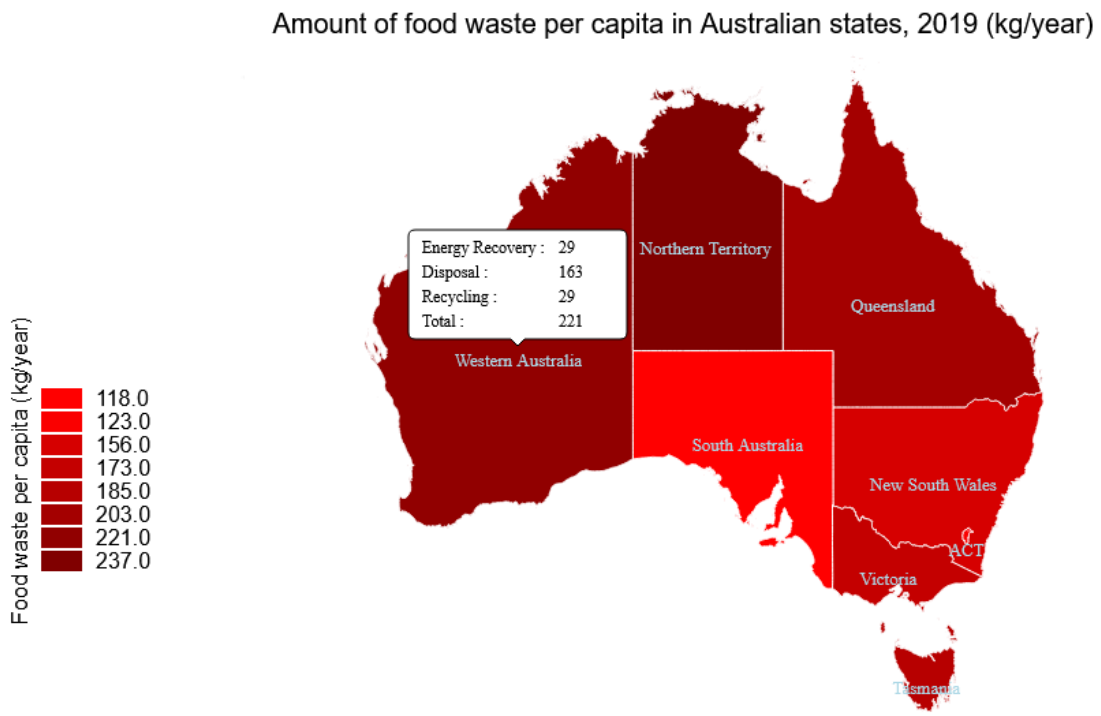


Figure 26: The visualisation when being hovered, showing the tooltip for each state (in this case, the data for Western Australia is shown).

4.3. The graph for household food waste per capita per country

4.3.1. Initial designs:

At the beginning, the idea of this graph was chosen to be a bar graph that included various major countries, including Japan and the United States. With this, we can generate the amount of food that is wasted inside the household, with the more food being wasted, the taller the bar will be in the bar graph. This helps compare each country with each other, being able to show more exact measurements when the user hovers over each of the bar. An example of what this may look like is shown in Figure 27:

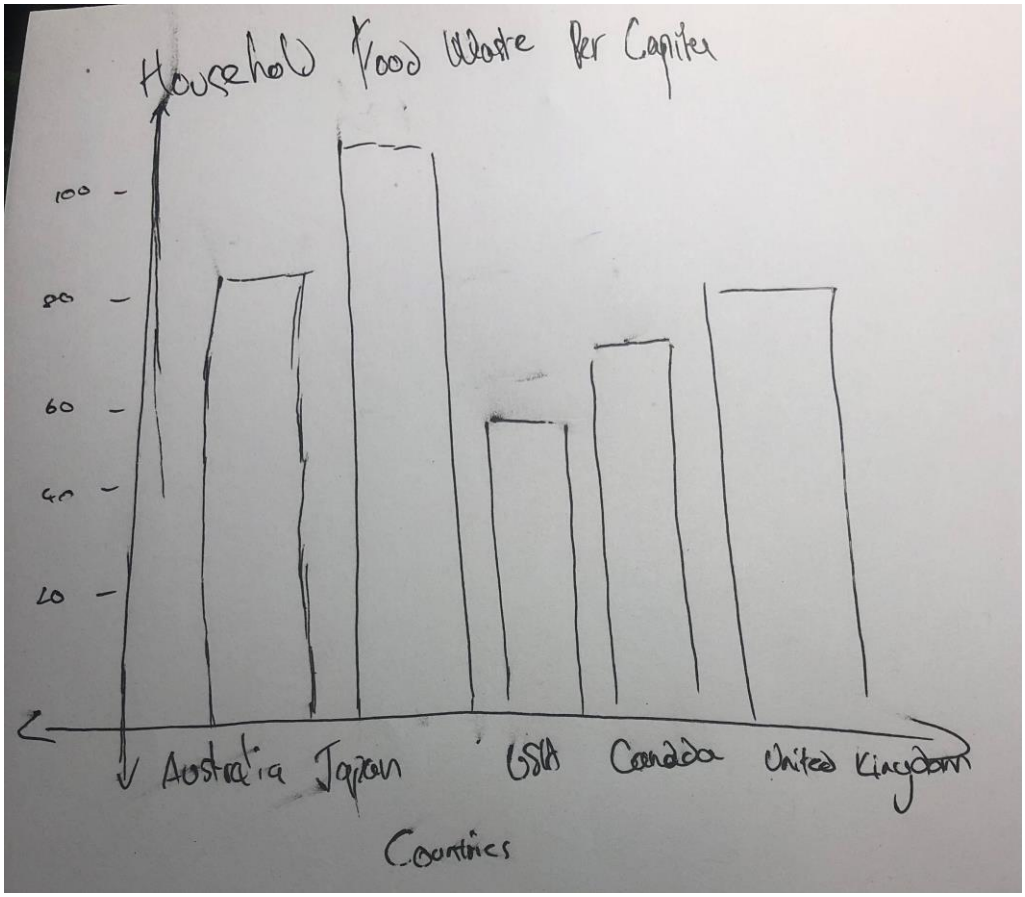


Figure 27: Draft Visualisation (Note, many countries not displayed here)

Whilst there are advantages to bar graphs, such as being able to easily compare the data for each country with every other country chosen, there are also some limitations as well, mainly:

+ Not all countries would be able to fit within the bar chart. Because of this, it would be impossible to compare every country with every other one within the world. To counter this, as explained in 2.1, we have decided to only include countries of “Medium” or “High” Confidence,

as well as specifically chose countries that are within similar socioeconomic status as Australia, comparing the country to other developed countries around the globe. To be able to compare to the world, we have also provided the “Global Average” as a line that can be compared to by any country that we have included within the bar graph.

+ Not all types of food waste were included in the dataset, namely: Food Service Estimations and Retail Estimations. Per capita, these account for very little of the food wastage within each country, such that we have decided to ignore these statistics within this visualisation.

All the changes have been implemented into the final design of the visualisation.

4.3.2. Final design:

The final design for the visualisation is a bar chart displaying the amount of Household Food Waste between countries. The colour has been chosen on a scale, based on the average kilograms of Household Food Waste per capita for each country: the darker the colour, the more household food waste within the country, per capita. As stated in the previous section, there is a line for the global average as well, allowing the user to compare each nation stated with the world average.

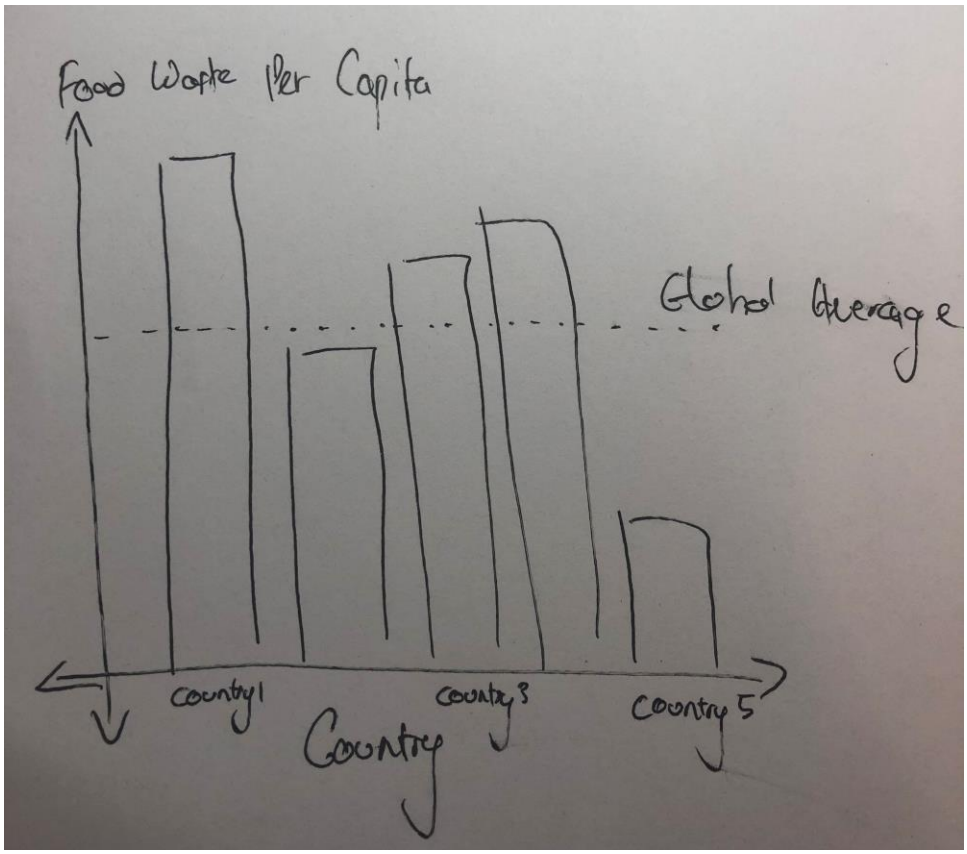


Figure 28: Final sketch of the bar graph.

The countries that are used in the visualisation are mentioned in part 2.1 of the report.

There will also be two buttons that follow this chart, allowing users to sort the data in ascending and descending order. This would allow users to compare each country with each other, being able to compare the highest and the lowest countries in terms of Household Food Waste per capita. An example of this is shown in Figure 29 below.

Like in the first chart in 4.1, there is an animation with the texts when clicking on either of the buttons, with the texts coming from the top, left-hand corner of the screen.

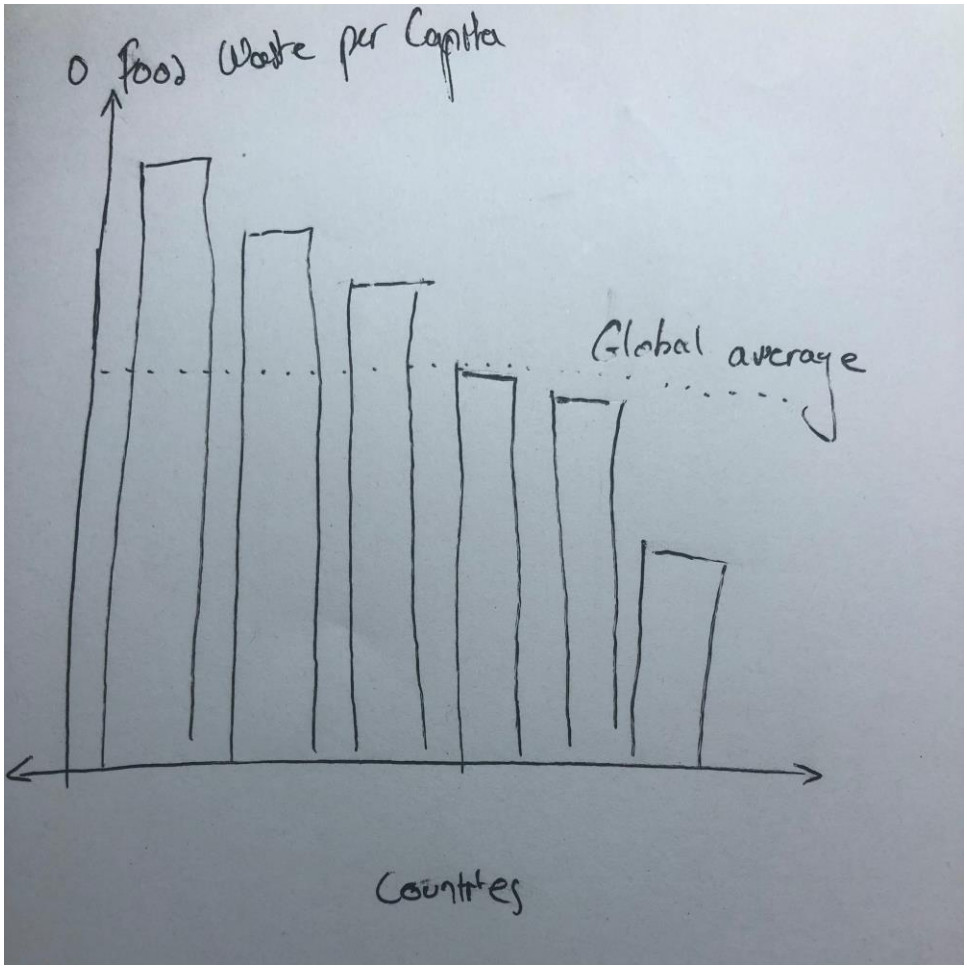


Figure 29: Final sketch of sorted bar graph (descending order)

This approach has multiple advantages:

+ The data encoding for both qualitative data (countries using distinct positions in the x-axis) and quantitative data (amount of food garbage, using color and bars' length) could be considered effective.

+ The sorting mechanism allows readers to know about where a country listed on the chart was in terms of food waste compared to other countries, therefore making the comparison easier.

+ Using animation on each click could make the transition between charts smoother for the users.

The final visualisations are displayed in Figures 30-33 below.

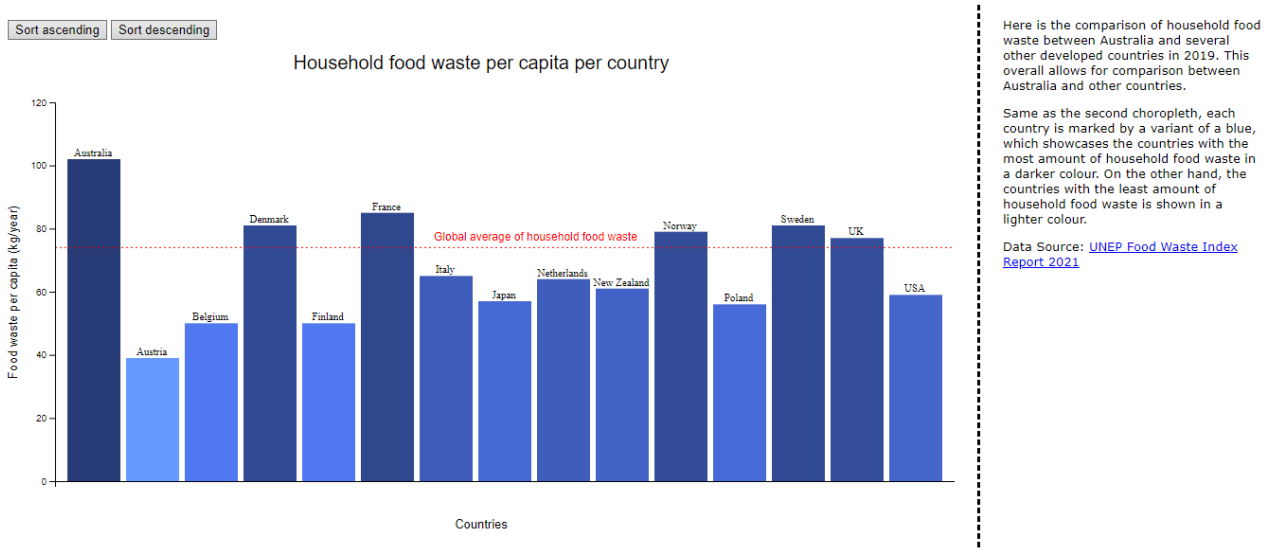


Figure 30: The final visualisation for the food waste per capita in different countries (with caption).

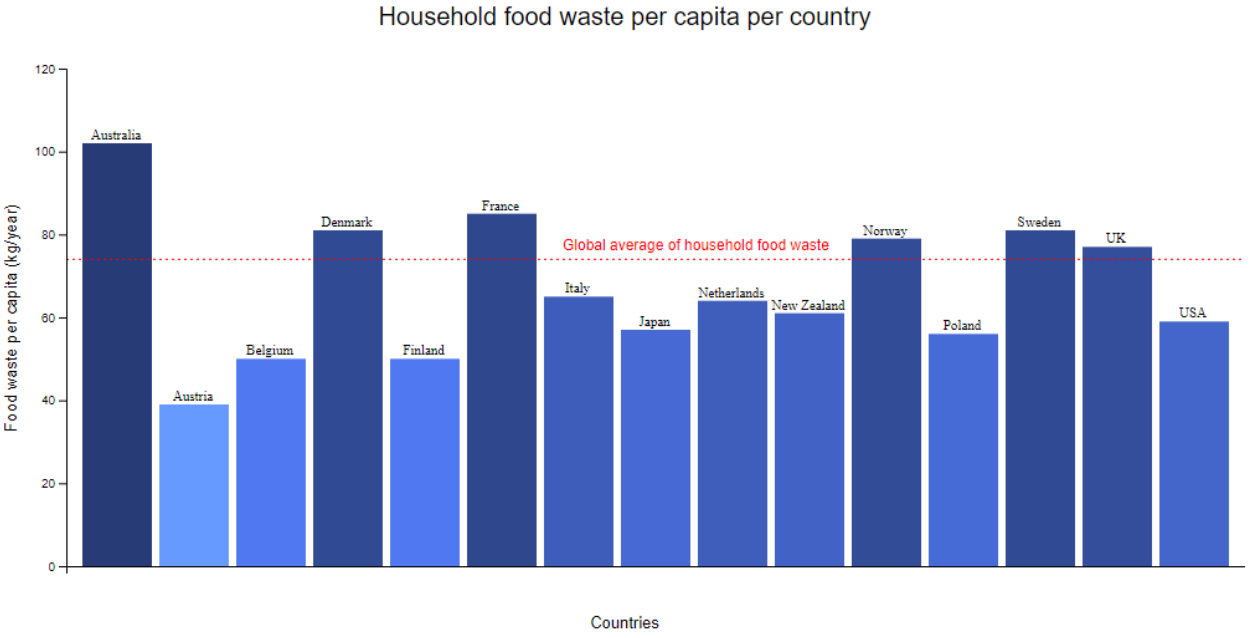


Figure 31: The result when hovering to one bar of the chart (in this case, Australia's bar is being hovered).

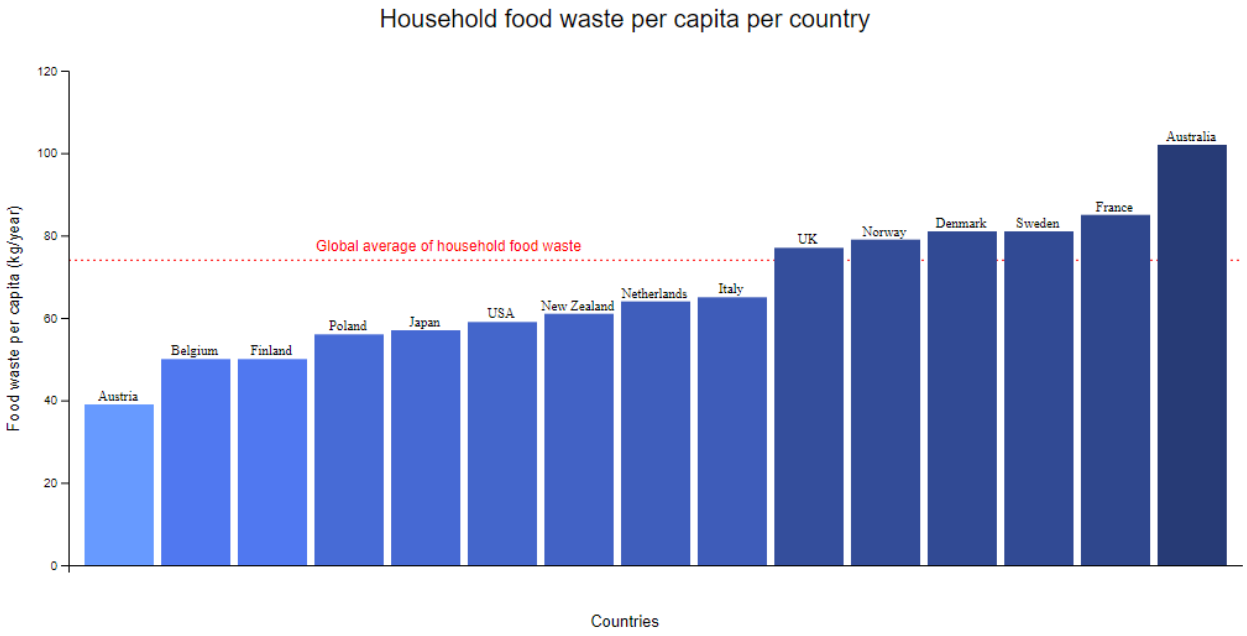


Figure 32: The result of sorting in ascending order.

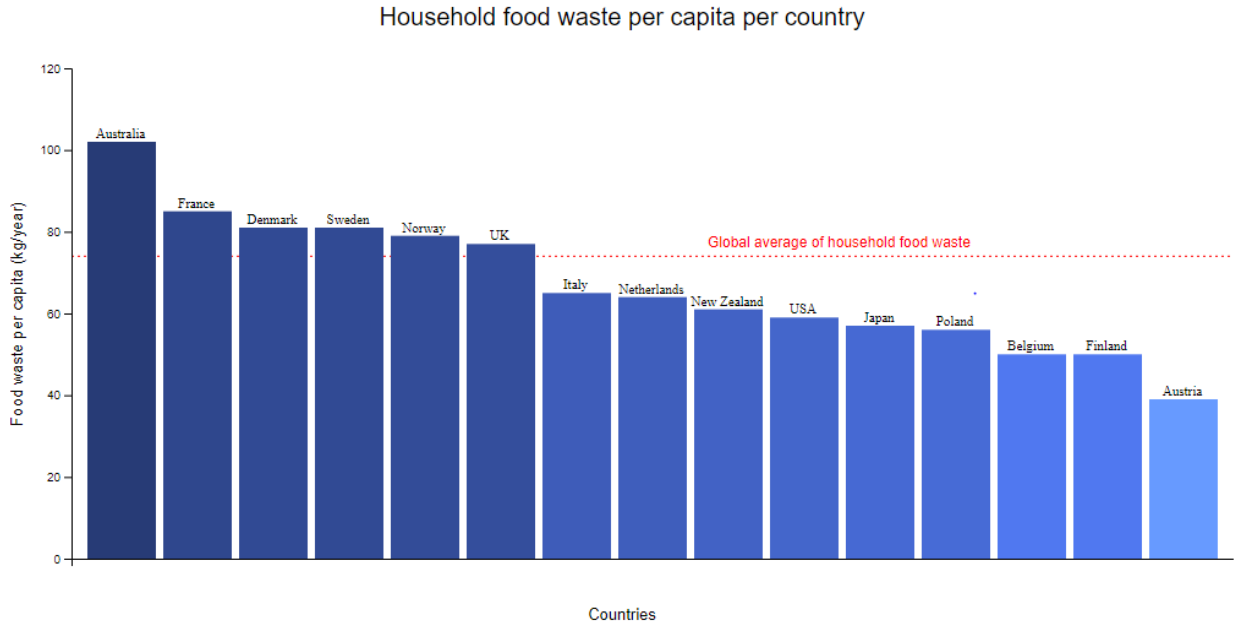


Figure 33: The result of sorting in descending order.

V. Conclusion:

Overall, the visualisations are made to provide information about Australian food waste problem for the public. We look at the amount of food waste in Australia as a whole and each major state and territory on a year-to-year basis, as well as a comparison between Australia and other countries in the world. The visualisation would be important for the audience to understand the degree of the food waste problem in Australia overall, and in comparison, to other countries. This is so that they are aware of the damage that is being done in general. And through this visualisation project, we have acquired invaluable knowledge about how to choose and process a real-world dataset, as well as how to design an infographic and implement the chosen ideas as a web-based visualisation – all skills which could be helpful in the future as Data Scientists.

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