University of British Columbia
Social Ecological Economic Development Studies (SEEDS) Sustainability Program
Student Research Report

Climate-Friendly Food (CFF) Labels Data Assessment at AMS Flavour Lab

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Executive Summary

As a response to rising concerns about climate change, the University of British Columbia (UBC) proposed the Climate Action Plan (CAP) 2030 to dramatically reduce greenhouse gas (GHG) emissions in the next 15 years. 17.9 billion tonnes of carbon dioxide equivalents (CO2 eq.), which account for approximately 34% of global GHG emission, is generated through the human-driven food supply chain. To reduce GHG emissions associated with food production, the Climate-Friendly Food Services (CFFS) team aims to display sustainability labels on each menu item sold at Flavour Lab. This project is a pilot project which serves to inform students at UBC Vancouver of sustainable food options and encourage them to develop climate-friendly dietary habits.

The CFFS Food Labeling Project first started with a pilot project conducted in 2020. The pilot project successfully assigned labels to menu items sold at three residence dining halls at the UBC Vancouver campus. Current research is an extension of the pilot project, with a separate workflow but sharing the same research objective, goal, and purpose. The data source provided by the current client, Alma Mater Society (AMS), does not align with that of the pilot project; hence a different workflow was needed.

Primary data is collected with the assistance of UBC AMS, which is exported from the food nutrition management service, Optimum Control (OC), as a PDF file. The data on carbon, nitrogen and water footprint factors came from external secondary data sources.

One critical change that distinguishes this research from the past pilot project is a change in the programming environment to PyCharm. PyCharm is an ideal environment for script automation and debugging.

In total, 26 food items are analyzed from the three residence dining halls: Feast, Gather, and Open Kitchen. 19 items are classified as green, 5 items as yellow, and 2 items are classified as red. This sets the distribution percentage of the green items to approximately 73.01% of all items analyzed, which perfectly adheres to the goal of reducing food production-associated GHG emissions by 50%.

Although all menu items are successfully analyzed, the analysis workflow still leaves a few limitations. In the next phase of the study, it is recommended by a new CFFS Data Analyst student to continue working towards improving the accuracy of the final outcomes.

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- UBC: University of British Columbia
- AMS: Alma Mater Society
- CAP: Climate Action Plan
- OC: Optimum Control
- GHG: Greenhouse Gas
- CFFS: Climate-Friendly Food Systems

1. Introduction

1.1 Research topic

With increasing global concerns about uncontrolled GHG emissions and their detrimental impact on the food supply chain, the University of British Columbia (UBC) announced an ambitious plan to reduce the net GHG emission to zero within the next 15 years[1]. Through the Climate Action Plan 2030 (CAP 2030), UBC pledged to significantly reduce GHG emissions for both the Vancouver and Okanagan campuses. Among the actions geared towards reducing GHG emissions, UBC promised to lower the food systems and production associated with GHG emissions to 50%. It is in accordance with AMS's Net Zero 2025 plan, which aims to reduce GHG emissions to 30% by 2025.

This research focuses on designing and implementing sustainability labels for all menu items in Flavour Lab at the UBC Vancouver campus. Ultimately, we aim to assist in reducing GHG emissions associated with food production while providing environment-friendly options for students to make wiser dietary choices.

1.2 Research relevance

In this research, we partnered with Alma Mater Society (AMS) to assign sustainability labels at Flavour Lab located at the Nest building. By assigning sustainability labels for each food item, students are encouraged to broaden their perspective and give more careful consideration when making dietary choices. Furthermore, through their constant exposure to the CFFS poster displayed in the aforementioned residence dining halls, students will gain deeper insight into CAP 2030 and UBC's strategies for achieving the goal.

Student purchasing behaviours, or their dietary choices, will be further studied by the CFFS front-end team to observe any changes in the purchase trend compared to pre-label periods.

1.3 Project context

Menu items from Flavour Lab are analyzed in the scope of the current research project. This research is a continuation of Silvia Huang's pilot project, which was implemented from September 2019 to February 2020, with a new workflow focusing on data extraction from PDF recipe files using natural language processing. Calculation metrics, such as impact baseline for emission factors, are derived from the pilot project and are continued to be used for the current research.

1.4 Project purpose, goals and objectives

A primary goal of the current research is to adhere to UBC's commitment to the CAP 2030 by achieving 50% GHG emission reduction by 2030. To achieve this goal, we designed an semi-automated workflow that assigns the sustainability labels for all food items at Flavour Lab. Once the analysis is completed and the labels are in effect, we implicitly encourage the students to make sustainable dietary choices and observe any noticeable changes made in their purchasing behaviours.

This research is a pilot project carried out in partnership with AMS at UBC. The CFFS team will provide suggestions for future research based on results and analyzed data. Ultimately, this pilot project will serve as guidance for any future research with its already established workflow.

2. Methodology and methods

2.1 Research methodology

This project relies on an existing workflow developed by Silvia Huang and her colleagues, developed and published in 2020[2]. The workflow is designed in collaboration with researchers from the University of Michigan, Université Laval, and the University of Victoria who are working on similar climate food labelling projects (Huang, 2020).

Calculation metrics, including emission baseline values and label cut-off values, used in current research are adopted from Silvia Huang's pilot project.

To further automate the existing semi-automatic workflow, function codes and data files are moved to the PyCharm developer environment from Jupyter Notebook. Instead of operating on several Jupyter Notebook files, the PyCharm environment requires only the main script to run to fully analyze the data.

2.2 Primary data collection research methods

2.2.1 Data Collection

All menu item data are derived from Optimum Control, which AMS personnels use to access and manage all nutritional information. All data provided are in PDF file formats.

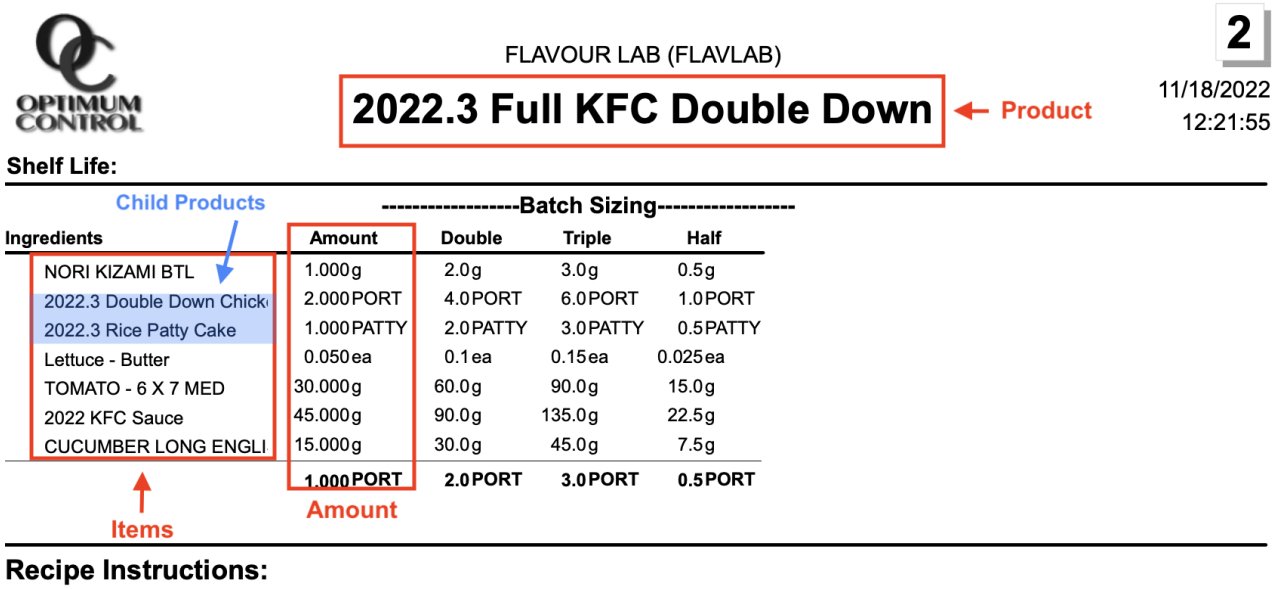
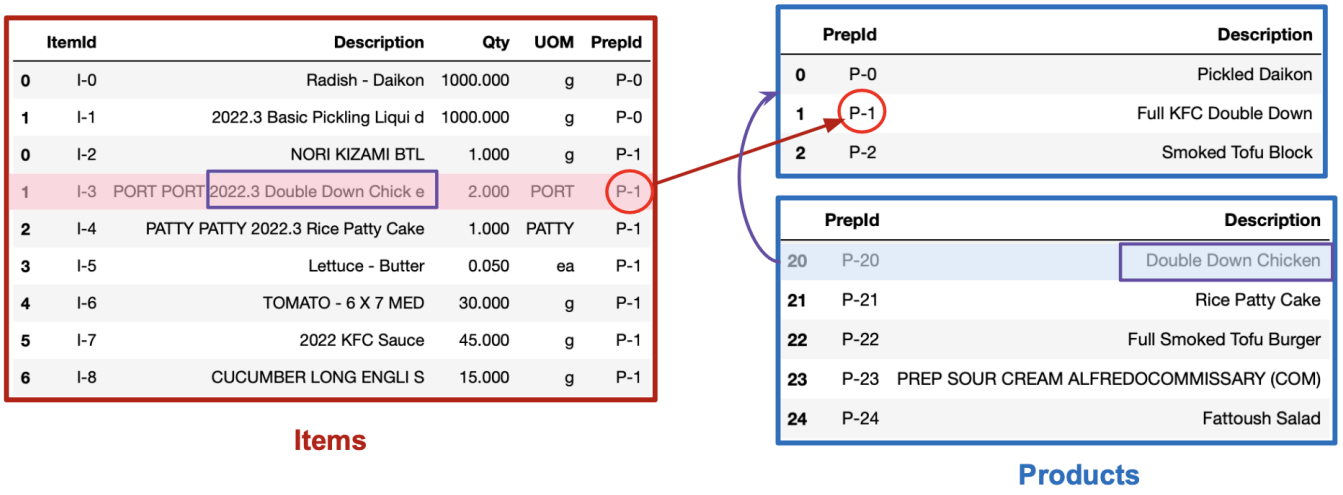


Figure 1 : Menu Recipe Example

Each menu item is broken down into its ingredients; workflow is first performed on individual ingredients, and a full menu item is later analyzed by encompassing impact values from corresponding ingredients. All data collection was completed by December 2022.



	ItemId	Description	Qty	UOM	PrepId
0	I-0	Radish - Daikon	1000.000	g	P-0
1	I-1	2022.3 Basic Pickling Liqui d	1000.000	g	P-0
0	I-2	NORI KIZAMI BTL	1.000	g	P-1
1	I-3	PORT PORT 2022.3 Double Down Chick e	2.000	PORT	P-1
2	I-4	PATTY PATTY 2022.3 Rice Patty Cake	1.000	PATTY	P-1
3	I-5	Lettuce - Butter	0.050	ea	P-1
4	I-6	TOMATO - 6 X 7 MED	30.000	g	P-1
5	I-7	2022 KFC Sauce	45.000	g	P-1
6	I-8	CUCUMBER LONG ENGLI S	15.000	g	P-1

Items

	PrepId	Description
0	P-0	Pickled Daikon
1	P-1	Full KFC Double Down
2	P-2	Smoked Tofu Block

	PrepId	Description
20	P-20	Double Down Chicken
21	P-21	Rice Patty Cake
22	P-22	Full Smoked Tofu Burger
23	P-23	PREP SOUR CREAM ALFREDOCOMMISSARY (COM)
24	P-24	Fattoush Salad

Products

Figure 2 : Child Product Dataframe Example

Menu items are primarily broken down into parent products and child products. Parent products are independent products that are ready to be analyzed without any *loops*. Child products are products that are generated to be used as an ingredient for another product, hence named “child” products. Child products are *looped* into the workflow by first being analyzed as a separate entity and later incorporated into another analysis workflow as an ingredient. For example, in Figure 1 and Figure 2, 2022.3 Double Down Chicken and 2022.3 Rice Patty Cake are child products. They exist as separate menu items in the products list but also exist as ingredients for Full KFC Double Down. Child products can be distinguished from parent products by their name; they are labelled with 2022.3 as prefixes in their names.

2.2.2 Evaluation Workflow

The evaluation workflow is divided into several individual steps, which are heavily dependent on the previous step. Thus all evaluations must be done respectively, in the order of how the steps are named.

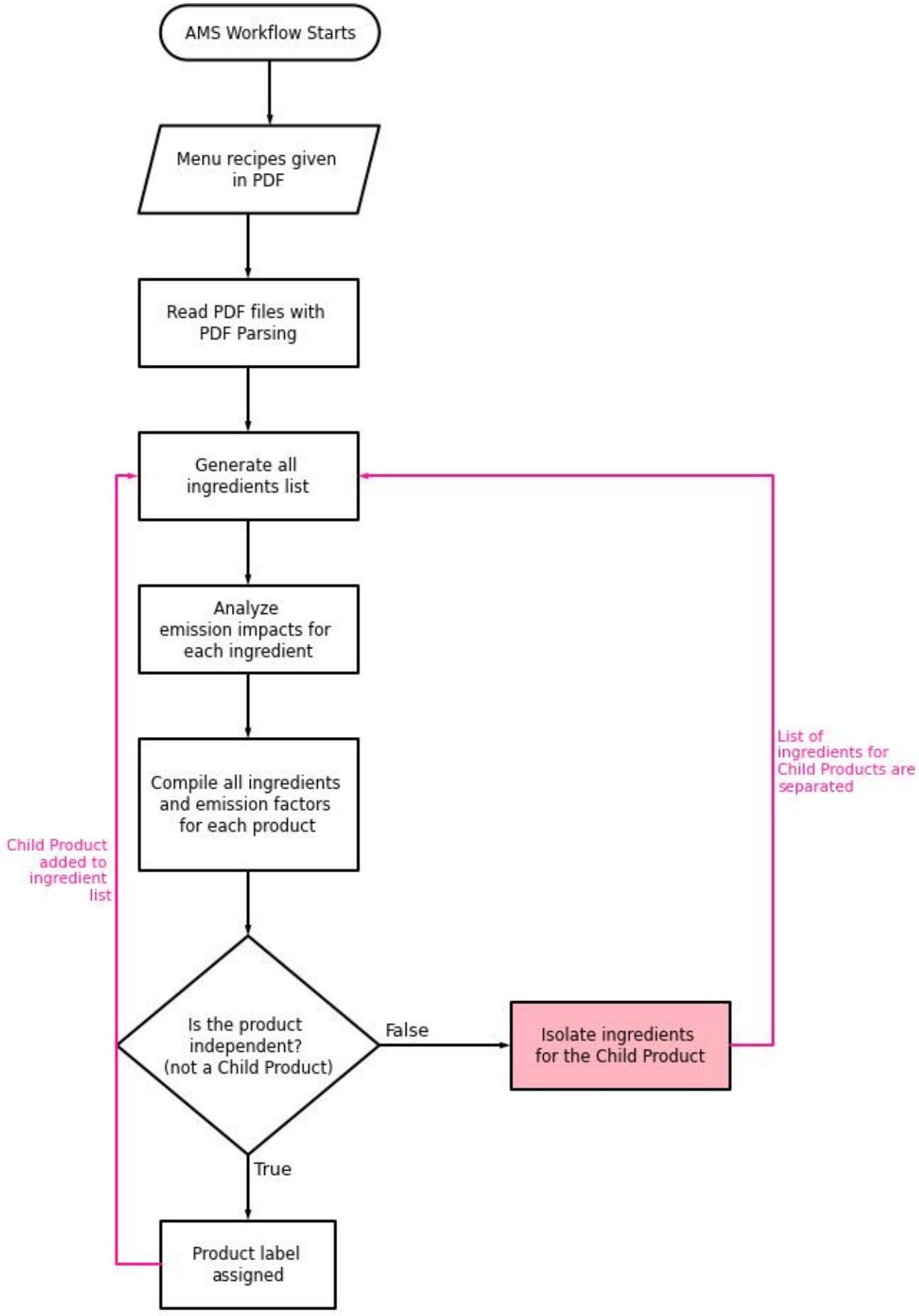


Figure 3 : Evaluation Framework Flowchart

The workflow proceeds in the order of data collection, data retrieving, data preprocessing, data cleaning, updating conversion information and mapping, automatic calculation, and finally, assigning the sustainability labels.

The first step is to extract raw ingredients and recipe data from Optimum Control. Primary data is collected in PDF file format. Texts are mined from the PDF files using regular expressions in natural language processing, then are reorganized into dataframes. Two dataframes, each containing information about ingredients and products, are generated from this step.

As a following step, collected data are *pre*-processed; parent products and child products are separated. Parent products undergo the rest of the workflow, and are followed by the child products. We relied on the Cool Food Calculator to gather the GHG emission factors, which include GHG emission footprints, nitrogen footprints, and water withdrawal footprints. We categorize each ingredient into one of the predefined categories set by the Cool Food Calculator, and match the emission factor information to the ingredient. Once all ingredients have gone through impact factor analysis, a sustainability label for 100g of each menu item is assigned.

For more information on how the workflow is designed, refer to this slideshow and GitHub webpage.

3. Results

In total, **26 menu items** are analyzed from Flavour Lab.

Label	Counts
Red	2
Yellow	5
Green	19
Total	26

Table 1: Label Count Distribution

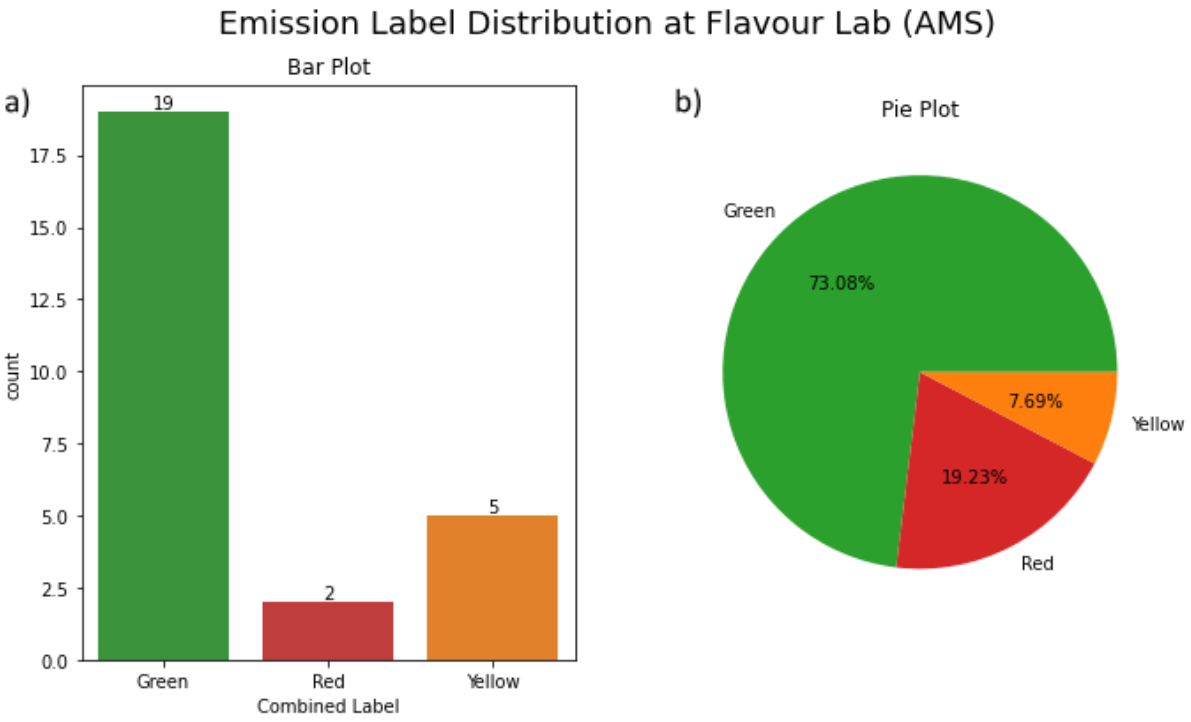


Figure 4: Label Count Distribution

a) Distribution in bar chart, b) Distribution in pie chart

19 items are labelled as *green*, 5 items are labelled as *yellow*, and 2 items are labelled as *green*. Among the three labels (red, yellow, green), items classified as *green* are most predominant.

4. Discussion

From the above analysis, we found that approximately 73.08% of food items found at Flavour Lab are labelled green. Compared to label distribution measured in the 2020 pilot project, the percentage of green labels greatly outnumbered that of the pilot project.

Percentage	2022 Flavour Lab	2020 Open Kitchen
Red	7.69%	29.5%
Yellow	19.23%	35.2%
Green	73.08%	35.2%

Table 2: Label Count Distribution Comparison

The high percentage of green labels at Flavour Lab can be attributed to the high usage of “Other Vegetables” as an ingredient in food items. Figure 5 shows that 25 ingredients used at Flavour Lab are classified as “Other Vegetables” or Category ID 40.

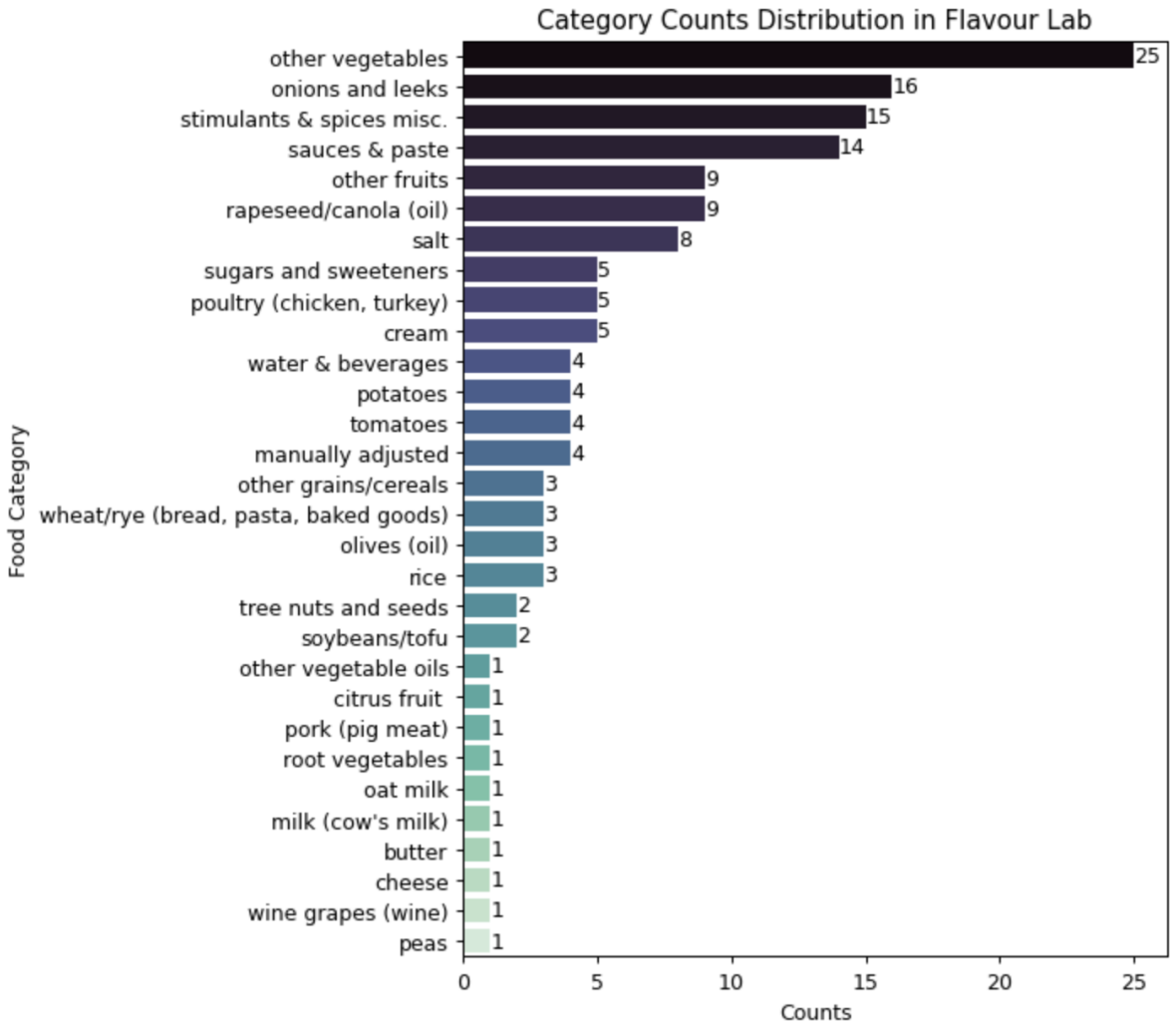


Figure 5: Ingredient Count Distribution

High usage of “Other Vegetables” can be explained by looking at the entire menu list at Flavour Lab. As seen in Figure 6, many food items sold at Flavour Lab are marked as Vegetarian-friendly.

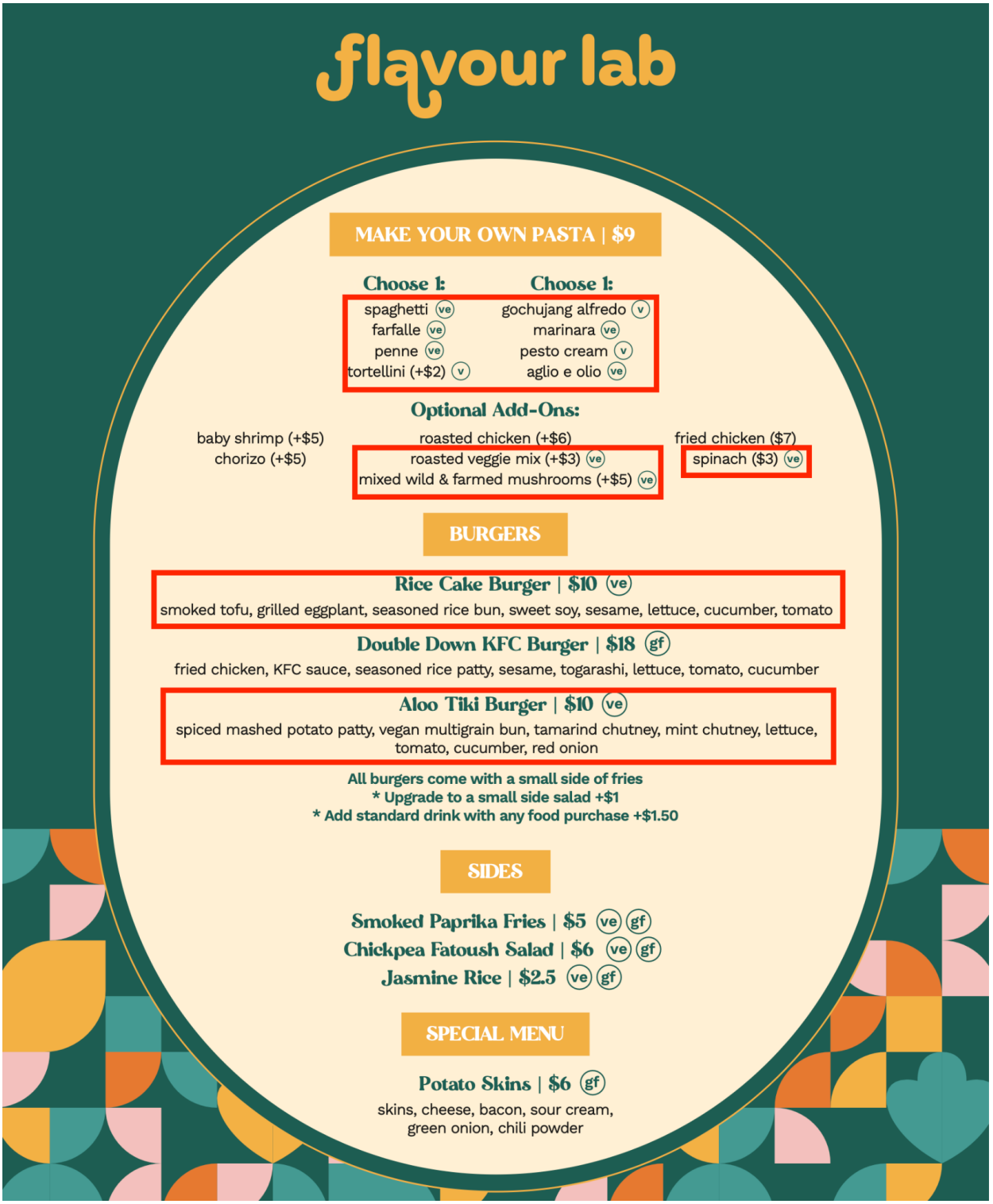


Figure 6: Full Menu at Flavour Lab

The current workflow is explicitly tailored to what UBC has in place, such as data derived from Optimum Control. Although the majority of the process is automatic, assigning a Category ID for each menu item still requires a manual process. Inconsistent naming for the menu items limits the automaticity of the workflow.

Category ID, predetermined by the Cool Food Calculator, needs to be more specific in its scope. For example, thyme, which is classified as an herb, is incorporated into a larger category of “Other Vegetables.” Therefore, the current workflow may have minor flaws in correctly calculating the impact values and further in assigning sustainability labels.

5. Recommendations

As discussed in **Discussion**, current workflow can be improved by addressing the following concerns.

5.1 Recommendations for action and implementation

- Food category of the emission factors (external dataset from the Cool Food Calculator) is too general. It is advised to prepare a more specific method to calculate the impact values.
    - *E.g.*, "herbs" such as thyme are classified under Category ID 40, "Other Vegetables".
- Automation of assigning Category ID to each ingredient.
    - Currently, category IDs are assigned based on the name of the ingredient– thus it is done *manually*. Instead, we can better automate the process by including some keywords that would link to a specific category ID.
        - E.g., if "Milk" is in the name of an ingredient, assign it to category 9.

5.2 Recommendations for future research

For a long-term process, it is recommended that **another student** would take over the Data Analyst position for the CFFS project. Since this workflow is not 100% automated, each time a new label needs to be created someone with *basic programming knowledge* needs to edit parts of the code.

Additionally, consultation with the Cool Food Calculator or other companies for their labeling assigning service may be considered.

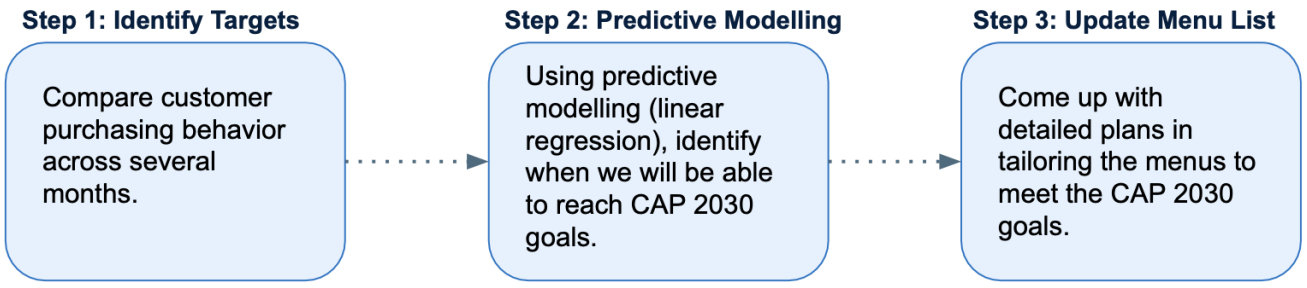


Figure 7: Suggested Workflow for Future Research

Since Flavour Lab has already reached the CAP 2030 goal, no further research is needed at this venue. Instead, future research can be directed at restaurants with a fewer number of Vegetarian-friendly options. For restaurants that are yet to meet the CAP 2030 goals, predictive modelling can be used after

several months of data collection and estimate the approximate year that the restaurants will reach the CAP 2030 goal. To make this research possible, monthly sales and menu list data at the specified restaurants are needed. This research will not only foresee the possibility of UBC achieving the CAP 2030 goals successfully but also allow researchers to observe changes in customer purchase behaviour in detail.

6. Conclusion

The Climate-Friendly Food Services (CFFS) labelling project largely contributes to achieving UBC's pledge to reduce food production-related GHG emissions to 50% by 2030. Furthermore, sustainability labels assigned to each menu item at Flavour Lab provide students with opportunities to reconsider their dietary habits and actively participate in climate protection. However, current research still leaves some limitations: the workflow still relies on a manual category-assigning step, undesirably increasing script running time. Also, more specific external sources can be looked into to enhance analysis accuracy.

Once the other CFFS team observes any change in students' purchasing behaviours, it can hint at the direction UBC must take in future research.

References

Huang, Silvia. (2021). Climate-Friendly Food Systems (CFFS) Labelling Project,

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