Project Report EatMe – I’m low carbon

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As a project start, we created a survey regarding existing knowledge about the CO2 footprint and ways that consumers would like further information about it to be made available to them. The aim was to get a clearer image of what people actually need and want. After a hard fight with EVASYS settings, our team managed to launch and even complete the survey shortly after the Christmas break. At that point, with the results of the survey in hand, the idea of creating a mobile app died. For the participants of the survey, a smartphone app would have been only the fourth most desirable option of getting information. On the other hand, a vast majority wanted more information about their food with respect to ecological implications. Thus, instead of trying to somehow still justify developing an app, our team reacted to the outcome by steering our efforts in the direction of a poster that could be displayed in supermarkets. For consumers, information presented directly on food packaging would be a more immediately accessible source of information, but we considered that the realization of such a goal would be unachievable in the limited amount of time available to us. Applying the concept of "SMART" goals that Miss Prehofer suggested in a workshop on project management helped us in setting realistic goals. After having agreed on the desired outcome, our team quickly started working on it.

In the beginning, our team consisted of a group of thirteen students, motivated by the common topic "decision processes in the food industry". We kicked off the team-building process, highlighted in a workshop by Miss Prehofer, with a beautiful day at a climbing garden in August 2016. Supporting each other at challenging points and succeeding in overcoming obstacles together got the spirits up. Nevertheless, bringing together the interests, passions, and skills of thirteen young and idealistic students is obviously quite a challenge. Therefore, we decided to split up into two smaller, more specific interest groups for efficiency reasons. Our sub-team decided to take a closer look at how people care about the CO2 footprint – as one aspect of the general ecological footprint – in their food consumption, hence the name "EatMe. I'm low carbon!". At first, the projected outcomes seemed clearer to us than they turned out to be in the end. For example, one team member had a "clear imagination of a mobile application that people would use during their shopping to scan barcodes." In the project evolution, unexpected events provided opportunities for re-examining our initial idea and redirecting our efforts to viable outputs. In fact, we ended up nowhere near the initial idea. But let us get back to the beginning.
Yet, the next experience was a huge setback. Realizing that existing data was either sparse or extremely complex, our team had to adjust the scope of our project. Rather than analyzing certain food types in depth, we decided to give a high-level overview of various types of food. During this data-gathering phase, we ourselves were repeatedly surprised by facts. Did you know that consuming cheese generally causes more CO2 emissions than eating chicken? Or that rice production is emitting CO2 not because of its transportation routes but because of the way it is grown?

Throughout the project time, we had constantly to evolve and rethink our ideas while still managing to advance the project. Our whole team agreed that „a great atmosphere of common enthusiasm“ as well as „lots of constructive discussions“ were crucial in ensuring the project’s success. Nevertheless, there were also phases of low productivity. That was the case especially at points where we struggled with „too many reportings, due dates and obligatory meetings/workshops, which slowed down the progress of our project,“ as one team member phrased it, giving voice to a common thought among the whole group.

A short sketch about conscientious food consumption and CO2 labelling at the buffet afterwards distinguished our presentation from standard talks. We were very pleased by the approval and encouragement we got from the attendees.

A second meaningful highlight was the making of a video in Munich’s pedestrian area. The video can be watched by scanning the QR code. Hoping to make people reflect on the issues involved, we interviewed random passers-by on their knowledge about and concern for their CO2 footprint. Switching sides and getting the „very interesting new experience of being in the role of an interviewer instead of the spectator“ gave our team members highly interesting impressions.

We have tried to improve awareness and actual knowledge about the CO2 footprint. Spreading the word about that topic in the forms of a talk, a video, and miniature versions of the designed posters has not only proved educational to our team but has generated actual value in making people think about their food decisions. After all, the most important thing is not that every single decision is made in favor of a smaller CO2 footprint but rather that people actually start thinking about what implications their food consumption has. Hence, we were happy when one of the interviewed people left with the words „thanks for telling me, this definitely made me think.“ Mission accomplished!

An unexpected opportunity arose through the network of the TUM: Junge Akademie when our team was presented with the chance to participate in an event of the series „acatech am Dienstag.“ We teamed up with Prof. Dr. Thomas Hofmann, Senior Vice President of TUM and leading researcher in food-related biotechnology, to give the audience different perspectives on food consumption.
Abstract

Quantifying the ecological impacts of human nutrition is a complex challenge. Based on the product carbon footprint, our information poster enables consumers to improve decision-making processes when buying food.

Background

Imagine yourself on a Saturday morning in the supermarket, shopping for groceries for next week. While you are walking through the aisles richly packed with an incredible variety of products, you are making an important decision every second – although lacking most of the knowledge and information you would need for a successful decision-making process. Standing in front of the vegetables, you might be wondering whether you should choose oranges from Spain, kiwi fruits from Italy or apples from Germany to fulfill your vitamin requirements with the smallest ecological footprint. Maybe the German apples have been stored in a refrigerated warehouse for months, making their resource consumption per kilogram larger than the environmental footprint caused by transporting the oranges from Spain to Germany? Should you buy yoghurt in a reusable glass or in a lightweight plastic container? Which one has a smaller ecological footprint, soy tofu or organic meat from a local farm?

Approximately three quarters of consumers in Germany experience uncertainty and indecision when buying food. These decision-making processes are connected to significant financial expenditures: in 2014, the average German household spent 285 euro on food each month. At the same time, human nutrition makes up a considerable share of global greenhouse gas emissions. The complex value chain of food production, from cultivation, harvest and processing to transport, supermarket sale and refrigeration in a private household, causes so-called “direct” emissions. In addition, “indirect” emissions due to land-use changes further increase the environmental footprint of nutrition. Deforestation for palm oil cultivation in Southeast Asia is a prominent example of indirect greenhouse gas emissions connected to food consumption.

Complex production chains and diverse environmental impacts make it hard to reliably quantify the ecological consequences of human nutrition. Within the 28 member states of the European Union, agriculture alone has a 10 % share of total greenhouse gas emissions (figure 1). When considering the total value chain from the farmer’s field to the dinner table or landfill, food consumption is estimated to be responsible for approximately 30 % of greenhouse gas emissions in Europe. These numbers show that research into the quantification of food’s environmental impact and the associated consumer behaviour is highly relevant. In addition, building consumer awareness within this area can play an important role in mitigating greenhouse gas emissions and tackling climate change.

Goals and methods

Our project pursued two key goals:

1. To develop a better understanding of consumers’ knowledge and behavior in relation to food’s ecological footprint
2. To build awareness among consumers for the importance of food’s ecological footprint by designing an information tool

Our two key goals also defined two consecutive project phases, each characterized by a distinct set of methods.

In our first project phase, we initially conducted an extensive literature search to understand existing approaches for quantifying food’s ecological footprint. The resulting overview of existing studies, key aspects and consumer behavior characteristics served as a groundwork for formulating our hypothesis: Better informed consumers will take a product’s ecological footprint into account for their purchase decision.

Based on this hypothesis, we designed a consumer survey to get a better insight into awareness of and knowledge about the term „ecological footprint.” Furthermore, we aimed to understand how such knowledge potentially influences consumers’ decisions when buying food. To allow for correlation calculation, we used the Likert scale for most of the questions. Additionally, we used multiple choice questions to allow participants a choice for their favored option(s). Aware of our survey’s explorative character, we also introduced several open questions where the participants had the opportunity of giving us further input. We intentionally tried to acquire participants from different social backgrounds to ensure a
diverse survey population. By offering the survey online as well as offline we were able to achieve a total of 243 participants.

In addition to quantitative customer surveys, we also conducted two expert interviews. An interview guide was carefully designed to ensure purposeful questions and high information density. We interviewed two researchers at the Technical University of Munich, Dr. Norman Siebrecht (Chair of Organic Agriculture and Agronomy) and Christian Wolf (Chair of Wood Science), who are both experts in the quantification and analysis of agriculture’s environmental impact.

The second project phase aimed at increasing public awareness and improving the transparency of a product’s ecological footprint for the customer in the supermarket. Here, an important method was the establishment of fruitful partnerships with public institutions and private companies. We employed personal networks and designed a one-pager for a convincing presentation of our project work when contacting potential partners via e-mail or telephone. In the development of our information tool, iterative prototyping based on direct customer feedback also constituted a major part of our methodology.

Outcome and discussion

In general, the ecological footprint “measures humanity’s impact on ecosystems in terms of resources used to satisfy human needs.” It describes a “ratio of human demand for natural capital and the planet’s capacity to sustain it.” For the quantification of a food product’s ecological footprint, various metrics with different units can be employed. Frequently used metrics are
Figure 2: Survey employed for online and offline consumer interviews.
1. Energy intensity: measures the net fuel-energy consumed to provide the heat and power requirements for the production process

2. Water consumption: measures the amount of fresh water, excluding rainwater, consumed per unit output of the production process

3. Greenhouse gas emissions: measures the amount of carbon dioxide equivalents emitted per unit output of the production process

Using a chosen metric, a product’s ecological footprint can be quantified by means of a life cycle assessment (LCA). A LCA comprises a detailed inventory of a product’s value chain to assess environmental impacts associated with all the stages of its life (figure 3). In the context of food, most research and quantification attempts are focused on the product carbon footprint (PCF). The PCF measures all greenhouse gas emissions along the food’s life cycle and is indicated in kg CO₂ per kg of a specific food product.

However, there is a controversial debate around the suitability of the PCF for reliably quantifying a food product’s sustainability. In most general terms, sustainability includes environmental, economic and social dimensions. However, the PCF does not consider important social criteria, such as social justice, human and labour rights, and it neglects environmental pollutants apart from greenhouse gases. These limitations of the PCF model have been confirmed in our expert interviews: Dr. Siebrecht stressed that greenhouse gas accounting was only a very small aspect of the huge idea of sustainability. Mr Wolf underlined this problem with the example of firewood: it has comparatively low CO₂ emissions as a fuel, but releases high concentrations of particulate matter when burned.

On the other hand, various reports have also emphasized the potential benefits of using the PCF as a sustainability metric. For example, a pilot study conducted in Germany has come to conclude that a “transparently documented product carbon footprint creates a stable foundation for a targeted product communication to improve climate-friendly consumption.” The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety has highlighted the necessity for developing better assessment standards and including relevant social and economic considerations in the PCF. However, further research “could transform the product carbon footprint into a useful tool to increase consumer awareness and identify possibilities of reducing greenhouse gas emissions in cultivating, processing, transporting and storing food.” After careful consideration, we have therefore decided to focus our development of an information tool on the PCF while constantly taking its limitations into account.

Our survey of 243 consumers produced several interesting results. For example, the majority of interviewees estimated that their purchase decisions have a medium to high impact on climate change; likewise, more than 50 percent are willing to pay a higher price for an eco-friendlier product. We found that roughly 86% of all participants would find it “good” or “very good” to have more information attached to the packaging about how “environmentally friendly” the food is, whereas less than 60% stated the same for information about the “ecological footprint.” Hence it could be inferred that people do not connect this latter term to eco-friendliness. The most favored means of information delivery
Figure 4: Key results of our consumer survey.
is on the food's packaging, followed by informational posters in supermarkets and via an app or website. This is contrary to our initial expectation that most would prefer an app or a website as their first information source. When looking at the kind of food that consumers want more information for, the survey shows that fruit, vegetables, and meat/fish are on top of the list. We also found that more than 88% would be willing to pay more for food that is more environmentally friendly.

Based on the results of our literature research, expert interviews and customer surveys, we designed an information poster for consumers in the supermarket. Our poster aims at increasing consumer’s understanding of the PCF in the context of food, and gives specific advice for buying less carbon intensive food products. To make our information tool as effective as possible, we designed it according to pre-defined criteria: simplicity, ease of distribution, focus on graphical representations and colorful illustrations, low cost and opportunities for further information about the topic (figure 5). Important research results presented on our poster are:

1. Organic, seasonal and regional cultivation of tomatoes emits 0.035 kg of CO$_2$ per kg of tomatoes, while conventional farming in heated greenhouses causes 9.3 kg CO$_2$/kg of tomatoes.$^{10}$

2. Beef production amounts to 16.9 kg CO$_2$/kg, potato cultivation to only 0.5 kg CO$_2$/kg.$^{11}$

3. The amount of food thrown away in Germany each year accounts for 22 million tonnes of greenhouse gas emissions.$^{12}$

To increase the impact of our information poster in building consumer awareness, we pursued two key activities. Firstly, in a partnership with the National Academy of Science and Engineering (“acatech”), we organized a successful discussion evening about sustainable food production with Prof. Dr. Thomas Hofman (Chair of Food Chemistry and Molecular Sensory Science, TUM) as key speaker. In addition, we produced a video as a starting point for a social media campaign or educational tool: passers-by in the Munich pedestrian area were quizzed about the carbon footprint of different food products in a fun and interactive way, and were presented with one of our posters at the end (figure 6).

Summary and future goals

The product carbon footprint (PCF) measures all greenhouse gas emissions along the life cycle of a food product. Our literature research and expert interviews have shown the limitations of the PCF as a sustainability indicator for nutritional choices, but also demonstrated its potential usefulness to improve consumers’ understanding of food’s ecological impact. The customer surveys highlighted that many consumers wish for more detailed information about the eco-friendliness of a specific food product. Our information poster gives specific and simple advice to consumers for reducing their carbon footprint in the supermarket. The discussion event at acatech and our awareness-building video provided starting points for increasing the public engagement with the topic.

To ensure our project’s positive impact on decision-making processes related to food products, we have two future goals:

1. Implementation of a distribution strategy for the information poster in supermarkets and iterative optimization.

2. Integration of the video into a social media campaign or educational tool.

Furthermore, there is also a pressing need for further research and policy implementation. An international standard for assessing the PCF is crucial to ensure a global and transparent comparison between products. In addition, the suitability of the PCF metric for quantifying sustainability needs to be improved by integrating social and additional ecological aspects. And, lastly, political measures are necessary to ensure reliable and accessible life cycle assessment data for any food product. This is a key requirement for successful employment of the PCF as a tool for improving consumers’ decision-making processes in the long term.
**Figure 5: Key elements of our information poster.**

- **Simple overview** shows carbon footprint of different foods, helping the consumer to develop a general understanding of his impact.
- **Short and precise advice** enables consumers to improve decision-making processes and lower their carbon footprints.
- **Examples** based on concrete scientific data highlight the potential positive impact of considering the carbon footprint in consumption choices.
- **Colour and easily readable illustrations** attract attention to the poster and ease understanding.

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**EatMe. I’m Low Carbon.**

Tipps für einen klimafreundlicherehen Einkauf

Besonders informierte VerbraucherInnen ziehen den CO₂-Fußabdruck in ihre Kaufentscheidungen ein.

**Tipps 1:**
Wer regionale, saisonale und biologisch produzierte Lebensmittel einsetzt, benötigt weniger Platz auf dem Feld, sondern unterstützt auch die örtlichen Landwirte.

**Tipps 2:**
Wer an Fleisch verzichtet, vermeidet mehr CO₂-Emissionen seiner Ernährung, indem er sich nicht nur auf das Fleisch konzentriert.

**Tipps 3:**
Wer das Auto nicht fährt, ist die CO₂-Emissionen seiner Ernährung nur halb so hoch, selbst wenn er den Pendelweg zu Fuß macht.

**Tipps 4:**
Wer verpackungspare, weniger Lebensmittel kauft, schützt nicht nur das Klima, sondern auch die Meereswelt, weil die Konsumption von Plastikmüll deutlich reduziert.

**Tipps 5:**
Wer ein Einzelhandelsschneidele und Lebensmittelverdichter verwendet, spart nicht nur die Umwelt, sondern auch seinen Geldbeutel.

**Was ist der CO₂-Fußabdruck?**

Verpackungspare, vermeidet man nicht nur die CO₂-Emissionen seines Lebensstils, sondern spart auch den Platz auf dem Feld und unterstützt die örtlichen Landwirte.

**Warum ist der klimafreundliche Einkauf wichtig?**

Klimawandel ist eine der größten Herausforderungen unserer Zeit. Deshalb ist es wichtig, dass wir uns bewusst sind, was wir kaufen und wie wir unsere Lebensweise verändern können, um den CO₂-Fußabdruck in unserer Ernährung zu reduzieren.

**Wie kann ich säubere und regionale Einkäufe?**

1. **Regionale Lebensmittel**
2. **Saisonaler Einkauf**
3. **Vermeidung von Verpackungsmüll**
4. **Klimafreundliche Verkehrsmittel**
5. **Vermeidung von Einwegverpackungen**

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**Inspired by:**

[Image of butterfly]
Acknowledgements

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• Prof. Thomas Hofmann for his thrilling talk at the acatech event

• Ulrich Leyermann for designing our information poster

• Martin Prankl for producing our video

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Bibliography


**EatMe**

**Decision-making processes concerning food consumption.**

Buying food is an everyday activity for most of us. Yet the choice of food has become a highly emotional topic in our western society.

We want to analyze what unconsciously and consciously drives people when it comes to the decision of buying a certain foodstuff.

Imagine yourself on a Saturday morning, shopping the groceries for next week. Are you walking through the abundantly packed aisles of supermarket or do you prefer to visit your local farmer’s market?

Which criteria are influencing your decision for a particular product when buying apples, potatoes, eggs or coffee?

**BACKGROUND**

While the average German household spends 285 euro on food each month [2], approximately 30% of greenhouse gas emissions in Europe [3], this is a highly interesting area of research. Therefore, we want to implement our survey into the households’ market.

Standing in front of the vegetables, you are wondering whether you should choose tomatoes from Italy or lettuce from Germany to fulfill your vitamin requirements with the smallest ecological footprint. Maybe the German oranges from Spain, Kiwi fruits from Italy or apples from Germany to fulfill your vitamin requirements with the smallest ecological footprint. Therefore, we would like to implement either a mobile phone application, a homepage with information on the ecological footprint or brochure for the freshmen starting at the Technical University Munich (TUM). In 2014 the average German household spent 285 euro on food each month [2] and food consumption is responsible for approximately 30% of greenhouse gas emissions in Europe [3], thus it is highly interesting area of research. Therefore, we want to implement our survey into the households’ market.

**GOALS AND METHODS**

Our primary goal is to perform decision-making processes concerning food consumption and to better understand the influence of consumers’ financial and psychological factors. Our initial research focuses on the households’ market.

We are planning to test our hypotheses towards an explorative study that takes place in two phases. In the first phase, we want to conduct a survey of randomly selected consumers to get an overview of the dispersion of and the knowledge about the term “ecological footprint”. Furthermore, we designed it to get some insights about the decision-making processes concerning food consumption. Following up on our project plan we carried out a survey to find out if people even want more information on this aspect of their food.

**SUMMARY AND FUTURE GOALS**

The survey’s aim is to get an overview of the dispersion of and the knowledge about the term “ecological footprint”. Furthermore, we designed it to get some insights about the decision-making processes concerning food consumption. Following up on our project plan we carried out a survey to find out if people even want more information on this aspect of their food.

In the first sight of our data we could include 85 online participants. Therein, we found that roughly 86% of all participants would find it “good” or “very good” to have more information about how environment-friendly they are. Hence, less than 60% stated the same for the ecological footprint. Additionally, we used multiple choice questions to explore the awareness for the product carbon footprint. Therefore, we would like to implement either a mobile phone application, a homepage with information on the ecological footprint or brochure for the freshmen starting at the Technical University Munich (TUM). In 2014 the average German household spent 285 euro on food each month [2] and food consumption is responsible for approximately 30% of greenhouse gas emissions in Europe [3], thus it is highly interesting area of research. Therefore, we want to implement our survey into the households’ market.

**OUTCOME AND DISCUSSION**

In the first sight of our data we could include 85 online participants. Therein, we found that roughly 86% of all participants would find it “good” or “very good” to have more information about how environment-friendly they are. Hence, less than 60% stated the same for the ecological footprint. Additionally, we used multiple choice questions to explore the awareness for the product carbon footprint. Therefore, we would like to implement either a mobile phone application, a homepage with information on the ecological footprint or brochure for the freshmen starting at the Technical University Munich (TUM). In 2014 the average German household spent 285 euro on food each month [2] and food consumption is responsible for approximately 30% of greenhouse gas emissions in Europe [3], thus it is highly interesting area of research. Therefore, we want to implement our survey into the households’ market.

**ABSTRACT**

In the first phase of our project we decided to deal with the product carbon footprint. Following up on our project plan we carried out a survey to find out if people even want more information on this aspect of their food. And if so, what kind of information they want and in what form they want it.

**REFERENCES**

EatMe. I’m Low Carbon.

ABSTRACT: Building on our consumer surveys and expert interviews, we are currently working on the next big challenge of conducting a reliable life cycle assessment for a food product and presenting its results to the consumer in a precise, but understandable manner. A poster, website, smartphone application or social media campaign are possible tools to transform our results into increasing public awareness for the ecological footprint of nutrition.

HYPOTHESIS: Better informed consumers will take a product’s ecological footprint into account for their purchase decision.

GOALS AND METHODS: The presented approach uses participatory design methods to elicit consumer preferences and impact statements. The ecological footprint “measures humanity’s impact on ecosystems in terms of area of land or sea needed to produce the goods and services consumed by an individual, population or entity.” Additionally, we aim to improve consumer awareness and give them a better understanding of how to reduce their footprint.

OUTCOME AND DISCUSSION: The ecological footprints were calculated using the program “Tremod 5.63” and compared to the Danish footprint. The Danish footprint is calculated using the same method as our footprint.

Summary

The ecological footprint “measures humanity’s impact on ecosystems in terms of area of land or sea needed to produce the goods and services consumed by an individual, population or entity.” Additionally, we aim to improve consumer awareness and give them a better understanding of how to reduce their footprint.

TIP: Reduce your ecological footprint by reducing your consumption of meat products. The ecological footprint of meat products is significantly higher than that of vegetables. This is due to the extensive land and water resources required to produce meat products. Meat products also require more energy and water than other food products, which contributes to their higher ecological footprint.

Figure 1: The ecological footprint of different food products is influenced by factors such as production methods, transportation, and packaging.

Figure 2: The ecological footprint of different food products is influenced by factors such as production methods, transportation, and packaging.

Food Water Electricity Transport Commodities

Table 1: The ecological footprint of different food products is influenced by factors such as production methods, transportation, and packaging.

<table>
<thead>
<tr>
<th>Product</th>
<th>Ecological Footprint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>9.3 kg CO₂eq/kg</td>
</tr>
<tr>
<td>Vegetables</td>
<td>0.1 kg CO₂eq/kg</td>
</tr>
<tr>
<td>Fruits</td>
<td>0.2 kg CO₂eq/kg</td>
</tr>
</tbody>
</table>

Figure 3: The ecological footprint of different food products is influenced by factors such as production methods, transportation, and packaging.

Poster 3: Evaluation Day II

How can we improve consumer awareness for the ecological footprint of food?

ABSTRACT: Quantifying the ecological impacts of human nutrition is a complex challenge. Based on the product carbon footprint, our information poster enables consumers to improve decision-making processes when buying food.

GOALS:
1. Develop a better understanding of consumers’ knowledge and behavior in reaction to foods ecological footprint.
2. Build awareness among consumers for the importance of foods ecological footprint by designing an informative tool.

HYPOTHESIS: Better informed consumers will take a product’s ecological footprint into account for their purchase decision.

TEAM STRUCTURE AND PROCESS: After an extensive brainstorming session, we designed a consumer survey to get a better insight into the influence of each ecological footprint on consumer behavior. We then created an interactive app with two different levels of information and feedback. Our team was divided into three groups: the app development team, the content creation team, and the design team. Each group worked on a specific task and then presented their findings to the team.

OUTCOME: The app was found to be user-friendly and effective in improving consumer awareness and giving them a better understanding of how to reduce their footprint. The app was also found to be engaging and entertaining, which can help improve consumer retention.

THOREK: EatMe – I’m low carbon

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OCTOBER 2017

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Poster 4: Annual Conference 2017

JUNE 2017

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