Klimato

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The University of Manchester

UNIVERSITY OF MANCHESTER

FOOD-RELATED SCOPE 3 GHG EMISSIONS ASSESSMENT 2023

INTRODUCTION

Anthropogenic Greenhouse Gas (GHG) emissions from the combustion of fossil fuels and other human activities, such as food production, have been steadily increasing since the preindustrial era (IPCC 2023). As a result, the concentration of GHGs in the atmosphere has increased at unprecedented levels driving global warming, which in turn causes climate change. In the last decades, these changes in the climate system have been causing negative impacts on human systems and ecosystems[1], which are anticipated to be exacerbated in the coming decades, unless deep reductions in GHG emissions are made quickly.

In this context, it is crucial to accelerate efforts to curb anthropogenic GHG emissions. Given that the food system accounts for approximately one third of global GHG emissions[2], reducing food system emissions is paramount in mitigating climate change. This requires all actors in the food supply chain to engage in efforts to reduce emissions from their activities.

When it comes to organisations operating within the food sector, the Scope 3 indirect GHG emissions can contribute up to 90-95% of their total emissions[3]. It is therefore of the utmost importance to calculate and report these emissions.

Recognizing this, the University of Manchester has assigned Klimato to calculate and report its food-related Scope 3 GHG emissions. This report describes the methodology applied by Klimato and presents the results of the assessment.

[1] IPCC, 2023
[2] Crippa et al., 2021
[3] WRAP, 2022

METHODOLOGY

OVERVIEW

Klimato's methodology relies on three main pillars: I) the Klimato Food Carbon Footprint database, II) the GHG Protocol standard and guidelines for Scope 3 reporting[4] and III) the WRAP methodology[5] that further details the Scope 3 reporting for industries within the food sector.

The Klimato Food Carbon Footprint database is based on data from comprehensive literature reviews of peer reviewed life cycle assessments (LCA). LCA is a globally recognized methodology to assess climate impact of products and processes, including agricultural and food products. The Klimato database includes the carbon footprints in CO_2 equivalents (CO_2e) for more than 9000 different food ingredients including different production methods and countries of origin. The system boundaries are from cradle-to-gate (including agriculture, processing, packaging, food losses and transportation to the regional distribution centre), as recommended by the GHG Protocol. The Klimato database is reviewed annually and has been certified by Coolfood, an initiative of the World Resources Institute.

The GHG Protocol has developed guidelines to support companies measure, calculate and report emissions resulting from their activities. These emissions are grouped in three groups, called Scopes. Scope 1 includes direct emissions from sources owned or controlled by the reporting company. Scope 2 includes energy-related indirect emissions. Finally, Scope 3 includes all other indirect emissions from the reporting company's supply chain.

For companies operating within the food sector, emissions resulting from food purchases and their associated transport represent the main contribution to the total GHG emissions. Therefore, the study conducted for the University of Manchester focuses on these emissions, falling under Scope 3 category 1. Table 1 shows the general descriptive information about the report and Table 2 describes the category included in the assessment, the methods used for the calculations and the activity data (i.e. input data) used.

[4] The GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard, a supplement to the GHG Protocol Corporate Accounting and Reporting Standard, WRI 2011
[5] Scope 3 GHG Measurement and Reporting Protocols for Food and Drink: full guidance, WRAP 2022

***Table 1**: General information*

General information	
Organization's name	University of Manchester
Country of operations	United Kingdom
Reporting period	August 2022 to July 2023
Scope of the assessment	Scope 3, category 1

***Table 2**: Categories included in the assessment*

Category	Method used	Activity data
Category 1: emissions from purchased goods and Tier 2 transportation	Average-data method based on cradle-to-gate emissions factors from Klimato's Carbon Footprint database. Distance-based method based on emission factors by transport mode for Tier 2 transportation.	Data on quantities, origin and production method of purchased food products taken from the university's procurement system. Quantities of the purchased food products and calculated distances from the origins of the products.

METHODS

The steps followed during the study are:

1. The University of Manchester provided Klimato with procurement data from their suppliers. Information includes product name and quantity for 3905 purchased products, including 337 ready-to-eat products (sandwiches, pastries, etc.) and the ingredients they are made of.
2. The Klimato Software was used to match the purchased products to the ingredients present in the Klimato Food Carbon Footprint database. This means that several purchased products correspond to one single ingredient in the Klimato database. For example "*13.6 litre box free range semi-skimmed milk*" and "*2 litre free range semi-skimmed milk*" were both mapped to the ingredient "*Free range semi-skimmed milk*" in the Klimato database. The ingredients were also further grouped into categories. Figure 1 presents this information in a conceptual schematic.

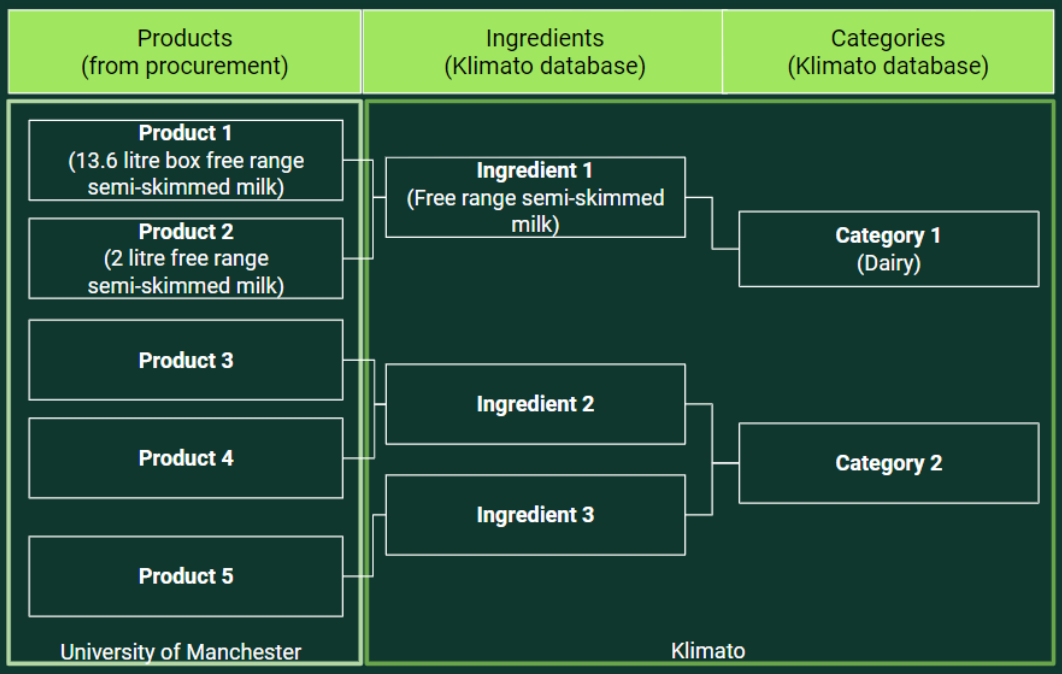

***Figure 1**: Conceptual schematic of Step 2*

3. When no match was found between purchased goods and ingredients present in the Klimato database, an assumption was made case-by-case to find the closest equivalent. For the ready-to-eat products not already present in the database, the provided recipes were used to calculate their carbon footprint.
4. Klimato calculated the total carbon footprint from the University of Manchester's food purchases and their associated transport and analysed the results. The results are expressed both following the nomenclature of the products purchased by the University of Manchester (Figures 2 and 3) and following their equivalent aggregated ingredient in the Klimato database (Table 5).

DATA QUALITY ASSESSMENT

The quality of activity data used for estimating GHG emissions was assessed using the pedigree matrix approach as described in the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard. The applied approach includes five data quality indicators (technological representativeness, time representativeness, geographical representativeness, completeness and reliability) and a rating scale from 1 to 4, with 1 indicating very good, 2 good, 3 fair, and 4 poor data quality. To aggregate the results into a single score, the Data Quality Rating (DQR)[6] was used.

The results of the assessment are summarised in Table 3. All but one datasets were rated as “very good”. The quality indicator Reliability was the only to be set to “good” because the data is based on non-verified measurements. In the present study, the data quality is considered sufficient and there is little room for improvement.

***Table 3**: Quantitative data quality assessment of activity data used to quantify GHG emissions (TE: technological representativeness, TI: time representativeness, GE: geographical representativeness, CO: completeness, RE: reliability, DQR: data quality rating)*

Emission	Activity data	TE	TI	GE	CO	RE	DQR
Scope 3: Emissions from food products (production)	Quantities and origin of purchased goods	1	1	1	1	2	1.8
Scope 3: Emissions from food products (Tier 2 transportation)	Distances travelled	1	1	1	1	2	1.8

[6] Joint Research Centre (JRC) (2010)

RESULTS

The total GHG emissions from the University of Manchester's Scope 3 category 1 in 2023 equals **781.1 tons CO_2e**, which is equivalent to 1.7 $kgCO_2e/kg$ purchased food. The transport of the food is responsible for 43.4 tons CO_2e.

***Table 4**: Results overview and performance indicator*

Results overview	
Total Scope 3 GHG emissions	781.1 tCO_2e
Performance indicator	
GHG emissions per unit	1.7 $kgCO_2e$/kg purchased food

Klimato analysed the impacts of all products referenced in the procurement data sheet. 3904 products were evaluated in the Klimato Software.

Figure 2 shows the 15 most purchased products, highlighting the total amount purchased (in tons) and the share of their CO_2e emissions. Some products were bought in large quantities but their contribution to the total GHG emissions is low since their carbon footprint per kg of product - or carbon intensity - is low. For example, the product "*evfav jacket potato xtra lrge*" is the second highest purchased item (51 tons) but represents only 1.4% of the total CO_2e emissions.

Figure 3 shows the 15 products resulting in the highest impact (percentage of total GHG emissions) and the purchased amounts. Despite some ingredients being purchased in low quantities they contribute largely to the total CO_2e emissions. A good example is the beef product "*Beef Minced Best 90%vl Halal Sourced UK*". This item represents less than 1% of all purchases (0.8 tons) but is the second contributor to total GHG emissions with 4.1%.

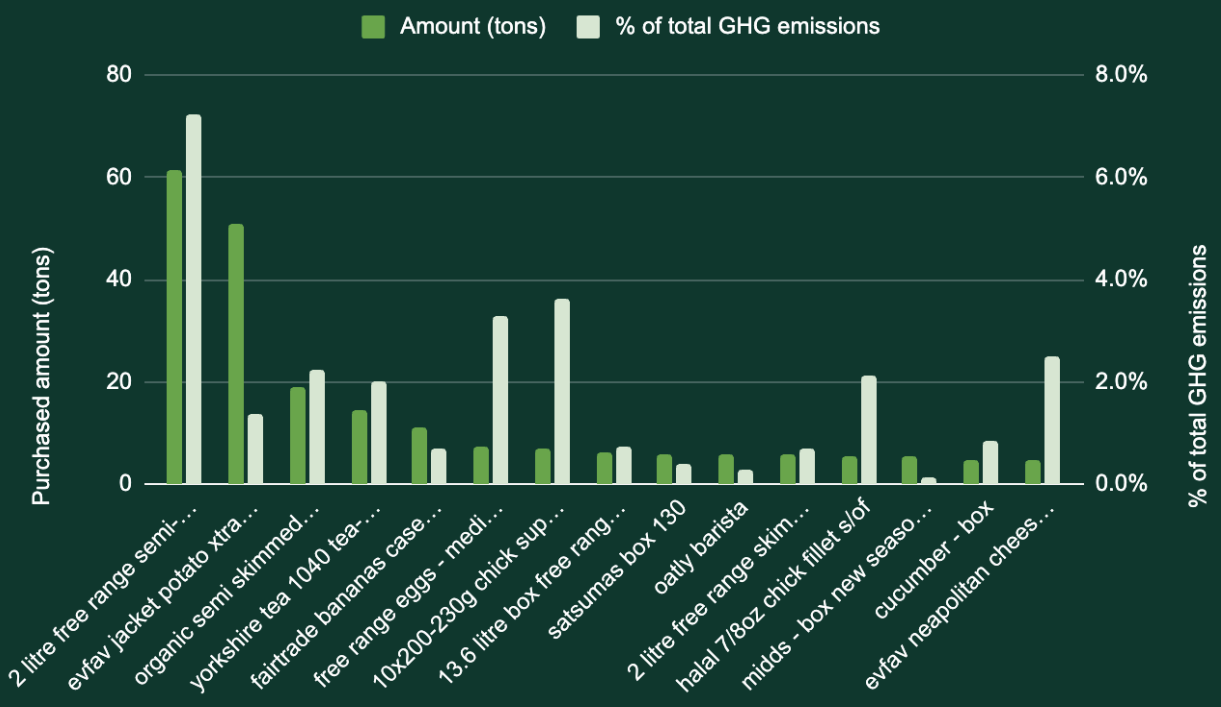

***Figure 2**: 15 most purchased products, with their purchased amount and share of total CO_2e emissions (the dark green columns refer to the left axis and represent the amount purchased (in tons), while the light green column refers to the right axis and represents the percentage of total CO_2e emissions for this specific product).*

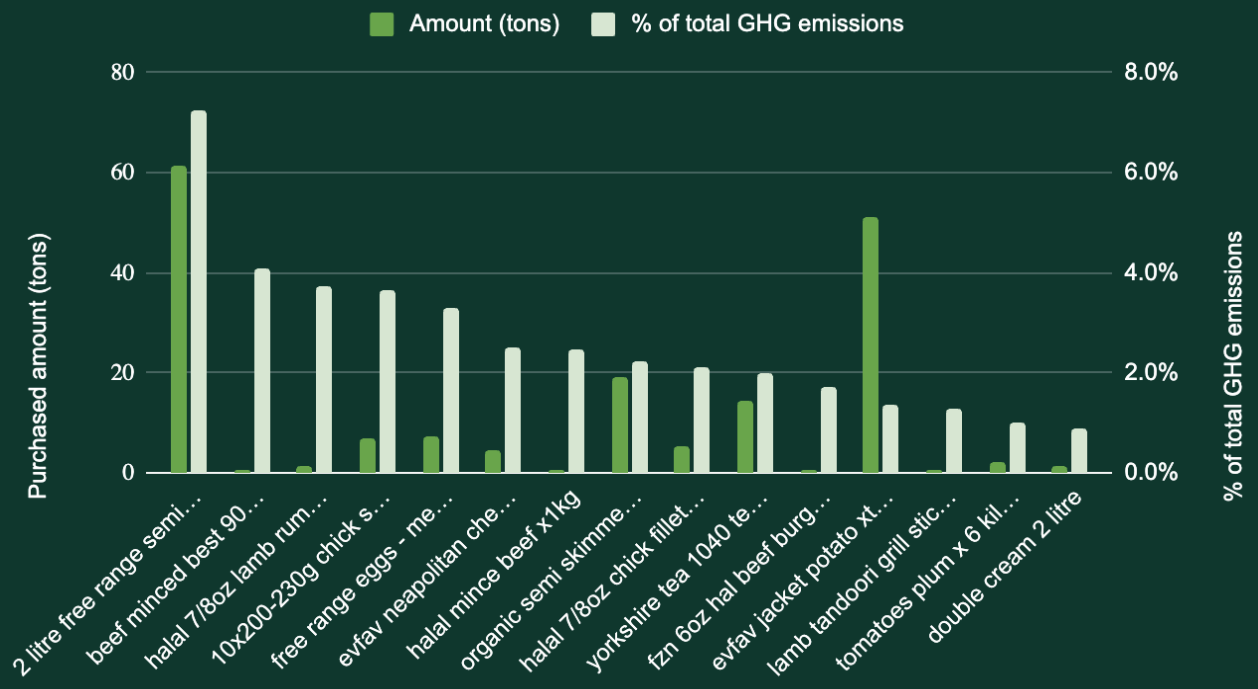

***Figure 3**: 15 most impacting product with the share of carbon footprint and the purchased amounts (the dark green columns refer to the left axis and represent the amount purchased (in tons), while the light green columns refer to the right axis and represent the percentage of total CO_2e emissions).*

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The Klimato Software aggregates similar products to identify the ones that most contribute to the overall GHG emissions and classifies them into broader food categories (see section METHODS, step 2).

Table 5 shows the 15 single ingredients with the highest carbon footprint. Overall, 34.8% of the total GHG emissions result from the Top 5 aggregated ingredients, and 55.9% from the Top 15.

***Table 5**: 15 ingredients with the highest carbon footprint and their category, as classified in the Klimato database*

Ingredient name	Category name	Carbon footprint (tCO_2e)
Free range semi skimmed milk	Dairy	80.2
Chicken breast	Chicken	55.3
Lamb	Lamb	54.4
Beef mince	Beef	53.2
Cheesecake	Ready-to-eat	28.4
Tea, brewed	Drinks (no milk)	28.3
Egg	Eggs	26.6
Beef	Beef	19.6
Sandwich, cheese	Ready-to-eat	15.6
Chicken	Chicken	15.4
Beef burger, frozen	Beef	13.4
Potato	Root vegetables	12.5
Sandwich, chicken	Ready-to-eat	12.1
Chicken thigh	Chicken	11.2

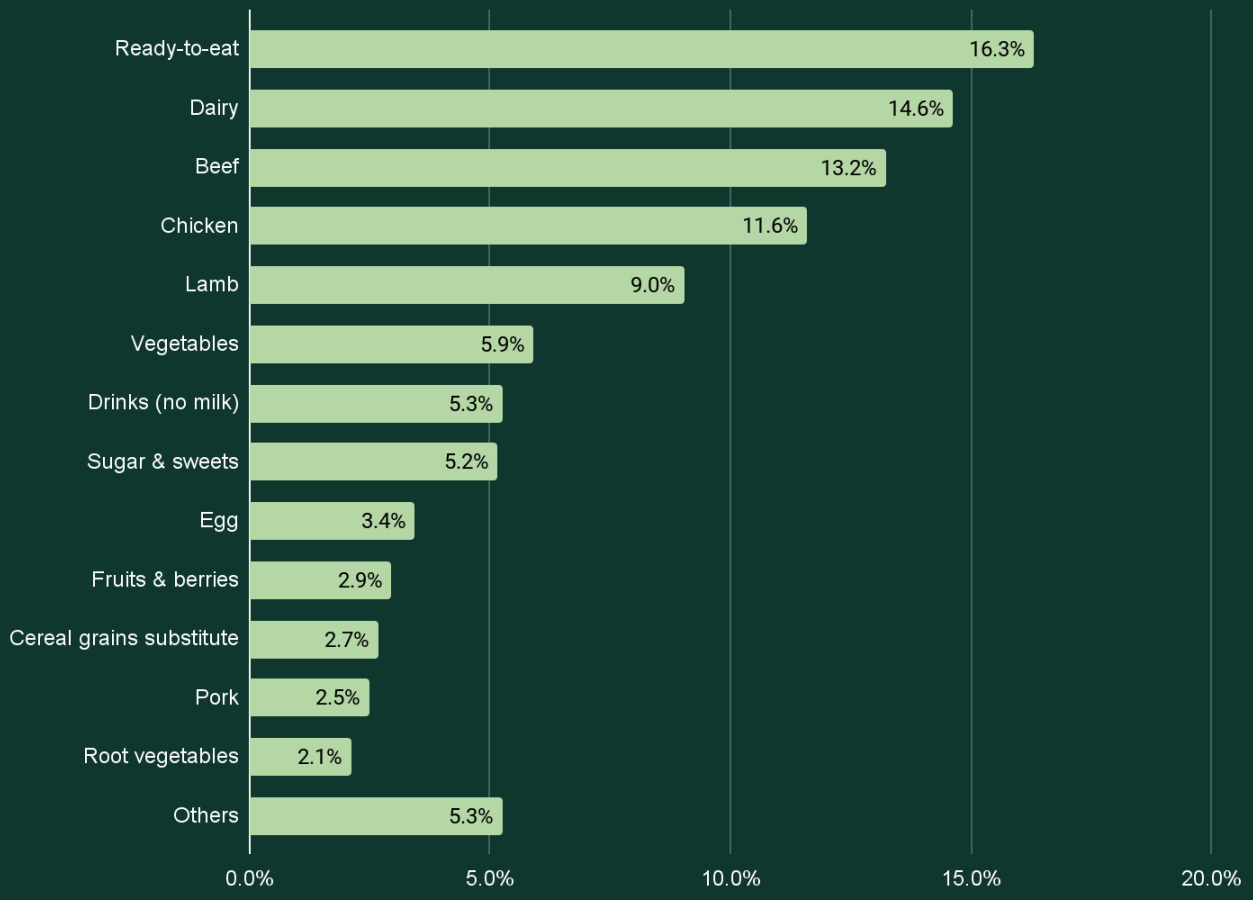

***Figure 4**: Share of the total CO_2e emissions per category of ingredient*

Figure 4 shows the share of emissions from the food categories contributing mainly to the total emissions (share > 1% of total emissions). The “Ready-to-eat” is the food category with the highest share of CO_2e emissions (16.3%), followed by Dairy (14.6%), Beef (13.2%), Chicken (11.6%) and Lamb (9.0%).

The Ready-to-eat category, which accounts for 16.3% of total purchased quantities, includes the recipes that were calculated by Klimato. Examples of recipes included in this category are panini, sandwiches or pastries.

RESULT INTERPRETATION

In order to reduce the Scope 3 emissions from the University of Manchester, the focus needs to be primarily on a few very impacting ingredients: milk, beef and lamb. These ingredients have high emissions either because their carbon intensity is high (for beef and lamb) or because they were bought in very large quantities (for example milk).

Red meat products (beef and lamb) contribute largely to the total GHG emissions. The quantities purchased are relatively low compared to other products but their carbon footprints per kg of food are among the highest.It is interesting to notice that, when looking at single ingredient emissions (Table 5), the 15 tons of purchased chicken ranks second, while lamb and beef rank third and fourth even if purchased in much lower amounts (2.4 and 1.3 tons), respectively. Reducing the use of red meat products, even slightly, will considerably cut the overall emissions.

Milk products have the largest share of emissions because they are purchased in very large quantities. In a hypothetical scenario where all the free range semi-skimmed milk purchased (87.2t) was replaced by a plant-based alternative (oat milk), its resulting carbon emissions would be almost halved, decreasing from 80.2 t CO_2e to 42.9 t CO_2e. The total Scope 3 category 1 would be reduced by 5.9%.

A notable finding is that the Ready-to-eat category contributes to around 15% of total GHG emissions. This is due to the large quantities purchased and the high carbon intensity of certain ingredients in their recipes, such as butter (e.g., in pastries), meat and fish (tuna in sandwiches). Encouraging students to opt for a vegetarian sandwich and offering vegan pastries will help decrease the emissions from this part of the purchases.

Finally, the transport of the ingredients represents 5.6% (43.4 tCO_2e) of the total emissions. This percentage falls in the usual range for the share of emissions allocated to transport in the food supply chain[7]. It would be interesting to refine the transport calculations because assumptions were made (for example several countries of origin for a single product could not be taken into account). Regardless of that, the transportation of products represents a low share of the total emissions, therefore this part of the supply chain does not offer substantial opportunities for reducing significantly the overall GHG emissions.

[7] Crippa, et. al. (2021)

CONCLUSION

The total CO_2e emissions associated with the food purchased during 2023 by the University of Manchester equals 781.1 tons CO_2e. These results can be used in a full Scope 1, 2 and 3 assessment, in place of Scope 3 category 1.

In order to reduce emissions, the study demonstrated that focusing on the largest emitters is pivotal. In this case, the ingredient responsible for the largest emissions is the semi-skimmed milk. It is therefore recommended to encourage the use of plant based alternatives. Solely replacing cow's milk with oat milk can reduce emissions by 5.9%. Additionally, the second and third highest emitting ingredients are lamb and beef meat. It is recommended to reduce the amount of red meat and favour poultry or vegetarian alternatives.

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If you have any questions, contact Klimato at hello@klimato.com