D4.1
Assessing consumer behaviour, current and future diets

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FOR SUSTAINABLE FOOD

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Table of Contents

Table of Figures

Table of Tables

Executive summary

Background

Although livestock production plays a crucial role in food security, providing essential nutrients, and contributing to economic and social well-being (Godfray et al., 2018; Lin & Niu, 2018; Mehrabi et al., 2020; Ozanne et al., 2022; Rojas-Downing et al., 2017), as well as offering environmental benefits like landscape conservation, natural soil fertilization, and biodiversity preservation (Peyraud & Macleod, 2020), the global consumption of animal-based foods has surged in recent decades. This increase now poses a significant threat to both the environment and human health (Godfray et al., 2018; Nelson et al., 2016; Rohrmann et al., 2013). To tackle these issues, there is a growing recognition of the need to promote alternative worldviews and agricultural models that adhere to sustainability principles, ensuring the needs of current and future generations are met while fostering social equity, human well-being, and the conservation of natural resources (Page & Witt, 2022). Simultaneously, action is required across the food system to secure food and nutrition for a growing global population.

Considering that advances toward greater sustainability can only be successfully implemented if incorporated into a change in the entire food system, the objectives of this study were to shed light on the potential for change on the consumer side and to identify leverage points and transition pathways for such a change by means of a consumer's survey, described in this report accomplished in Workpackage 4.1 of the Pathways project.

Objectives and scope

The objectives of this study were to explore the potential for change towards greater sustainability in the food system on the consumer side and to identify leverage points and transition pathways for such change, considering that advances toward greater sustainability in the food system can only be successfully achieved if incorporated into a holistic system-wide transformation. The study focuses on dietary patterns that have reached unsustainable levels and therefore need to be considered and studied in more detail. In particular, the study emphasised on the interrelationship between dietary patterns (behaviour) and psychological (including motivational levels, attitudes, and knowledge) and socio-demographic characteristics as determining factors identified being relevant in the context of food choice (see chapter background), as suggested by the alphabet theory (Zepeta et al., 2009).

The primary objectives of this research were to:

- Identify different consumer archetypes regarding their dietary patterns, revealing differences in terms of impacts on the food system sustainability (to be further analysed in WP 4.2)

- Establish profiles of each archetype regarding main socio-demographic characteristics, motivational levels, attitudes, knowledge regarding food sustainability, serving as background information on the consumers' position towards food system sustainability
- Analyse how consumers perceive their own role in a food system change towards greater sustainability
- Determine the potential and acceptance of selected intervention and policies, hereunder specific policies that were addressed in the Pathways project as visions, to receive information on how a shift in consumer demand and in the food system.
- Identify consumers' preferences and willingness to pay for selected sustainability innovations in livestock farming practices as envisioned in the Pathways project in the practice hubs
- Identify culturally-rooted differences between study countries regarding dietary, psychological factors, socio-demographics, acceptance of sustainability interventions and policies and willingness to pay for sustainability innovations on the livestock sector

Methodology

We carried out an online survey and choice experiment in five study countries, Germany, France, Italy, Sweden and Romania. These countries were chosen to cover the different geographical regions with different cultural backgrounds and eating habits in the EU. The data was collected in autumn/winter 2023/2024.

In each study country, approximately 500 respondents participated in the survey. The survey concept consisted of three main elements: i) the identification of consumer dietary types, ii) the profiling of these dietary types by various consumer characteristics, such as socio-demographic characteristics, psychological factors, buying habits and acceptance of transition towards sustainable food systems, resulting into consumer archetypes, and iii) identify the consumer archetypes' preferences and willingness to pay for a selection of sustainability innovations in the livestock sector.

Results

CONSUMER ARCHETYPES

We identified four dietary types based on self-reported patterns and characterized them using socio-demographic and psychological factors.

Consumer archetype 1 "Dairy": The first cluster is characterised by a high uptake of milk and dairy products. With a share of 23.29 %, Cluster 1 is the second smallest of all clusters. This archetype is particularly strong in Sweden. Germany and France also have a high proportion of this type of consumer.

Males and females are almost equally represented, while younger consumers are slightly less represented than middle and older consumers. People with a low or medium level of education are more likely to belong to this archetype than consumers with a high level of education, while there is no clear trend in income level despite the rather high level of medium education in this archetype. It furthermore has the second lowest average level of motivation for more sustainable food consumption.

Consumer archetype 2 "Starch": Cluster 2 is typified by a high uptake of starch containing products, such as bread and bakery products, pasta, rice, etc. With a share of 18.55 %, it is the smallest of all the clusters. The second archetype is particularly represented in Romania, where it is the largest archetype (36.3%). In the other countries, this archetype is much less represented, ranging from 22.1% in Germany to only 10.6% in France and 11.5% in Italy. The cluster is clearly represented by male consumers (22.7%) rather than female consumers (14.5%). The higher the age group, the more consumers are likely to belong to the archetype. Conversely, higher levels of income and education are associated with lower levels of representation in this archetype. In addition, consumers in this archetype have the lowest average level of motivation for more sustainable food consumption, while it is the most relevant archetype in Italy.

Consumer archetype 3 "Protein": Consumers in the third cluster are characterised by a high uptake of all types of meat, fish eggs and by protein-rich plant food. In addition, the cluster is characterised by a high uptake of sweets and snacks. With a share of 31.73%, the cluster is the largest of all the clusters. It is also characterized by the highest intake of meat substitutes. It is the most common archetype in Italy (closely followed by archetype 4 in Italy). In Germany, however, it is less represented than in the other countries. More men than women belong to this archetype, and younger than older consumers. There is no clear trend in terms of education and income level. Consumers in this archetype have the second highest average level of motivation for more sustainability in food consumption.

Consumer archetype 4 "Fibres": Consumers in the fourth cluster have a high uptake of the fibre-rich and plant-based food categories fruit, berries, vegetables and salads. With a share of 26.43 %, it is the second largest of all the clusters. It is also characterized by the lowest consumption of sweet and snacks. With a total share of 26.43 %, this consumer archetype is the second largest of all archetypes and particularly consumers in Italy are likely to belong to this archetype. The archetype is clearly represented by female consumers and is more common in the medium and especially in the highest age group. The higher the level of education and income, the more likely consumers are to belong to this archetype. Consumers in this archetype also have the highest average level of motivation for more sustainability in food consumption and for high nutritional quality (fibre, less sweets and snacks).

ATTITUDES

As regarding the attitudes towards sustainability in the food system, a clear pattern is that consumers belonging to the archetype "Fibres" show positive attitudes towards food sustainability. These consumers would like to have more information and practical tips on sustainable food consumption. They are also in favour of more support for animal friendly, environmentally friendly, climate friendly production systems,

and the preservation of natural landscapes, whereas the latter had the highest level of agreement in this archetype. Consumers in this archetype also had the highest willingness to pay for animal welfare, climate and environmentally friendly production. For the other archetypes, no clear patterns could be identified. The average attitudes in the other dietary types are lower. Consumers in these types tend to neither agree nor disagree with most of the statements except consumers in the dairy and starch types, which, on average, slightly disagree with the statements "I am willing to pay higher prices for climate friendly food production" and with "I am willing to pay higher prices for environmentally friendly food production".

Consistent with their high mean scores for food sustainability, consumers of archetype 4 'Fibres' had the lowest mean scores for negative attitudes towards food sustainability (see Table 16). Consumers of archetype 1 'Dairy' appear to be the most price sensitive and least willing to pay for food sustainability. They have the highest level of agreement with the statements 'I already pay enough for other things', 'I refuse to pay more for food sustainability' and 'When I buy food, I always look for the cheapest option', and the second highest level of agreement with the statement 'Above all, food should be cheap'. Consumers belonging to archetype 2 'starch' also show high levels of agreement with the above attitudes. However, even archetype 3 'protein' consumers are not necessarily in favour of more sustainability in food. These consumers (together with archetype 1) showed the highest levels of agreement with the statements 'I refuse to pay more for food sustainability', for 'I am not interested in food sustainability' and for 'The current level of sustainability in food production and consumption is sufficient. There is no need to increase it. Obviously, consumers in this archetype are the least aware of food sustainability and see no need for action.

KNOWLEDGE

The study results, furthermore, outline the lack of consumer knowledge on issues that are related to European agricultural regulations and practices. Regarding the statement "By EU legislation, all farm animals in Europe have access to outdoor runs several months a year", it is striking that about one third of the consumers in the study countries and particularly consumers belonging to the type "dairy" believe that all farm animals have access to outdoor runs several months a year and only a small portion of consumers know that the statement is false, whereas the answer "I don't know" was the most frequently chosen answer.

Similarly, the share of consumers, who believe that by EU legislation, dairy cows must be kept on pastures several months a year is mandatory is high for all consumer types and particularly high among consumers belonging to the consumer type "dairy", whereas only a small portion of consumers in the study countries believe that this statement is false. Again, the answer "I don't know" was the most frequently chosen answer and was chosen by more than 40% of the respondents across all consumer types.

Particularly consumers in consumer type "Fibres" believe that reducing a high level of animal product consumption significantly reduces negative impacts in GhG emissions, whereas it is much lower in the other archetypes and lowest among consumers belonging to the consumer types "protein" and "starch". The

share of consumers who chose the answer "I don't know" was considerably lower for this consumption related statement than for the two previous production related statements

Similar to the first two production-related statements, about one third of the consumers believe that by EU legislation, pig stables include bedding material, whereas only a very small portion of consumers, ranging from 14.5 % in the consumer type "Dairy" to 22.1% in the consumer type "Protein" stated that this statement is false. Again, the answer "I don't know" was the most frequently chosen across all consumer types.

Same as for the other production-related statements, the level of consumers who believe that per EU legislation, calves must remain with the mother cows several months after birth, is relatively high and ranges between 31.8% in the consumer type "Fibres to 37.1% in consumer type "Protein". Same as for the other production-related statements, the answer "I don't know" was the most frequently chosen answer and was chosen by more than 40%t in consumer types "Protein" and "starch" and even by more than 50% of consumers in the consumer types "Fibres " and "Dairy"

To conclude, the study revealed regional and cultural differences in dietary patterns and attitudes towards sustainability. It highlighted varying potentials for transition among different consumer archetypes, with the overall motivation for sustainability in food consumption being moderate and insufficient to drive significant change without accompanied interventions and policies.

INTERVENTIONS AND POLICIES

Among the interventions to promote more sustainability in the food system, consumers' acceptance is highest for financial incentives for sustainable food choices (e.g. VAT reduction for sustainable alternatives) recommended, followed by labelling of sustainable products (traffic light), whereas imposing taxes/monetary compensation for unsustainable products had the lowest level of acceptance in all four consumer archetypes. This result suggests that structural changes towards financial incentivisation of sustainable food choices in the food environment and particularly at the point of sale, e.g. by introducing payback systems for sustainable food choices, might be welcomed by consumers.

More diversity was found regarding the acceptance of future policies to improve the sustainability in the livestock sector, whereas a "Shift to consumption of locally produced meat (and other animal-based products)" and a "Shift to consumption of meat (and other animal-based products) from animal friendly production systems" were the policies with the highest acceptance among consumers. In contrast to other consumer archetypes, consumers in the **Protein** and **Dairy** archetypes are in favour of "more artificial lab-grown meat" as an alternative to meat. Typical among consumers of the **Starch** archetype is their high acceptance of "Significant reduction of meat (and other animal-based products) consumption" and for "Shift to consumption of meat (and other animal-based products) from animal friendly production systems". Also, their support of the policy "More meat and other animal-based products from organic production" is relatively high. In general, information and financial incentives for sustainable food choices (e.g. VAT reduction for sustainable alternatives) have the highest acceptance. These conclusions are confirmed by

previous findings pointing out the role of nudging in fostering sustainable consumptions. However, incentives should be designed according to the type of consumers, that are not to be considered a homogeneous group and need to be embedded or tailored to local/national context.

WILLINGNESS TO PAY FOR SUSTAINABILITY INNOVATIONS

Furthermore, the research on consumer preferences and willingness to pay for sustainability innovations in the dairy and pork sectors through choice experiments revealed a strong preference for animal welfare-related innovations, particularly pasture-based systems for dairy and free-range options for pork. Looking at the willingness to pay for cow milk in the single consumer types, the willingness to pay more for "pasture-based dairy cows" is highest among consumers in the Dairy type, closely followed by consumers in the Fibers type. For "Pasture-based dairy cows with calf rearing" the relative willingness was similar across all dietary types. Same applies to "Reduction of water pollution" and "Biogas production", whereas the latter had the lowest willingness to pay scores. Interestingly, the willingness to pay scores were relatively low in all country and only about half as high as the ones estimated for "pasture-based dairy cows" and for "Pasture-based dairy cows with calf rearing", although products produced in organic production systems provide a large range of sustainability improvements, such as reduction of water pollution, maintaining biodiversity, higher animal welfare standards, etc. Looking at the willingness to pay in the single consumer types for cooked ham, the willingness to pay more for "More space and designed indoor and outdoor area" is highest among consumers belonging to the "Protein" type, closely followed by consumers belonging to the "Dairy" type and lowest among consumers belonging to the "Starch" type. The same pattern holds for all the other attributes, except for "organic", where the willingness to pay is highest among consumers belonging to the "Fibers" type.

This unique approach to consumer profiling provides new insights into consumer behavioural research and contributes to the scientific debate on food system transformations.

Limitations

We acknowledge limitations in our study, including the generalizability of country-specific results to the broader European context, potential inaccuracies in self-reported dietary data, the dependence of the identified consumer archetypes on the chosen method, and the hypothetical nature of willingness-to-pay estimates from choice experiments. Despite these limitations, the study provides valuable insights into consumer behavior and preferences regarding sustainable food systems, offering a basis for decision-making in the food sector and supporting the identification of transition pathways towards greater sustainability, particularly in the livestock industry.

Introduction

While the consumption in Europe has slightly decreased over the past three decades, with an increase in poultry consumption and a decrease in beef and pork consumption (Our world data, 2024), global consumption of animal-based foods has increased significantly in recent decades. This trend and intensification of livestock production is expected to continue, with an estimated 60-150 % increase in demand for livestock products by 2050 (Godfray et al., 2018). The large increase in livestock production and consumption is a major threat to nature and health, and it is responsible for 80% of global deforestation (Nepstad et al., 2008) and associated with terrestrial biodiversity loss (Boakes et al., 2024). In addition, it is linked to greenhouse gas emissions (Cheng et al., 2022), which account for approximately 15% of all global greenhouse gas emissions, while at the same time climate change is negatively affecting livestock production systems (Cheng et al., 2022). Livestock production is also extremely intensive in terms of land, water and energy use (Blair et al., 2024). In addition, livestock production and consumption are associated with moral concerns regarding animal welfare (Bonnet et al., 2020), and the excessive consumption of processed meat has reached unhealthy levels, leading to dietary recommendations to reduce consumption (Godfray et al., 2018; Nelson et al., 2016; Rohrmann et al., 2013).

To address these challenges, there is growing recognition of the need to promote alternative agricultural models and food systems that are consistent with the core principles of sustainability, meeting the needs of present and future generations while promoting social equity, human well-being and the conservation of natural resources (Page & Witt, 2022). At the same time, action is needed across the food systems to ensure food and nutrition security for a growing population. Addressing these global challenges of food security and climate change will require simultaneous action on the demand and supply side (Bonnet et al., 2020; IPCC, 2022).

Previous research suggests that in European countries, changes in dietary behaviour depend on psychological factors, such as attitudes, social norms, and other factors ((Lin & Niu, 2018; M. Ross & Kapitan, 2018; Schwartz, 2012) and that the process of change can be facilitated by the coordinated efforts of civil society, health organisations and government. Dietary change requires a certain level of understanding and awareness of the impact of meat consumption (Blair et al., 2024; Cheah et al., 2020; Godfray et al., 2018). A key ambition of climate change policy is to (intrinsically) motivate consumers to make sustainable food choices over time by understanding the psychological drivers of behaviour (Clark et al., 2016; Hoek et al., 2021; Lin & Niu, 2018; Righi et al., 2023).

The Intergovernmental Panel on Climate Change (IPCC) has recognised in its latest report (Masson-Delmotte et al., 2019) that "the consumption of healthy and sustainable diets offers opportunities to reduce greenhouse gas emissions from food systems and improve health outcomes" (Peyraud & Macleod, 2020). Indeed, livestock production, when sustainable, can provide multiple benefits that not only contribute to food production and the supply of a wide range of foods, but also to the economic, environmental and social well-being of communities.

Livestock contributes to food security as it provides 33% of global protein, vitamins (such as B12), minerals (such as iron and zinc) essential for a balanced diet and 17% of global kilocalories consumed. In addition, livestock generates nearly 40% of global agricultural gross domestic product (GDP) (Beal & Ortenzi, 2022; Cheng et al., 2022; Rojas-Downing et al., 2017; Williams, 2007). Another added value is the recycling of non-edible plant parts in the food chain (e.g. as cellulose, non-edible proteins) (Peyraud and Macleod, 2020).

It is also an economic resource in that it provides employment for rural households at all stages of production, from farmer to processor, and trade in livestock and related food products is a key component of the economies of many countries (Godfray et al., 2018; Mehrabi et al., 2020; Rojas-Downing et al., 2017). In addition, livestock grazing can lead to numerous environmental benefits, such as landscape conservation, natural soil fertilisation and biodiversity conservation (Peyraud & Macleod, 2020).

Finally, there is also the social and cultural aspect that livestock farming can play, as in some rural communities it can contribute to identity and cohesion by being linked to the local and cultural traditions of the area, as well as promoting education and awareness about food origins and sustainable practices. All this can improve the quality of life for humans (Lin & Niu, 2018; Ozanne et al., 2022), but animal welfare-friendly practices can also improve the quality of life for animals, which is another important aspect that should not be forgotten (Clark et al., 2016; Rothgerber & Rosenfeld, 2021).

Recognising that progress towards greater sustainability can only be successfully implemented if it is embedded in a change in the whole food system, the aim of this study was to shed light on the potential for change on the consumer side and to identify leverage points and transition pathways for such change through a consumer survey carried out in five case study countries (France, Germany, Italy Romania and Sweden), described in this report, carried out in work package 4.1 of the Pathways project.

This report is structured as follows: after this introduction, section 2 provides the background to this study, including an analysis of sustainable practices, sustainable consumer characteristics and future opportunities, followed by an overview of theoretical frameworks in consumer behaviour, and the chosen theoretical framework in this study. The next section presents the objectives, scope and research questions, followed by the methods used in the study and the results. The final section provides a synthesis of the findings, discussion and conclusions.

Background

Sustainable practices, sustainable consumer characteristics and future opportunities

SUSTAINABLE PRACTICES

Food consumption depends to a large extent on the achievement (deliberate or automatic) of consumption goals related to consumers' values and beliefs (Lin & Niu, 2018; Righi et al., 2023). However, current consumption patterns and food choices have detrimental consequences both for human and planetary health (Springmann et al., 2016; Tilman & Clark, 2014). Agriculture occupies 40 % of global land area (Foley et al., 2005) with food production responsible for almost 30 % of greenhouse gas (GHG) emissions and 70 % of freshwater consumption (Foley et al., 2011). Consumers' eating habits can further increase the pressure on the environment in our food system, either through overconsumption of certain types of products (as red meat) or food waste (Springmann et al., 2016; Tilman & Clark, 2014).

Consumers are a key player in the change and must agree to change their consumption habits, but this is not enough since consumers are also influenced by the food environment, going beyond sustainable consumer food choices. It is necessary to look at producers, traders, marketers, distributors, policy makers and everyone in between, i.e. at all stakeholders in the value chain. The food system is what ultimately defines a diet, and thus it is necessary to look at the whole process.

The call for advocating for sustainability in the agri-food systems has long been witnessed. A half-century ago, two mentionable books successfully highlighted the dangers of exploiting farmlands and animals. The first, Silent Spring (1962) by Rachel Carson, documented the potential irrevocable harm to our ecosystem by a chemical pesticide called DDT. It was found to be killing animals in areas it was sprayed, and she later referred to chemicals like this as "biocides", as they were not just killing the insects. Beyond this, she emphasized the eventual consumption of critical pesticides, as it is in animals, crops, and water. She argues that man must proceed with caution when using this newfound power before witnessing the destruction of the environment.

Another notable piece of literature, Animal Liberation (1975) by Peter Singer highlights the importance of all beings that are capable of suffering deserve equal consideration. This is in reference to animals' capability to feel pain just as much as humans. This led to many altering their way of life by avoiding the use and consumption of animal products, which can be observed in vegan lifestyles. The publication of these books has also helped develop a growing concern over the topic of sustainable practices.

Another approach is the sustainable industrial practice. Theoretically, sustainable industrial practices are those using the 'triple bottom line' approach. This prioritizes adding value to the three P's profit, people, and the planet; or more specifically, economic, social, and environmental dimensions (Elkington, 1997). By emphasizing this, businesses engage in market competition through actual value generation for society, instead of just pure profit. Taking into account social and environmental dimensions on top of economics addresses the generality of sustainable practices in the food supply chain. It exposes the priorities of companies and their willingness to adopt stakeholder engagement. Thus, communicating the three P's with consumers is imperative when highlighting the sustainable characteristics of products (Gimenez et al., 2012).

Another industrial concept that individual corporations have embraced is corporate social responsibility (CSR) initiatives to mitigate their environmental and health impacts (Rayner et al., 2008). Manufacturers and retailers have various strategies at their disposal to realign their product offerings and corporate image to enhance consumer trust and gain a competitive edge. These strategies encompass product reformulation, the introduction of new "better for you" product lines, commitments to carbon footprint reductions, minimizing packaging, pledges to refrain from marketing to children, and other thematic initiatives (Rayner et al., 2008). Companies have endeavored to leverage concerns about health and the environment to their advantage by launching new product lines or repositioning existing products to capitalize on perceived health benefits.

In the field, sustainable agricultural practices tend to integrate traditional agricultural practices with more natural systems (Gunden & Thomas, 2012). Examples of sustainable approaches may include crop rotation, the use of organic fertilizers and materials, agroforestry, drip irrigation, and holistic pest management. Overall, organic agricultural systems best capture these aspects, so researchers will often look towards organic agriculture as a reference point. Other authors, namely Roy & Chan (2012), define sustainable agriculture as practices that are in line with ecological stability, socially just systems, and economic vitality. (Binder et al., 2010) emphasize sustainability goes beyond environmental factors to include economic and social dimensions. This interdisciplinary approach is vital in maintaining these systems. Lastly, the FAO utilizes a multi-dimensional perspective based on sustainable agricultural activities that are technically appropriate, economically viable, and socially acceptable, with no prospect of environmental degradation, all while satisfying human needs for current and future populations (FAO, 2020).

While there are many ways to define sustainable practices in all sectors of our food system, there are some obvious themes in common. For the processing and distribution sector, adopting ideas such as the triple bottom line approach or corporate social responsibility can aid in the development of sustainable goals. For agri-food system, by making use of good agricultural practices (fair use of synthetic fertilizers and pesticides), more holistic pest management, creating social equity for workers and community members, emphasizing animal welfare, and emphasizing natural cultural practices, a more sustainable agricultural system can eventually be achieved.

In a recent survey spanning 27 EU countries, taste, food safety, and cost emerged as top priorities for consumers, overshadowing sustainability concerns. Sustainable food and diets are primarily associated with health and nutrition (Hinojosa-Nogueira et al., 2021; Niehues & Klöckner, 2016). Accordingly, there is need to broaden efforts to incorporate additional dimensions of sustainable diets. While environmental considerations may not be the main motivator for most consumers, evidence suggests that other sustainability concerns, such as fair revenue for producers, workers' rights, animal welfare, and pesticide usage, hold significance (Panzone et al., 2016; Righi et al., 2023; European Commission, 2021). This presents an opportunity for awareness campaigns to underscore the inter-connectedness of these concerns with environmental issues.

CONSUMPTION TRENDS IN THE EU AND IN THE SINGLE CASE STUDY COUNTRIES

The following section describes the recent developments and statistics of consumption trends related to animal-based products in the European Union during and in the single case study countries the past three decades based on Our World Data (2024) (**Error! Reference source not found.**).

Figure 1 Per capita meat consumption in the EU (27) Source: Our world data (2024)

The meat consumption has slightly decreased over the past three decades, with an increase in poultry consumption and a decrease in beef and pork consumption (Our world data, 2024).

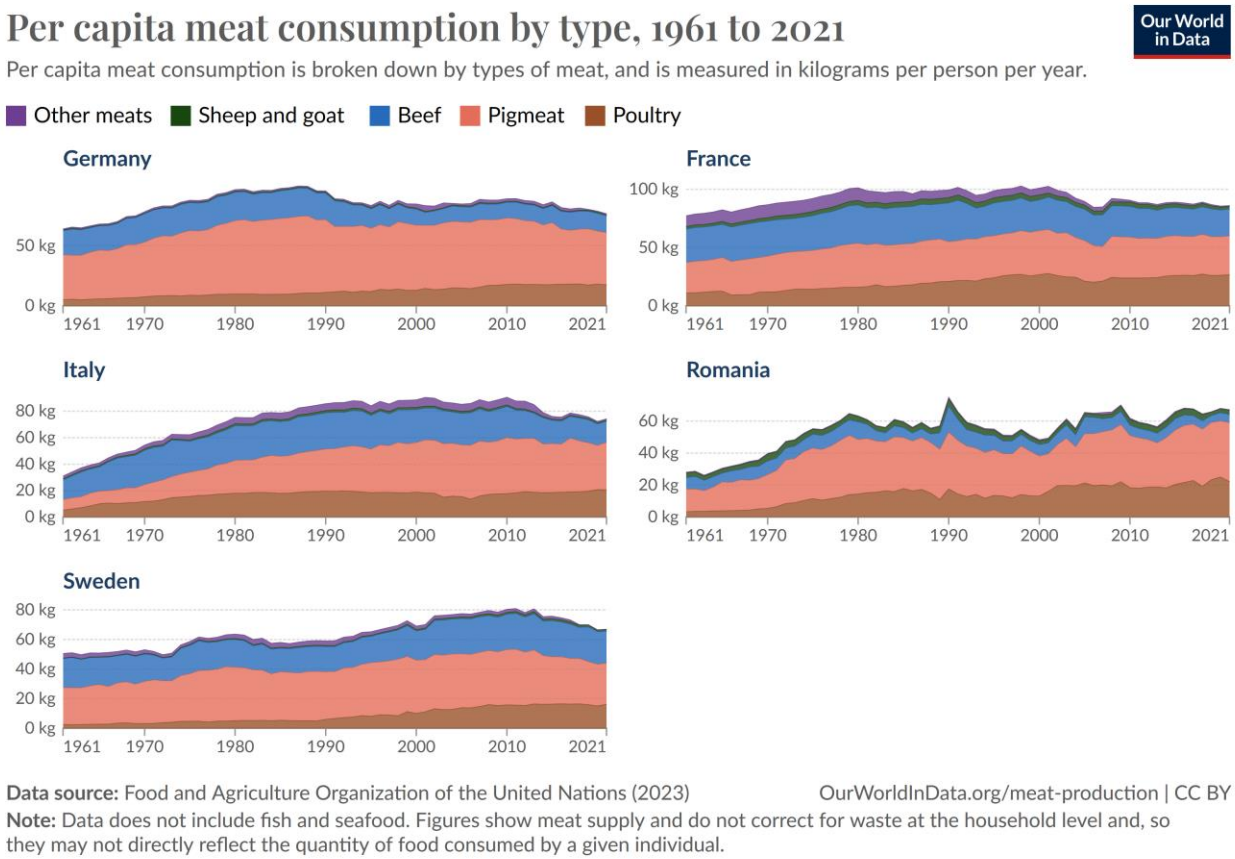

Figure 2 Per capita meat consumption in the single case study countries, Source: Our world data (2024)

France is the country with the highest annual per capita **meat** consumption (85.68 kg), followed by Germany (76.59 kg), Italy (74,31 kg), Sweden (66.92 kg), whereas Romania is the country with the lowest annual per capita consumption (67.15 kg). In Germany and Romania, **pork** is the most relevant meat product category, with annual per capita consumption of 43.26 kg in Germany and 36.9 kg in Romania. In Germany, however, pork consumption has decreased over the past decade whereas in increased in Romania during the same time. The lowest per capital consumption of pork is found in Sweden, where the per capita consumption has strongly decreased over the past decade from 37 kg to 27 kg per capita per year. Regarding **beef**, consumers in France have the highest annual per capita consumption (23.01 kg), followed by Sweden (21.58), Italy (15.98 kg), Germany (14.04 kg) and finally Romania (5.05 kg). Regarding **poultry**, consumers in France have the highest annual per capital consumption of poultry of 26.57 kg, followed by 22,31 kg in Romania, 20,61 kg in Italy, 17.63 kg in Germany and finally 16.29 kg in Romania.

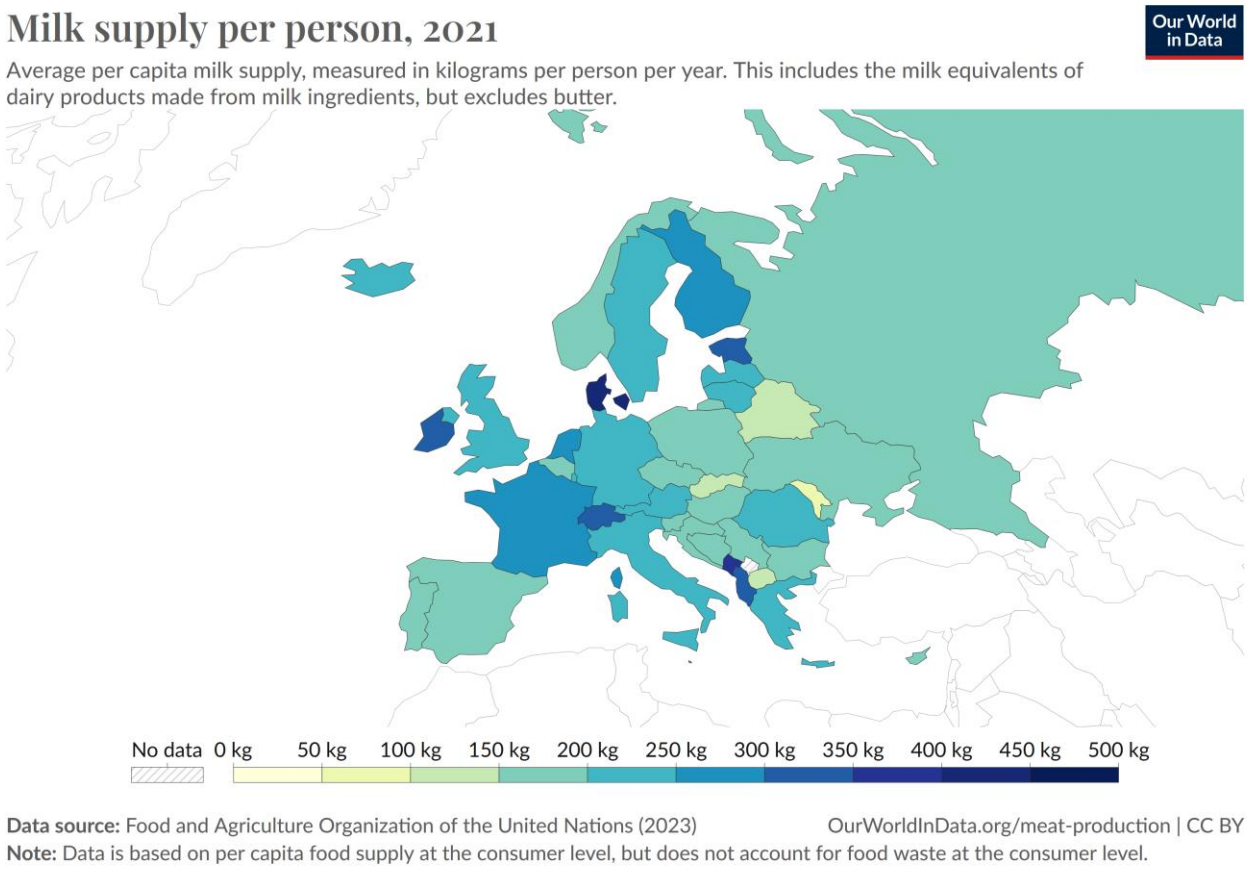

Figure 3 Per capita milk consumption in the single case study countries, Source: Our world data (2024)

Regarding the per capita milk consumption, less detailed data is available in Our world data (2024) as compared to meat. Data is provided on European (and not on EU level) and country levels for 2021. Looking at the annual per capita consumption in the single case study countries, France shows the highest consumption levels of 250 to 300 kg per year in 2021. In the other case study countries, the annual per capita consumption was between 200 and 250 kg in 2021 (Our world data, 2024).

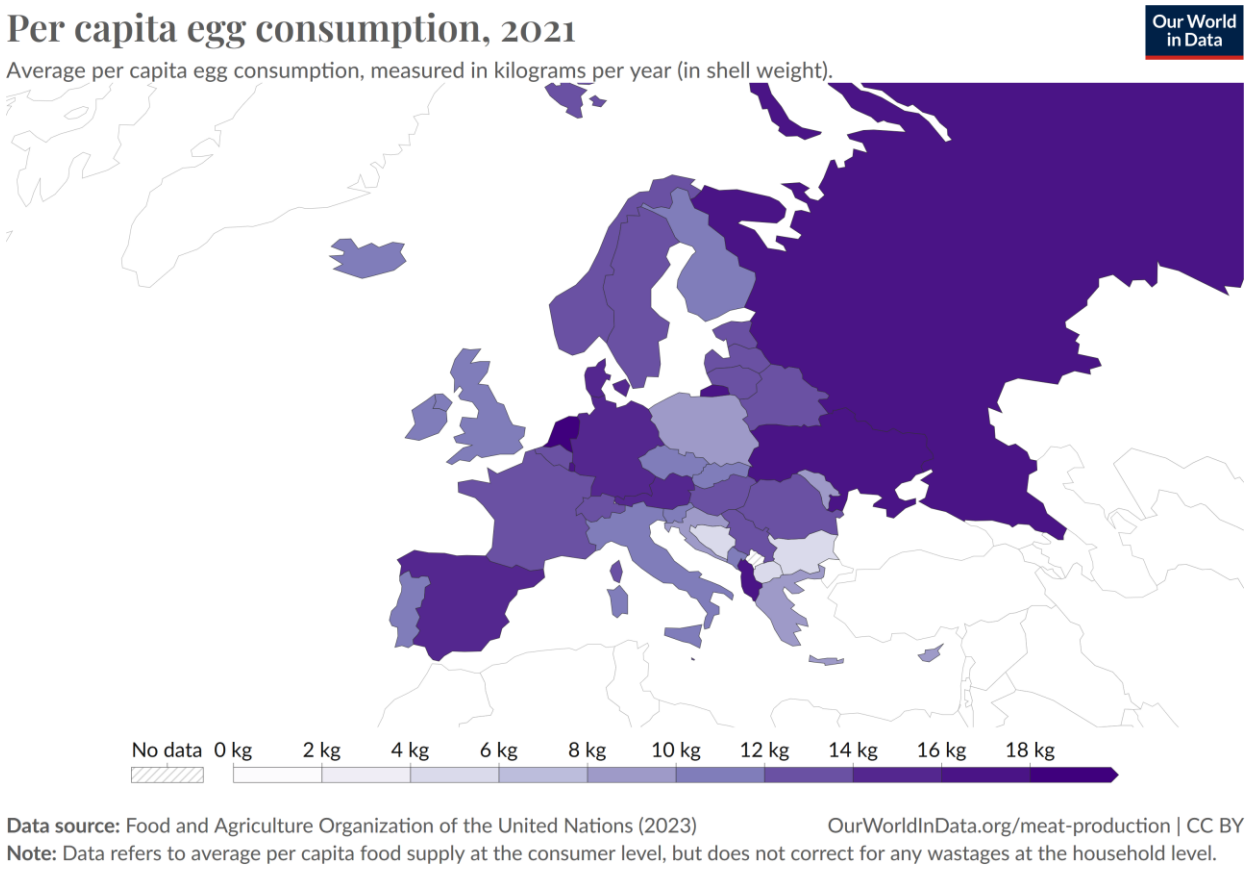

Figure 4 Per capita egg consumption in the single case study countries, Source: Our world data (2024)

Regarding the per capita egg consumption, less detailed data is available in Our world data (2024) as compared to meat. Data is provided on European (and not on EU level) and country levels for 2021. Looking at the annual per capita egg consumption in the single case study countries, Germany shows the highest consumption levels of 14 to 16 kg per year in 2021. In France, Sweden and Romania, the annual per capita consumption was between 12 and 14 kg and in Italy, it was lowest with values between 10 to 12 kg in 2021 (Our world data, 2024).

Regarding eating styles, according to YouGov (2024) , there is as growing interest in the environmental, ethical, and health impacts of our diets that translates into dietary patterns in the UK. According to the study, 15% percent of consumers are flexitarians, 5 % vegetarians and 2 % vegans. Similar figures can be found also in other countries, such as in Switzerland (Stolz et al. 2020). A recent study of Siegrist and Hartmann, (2019), furthermore revealed that consumers with low meat consumption, perceptions about the high environmental impact of meat, high health consciousness, low disgust sensitivity, and who were female, younger, and better educated were more likely to consume meat substitutes compared with people who had the opposite.

CONSUMER CHARACTERISTICS

Consumer characteristics significantly influence sustainable product choices. Benevolence, personal values, awareness, knowledge, and information all play roles in shaping consumer decisions (Lin & Niu, 2018; M. Ross & Kapitan, 2018; Schwartz, 2012). Marketing and purchasing factors also influence consumer decision-making. In-store strategies, pricing, and cultural disparities impact consumers' willingness to pay for sustainable products (Herbes et al., 2018; Van Herpen et al., 2012). Additionally, regional contexts influence consumer preferences for sustainability labels, with variations observed between countries and economies (Akaichi et al., 2016; Mueller Loose & Remaud, 2013). Environmental sustainability may carry more weight in emerging economies, while consumers in developed economies may prioritize social-product attributes (Auger et al., 2010).

Various studies advocate for leveraging health considerations, rather than environmental ones, to promote sustainable diets (Larson et al., 2019; Mann et al., 2018; Righi et al., 2023; Tepper et al., 2018). Such an approach necessitates explaining the nexus between food and the broader physical and social environment across all initiatives, from raising awareness to policy formulation, aimed at fostering more sustainable consumption (Kenny et al., 2023). Given consumers' emphasis on health in their perception of sustainable diets, public health and nutrition professionals have a central role to play. This begins with acknowledging that human health is contingent on ecological health and consequently adopting an ecological public health approach to advocate for sustainable diets (Mason & Lang, 2017; Rayner et al., 2008). However, in most studies, the focus in on links between nutrition and human health, whereas the concept of One Health gains in popularity including human, animal and environmental issues. The One Health approach is based on the understanding that human, animal and environmental health are closely interlinked. The One Health approach serves prevention and promotes interdisciplinary cooperation, particularly between human medicine, veterinary medicine and environmental sciences (WHO, 2017).

Regarding the relationship between sustainable product attributes and consumer decision-making, studies reveal a growing appreciation for sustainability characteristics, particularly in the food sector (Akaichi et al., 2016; Berry et al., 2017; Rousseau & Vranken, 2013). However, the significance of sustainability attributes varies across different product types and purchasing scenarios. Consumers may prioritize conventional attributes like price, brand, taste, or functionality over sustainability (Raghunathan et al., 2006). Moreover, the influence of sustainability on consumer preferences can be ambiguous, sometimes strengthening or weakening them depending on specific product benefits. Segmenting consumers based on socio-demographic or behavioral variables could provide insights into potential consumer groups interested in sustainable products (Gerini et al., 2016; Panzone et al., 2016).

Attitude-behaviour gap

The attitude-behavior gap is a notable phenomenon observed in consumer behavior research, wherein attitudes toward certain behaviors do not consistently translate into corresponding actions (ElHaffar et al.,

2020). Research in this area highlights several factors contributing to this occurrence. The discussion surrounding the attitude-behavior gap (also known as the green gap) delves into the efficacy of behavioral versus cognitive interventions in steering consumers toward sustainable purchases (Groening et al., 2018).

Results from a study by Panzone et al. (2016) indicate that implicit attitudes towards environmentally friendly food are not always indicative of sustainable consumption. Furthermore, the mixed outcomes observed in attitudinal variables may be attributed to issues of behavior specificity, wherein attitudes towards general concepts poorly correlate with specific behaviors (Weigel et al., 1974), thus resulting in a weak connection between attitudes and behaviors.

Additionally, the failure to activate relevant attitudes may be influenced by a perceived disconnection between the behavior and its intended goal. For instance, individuals with pro-environmental attitudes may still engage in environmentally harmful behaviors, such as over-consumption meat, if they believe their actions have minimal impact on the environment. Similarly, attitudes may remain dormant due to consumers' conscious disregard of important information based on their emotional attachment to certain products or behaviors (Gawronski & LeBel, 2008), such as refusing to acknowledge the environmental consequences of consuming red meat due to personal preferences.

While some advocate for behavioral insights, others emphasize the significance of conscious awareness and knowledge. Research predominantly employs the economic rational paradigm, often through the Theory of Planned Behavior (TPB), assuming a strict alignment between attitudes, intentions, and behaviors (Ajzen, 1991). However, behavioral insights also rely on triggering unconscious responses, contradicting the rational paradigm's emphasis on conscious acknowledgment and deliberate action.

The sociodemographic status of specific segments may provide valuable insight into the influence of sustainable consumer behavior. While sociodemographic status can be defined by area, gender, religion, economic class, race, and much more, gender and country of origin will be further highlighted, as this information is most pertinent to this study.

In a paper by Panzone et al. (2016), a statistical analysis revealed that socio-demographic characteristics significantly influence actual sustainable consumption behaviors. Education, for instance, plays a crucial role by enhancing environmental concerns and directly shaping behavior. Additionally, certain demographic factors, such as gender, indicate higher explicit pro-environmental attitudes among women compared to men, possibly reflecting social desirability biases in environmental attitudes (Felonneau & Becker, 2008). Moreover, while younger consumers tend to exhibit greater environmental concern, older consumers demonstrate higher scores in green-related consumer action (Panzone et al., 2016; Righi et al., 2023). Furthermore, university education positively correlates with environmental concern.

According to Lang et al. (2004), various fronts are emerging. The first of these fronts revolves around the environment. The shift in consumer demand from locally sourced and seasonal produce towards imported, non-seasonal fruits and vegetables has led to an increase in transportation, cooling, and freezing

requirements, consequently raising energy consumption (Rayner et al., 2008). Moreover, the increased processing of food results in higher energy and material inputs and generates more packaging waste (Rayner et al., 2008).

The second front is cultural, particularly impacting European food traditions and attitudes towards food. A study spanning 15 European countries has identified three primary attributes or approaches guiding Europeans in their food product choices (Debomy, 2005). The epicurean or affective approach views food as a source of pleasure and sensations, evaluating products based on taste, appearance, aroma, origin, and trustworthiness of the producer/retailer (Raghunathan et al., 2006). The rational or functional approach considers food in terms of price, convenience, or ease of use. The dietetic approach regards food in relation to health considerations (Hinojosa-Nogueira et al., 2021; Niehues & Klöckner, 2016) .

These diverse approaches to food selection are influenced by societal factors (such as food cultures), demographic characteristics (including social class, gender, and ethnicity), and economic conditions (such as disposable income levels) (Loopstra, 2018; Rayner et al., 2008). Within families or social groups, influences include personal or familial history, life stage, family status, and openness to adopting new influences and food choices, with potentially rapid changes observed in transition countries within Europe (Rayner et al., 2008). The emphasis on pleasure and sensation criteria is more prominent in countries with strong culinary traditions or those still closely tied to traditional agriculture, such as France, Belgium, Italy, Spain, Greece, and Germany (Rayner et al., 2008). Conversely, the dietetic approach is prevalent across all countries, particularly emphasized in Northern Europe (e.g., the United Kingdom, Sweden, and Ireland), especially among women, and more widely adopted in countries where consumers prioritize maintaining a balanced diet, such as Spain where concerns about weight issues have heightened (Rayner et al., 2008). The price criterion holds greater significance among lower to middle social groups and in Eastern European countries (Rayner et al., 2008). The recent crisis (Ukrainian crisis, inflation), however, might have led to a higher price sensitivity of at least some parts of consumers.

Health benefits are not the only factors influencing meat avoidance; ethical concerns also play a significant role. Lea & Worsley (2003) found that animal welfare concerns are associated with the interest in vegetarianism, especially among women. Scholars posit that gender differences in pro-environmental behavior stem from societal socialization, with women more inclined towards such behaviors due to values like caretaking and compassion (Bloodhart & Swim, 2020).

In another paper, Trocchia and Janda (2003) conducted a study utilizing cluster analysis to segment consumers into distinct groups based on dietary behaviors, psychological traits, and demographic characteristics. In this study, gender differences were observed, with women dominating segments focused on animal welfare and health concerns. This segmentation allows for targeted marketing and advertising efforts tailored to specific consumer groups, considering gender and values represented within each segment.

Beyond the study by Debomy and colleagues (2005) highlighted above, other research on pro-environmental behavior has highlighted differences between countries (Liobikienė et al., 2016; Vicente-Molina et al., 2013), yet criticism exists for neglecting the role of culture in determining these behaviors (Popovic et al., 2019). Cultural variables such as collectivism versus individualism, affluence, and education level influence the level and strength of determinants like subjective norms and attitudes across countries (Cho et al., 2013; Halder et al., 2020; Husted, 2005). Affluent countries may prioritize environmental issues once basic needs are met, shaping cultural norms and attitudes toward pro-environmental behaviors (Inglehart, 1995).

Similarly, in dietary contexts, the impact of behavioral determinants may vary based on a country's food culture (Munz Fernandes et al., 2021; Nguyen and Platow, 2021). Meat consumption, often integral to food culture, exhibits varying attitudes between countries (Ruby et al., 2016). For instance, Brazil's high beef consumption reflects positive attitudes towards beef (Ruby et al., 2016), while regions like the Mediterranean, known for plant-based diets, foster stronger norms and attitudes favoring sustainable dietary behaviors (Zamora-Ros et al., 2013). The prevalence of the Mediterranean diet in Italy, for example, may explain why perceived behavioral control influences meat consumption intentions differently in UK and Italian participants, reflecting cultural differences in food practices (Wolstenholme et al., 2021).

Dietary patterns

In most scenarios, consumers can be grouped into segments according to their dietary patterns. These eating styles can be correlated to meat eaters, meat avoiders, or meat reducers (Dagevos & Voordouw, 2013). Although meat consumption has been associated with human health and environmental degradation (Stehfest, 2014), it is expected that consumption of meat and meat products will not decline in the near future. According to Godfray et al. (2018), meat consumption is forecasted to increase by 75-145% by 2050. This rise will largely occur in developing countries due to population increase, wealth increase, and dietary preferences (Blair et al., 2024). However, it is currently observed that developed countries consume the highest proportion of meat per capita (Blair et al., 2024).

Beyond environmental or personal health-related reasoning, dietary choices are developed from many other factors. This can include cultural significance, sociodemographic status, taste preference, accessibility, social influence, and more (Drewnowski & Kawachi, 2015). Within the meat eaters' segment, specifically mixed diet/omnivores can be found. This dietary type contains those who consume a variety of animal products (including eggs, dairy, and processed meats) as well as fruits, vegetables, and grains (Rosi et al., 2017). This diet is not restricted to a type of food. The ketogenic diet (also known as low-carb, high-fat diet) and paleo diet (also known as Stone Age diet) can also be grouped with the meat eaters. These diets are stricter, as they are often related to health-concerned consumers (Cambeses-Franco et al., 2021; Joshi et al., 2019). The ketogenic diet, originally used as a medical diet for children with epilepsy, emphasizes the significant reduction of carbohydrate intake and replacing it with fats to put the body into a metabolic state called ketosis (Joshi et al., 2019). The other diet mentioned above, the paleo diet, focuses on unprocessed

and whole foods. This can include nuts, seeds, vegetables, and lean meat. Reduction of added sugars, grains, dairy products, and legumes is encouraged (Cambeses-Franco et al., 2021).

The next eating style, meat avoiders, includes vegans and vegetarians. Those who identify as vegan avoid the consumption of all animal-based products, including dairy and eggs. This goes beyond the diet to include lifestyle choices, such as avoidance of any products that could have resulted in bodily harm to animals (Rosi et al., 2017). Vegetarian diets focus on plants as food and reducing/completely avoiding animal product consumption in the diet. There are many subtypes of vegetarianism. The most popular are lacto-vegetarians (dairy, but no meat), ovo-vegetarians (eggs, but no meat), pesco-vegetarians (fish, but no meat), and commonly some combination of these (Fresán & Sabaté, 2019). Oftentimes, this meat avoider segment is chosen for animal welfare reasons, but those with environmental and personal health concerns may opt for veganism and vegetarianism as well (Rosi et al., 2017).

Meat reducers, the final eating style according to Dagevos & Voordouw (2013), can be defined as a compromise between meat eaters and avoiders. A diet that may fall under this category is flexitarian (Derbyshire, 2017). Consumers in this relatively newly defined segment recognize the importance of meat reduction due to environmental and animal welfare reasons but opt to consume a reduced amount of meat, fish, and animal products for personal health benefits and personal pleasure (Derbyshire, 2017). The diet can include at least 500g of vegetables and fruits per day, at least 100g of plant-based proteins, modest amounts of white meat, fish, eggs, and dairy products, and one portion of red meat per week (Springmann et al., 2018). As stated by Willett et al. (2019), "Transformation to healthy diets by 2050 will require substantial dietary shifts, including a greater than 50% reduction in global consumption of unhealthy foods such as red meat and sugar, and a greater than 100% increase in the consumption of healthy foods such as nuts, fruits, vegetables, and legumes." This statement reflects the ideology of flexitarianism and is aligned with the proposal as the most realistic diet for planetary health goals by Springmann et al. (2018).

Sustainable Consumer Typology

Alongside eating styles, also known as dietary patterns, there is also consumer typology. This is the segmentation of consumers based on factors beyond their sole consumption habits. This can include motivations, mindsets, and behaviors (Hoek et al., 2021; Verain et al., 2017). Several studies have identified different typologies.

The concept of self-transcendence values suggests that individuals consider collective interests in decision-making. Recent studies, building on Schwartz's (1992) value theory, identify two self-transcendence values: altruistic and biospheric. Altruistic values prioritize human welfare, while biospheric values focus on nature's quality, both positively correlating with pro-environmental beliefs and behaviors. Biospheric values tend to be more predictive than altruistic values, and conflicts between them can influence preferences, such as donating to environmental versus humanitarian causes (De Groot et al., 2008; Steg, 2005).

In contrast, self-enhancement values center on personal costs and benefits, with individuals acting pro-environmentally when perceived benefits outweigh costs. These values, mainly egoistic, negatively correlate with pro-environmental attitudes, reflecting less concern for the environment when personal gains are prioritized (De Groot et al., 2008; Nordlund & Garvill, 2002; Steg, 2005).

However, individuals may refrain from pro-environmental actions despite promising personal gains, which egoistic values typically prioritize. This discrepancy may be due to the threat pro-environmental actions pose to other personal benefits, particularly pleasure and comfort, rooted in hedonic values. Therefore, the inclusion of hedonic concerns alongside egoistic, altruistic, and biospheric values is proposed to better understand environmentally relevant beliefs and behaviors. Hedonic values may especially influence environmental actions when they require effort or compromise comfort, such as adjusting the thermostat for environmental benefits but sacrificing comfort (De Groot & Steg, 2008).

Other segment groupings by Verain (2017) identify three typology segments: pro-self, average, and sustainable conscious. The study suggests that communication of both health and sustainability benefits leads pro-self and average consumers to think more about sustainability, although it does not result in changes in dietary intentions for these segments. However, for sustainable-conscious consumers, the intention to reduce meat consumption increased when both health and sustainability benefits were communicated. These findings underscore the importance of segmentation research in crafting effective dietary messages and emphasize the need to consider product category differences in studying consumer food motivations and intentions (Verain et al., 2017).

The study concludes that communicating both the health and sustainability benefits of consuming fewer animal-based and more plant-based products is advisable for all motive-based consumer segments (Verain et al., 2017). However, the effects on behavioral intention vary across these segments, highlighting the need for additional strategies to stimulate sustainable food consumption beyond simply informing consumers, particularly for pro-self and average consumers. Furthermore, the effectiveness of such communication strategies depends not only on the consumer segment but also on the specific product category under consideration (Verain et al., 2017).

Lastly, Jog and Champaneri (2020) identified segments of three consumer typologies: green consumers, non-green consumers, and pseudo-green consumers. Green consumers actively engage in pro-environmental behaviors driven by environmental motivations, such as purchasing products with lower environmental impacts and supporting environmentally friendly services. On the contrary, non-green consumers do not prioritize environmental concerns in their consumption choices (Jog & Champaneri, 2020).

Conventional consumers are typically considered non-green due to their lack of emphasis on the environmental impact of their purchases. However, some consumers exhibit inconsistent green behaviors, selectively opting for environmentally friendly products in certain categories while neglecting them in

others. Such behavior is influenced by factors like peer pressure, local environmental involvement, pricing, and the availability of green alternatives (Jog & Champaneri, 2020).

To address this inconsistency, a new typology by Jog and Champaneri (2020), coined "pseudo-green consumers" is introduced. These consumers superficially engage in green behaviors without consistent commitment. The term "pseudo-green" is derived from Mahdavinejad et al. (2014), describing individuals who may adopt green behaviors for reasons such as societal pressure or to maintain a green consumer image. Pseudo-green consumers are not steadfastly committed to green practices and may change their preferences based on circumstances.

Self-Determination Theory (SDT), a prominent theory in human motivation, has been extensively utilized in various domains, including eating regulation and environmental behaviors (Green-Demers et al., 1997; Guertin et al., 2017; Masson & Otto, 2021; Ryan & Deci, 2017). SDT aids in understanding the initiation and maintenance of behaviors, emphasizing motivational quality as a central concept (Ryan & Deci, 2017). According to SDT, individuals engage in behaviors for different reasons based on the degree of internalization, leading to six types of motivation, ranging from least to most self-determined (Ryan & Deci, 2017).

Beginning with the least self-determined, amotivation describes behaviors lacking intentionality or purpose, followed by extrinsic motivation, which comprises external, introjected, identified, and integrated regulations (Ryan & Deci, 2017). Extrinsic regulations vary in the level of self-determination, with external regulation being the least and integrated regulation being the most self-determined. Intrinsic motivation, regarded as the optimal type, involves engaging in behaviors for personal satisfaction or pleasure (Ryan & Deci, 2017).

Research spanning over two decades supports the significance of self-determined motivation in environmental behaviors, indicating its positive association with various eco-friendly actions such as recycling, conserving water, and using biodegradable products (Lavergne & Pelletier, 2016; Pelletier et al., 2010). Additionally, self-determined motivation is linked to positive environmental behaviors and inversely related to negative ones. This suggests that fostering self-determined motivation can promote positive environmental actions while reducing negative ones.

Moreover, SDT has implications for ecological eating behaviors, which are considered a form of environmental behavior. The correlation matrix indicates significant relationships between variables, with environmental self-determined motivation positively associated with pro-environmental behaviors, while eating self-determined motivation correlates with healthy eating and ecological eating (Gauthier et al., 2022). Ecological eating, in turn, exhibits positive correlations with both environmental and eating behaviors, emphasizing its role in promoting sustainable dietary choices (Gauthier et al., 2022).

As it is seen, motivation plays a crucial role in shaping consumer behavior towards sustainable food choices, with individuals being driven by various factors such as taste, price, quality, ease of preparation, health

benefits, and the product's origin from sustainable agriculture (Blanke et al., 2022; Eker et al., 2019). Motivation, defined as the driving force behind goal-directed behavior, stems from the satisfaction of basic psychological needs including autonomy, competence, and relatedness, ultimately contributing to physical and mental well-being (McClelland & Jorba, 2023; Standage & Ryan, 2020).

Research indicates that intrinsic motivations tend to have a greater influence on dietary choices aligned with a planetary health diet compared to extrinsic motivations (Ambroży et al., 2023). Moreover, the self-determination theory has been proposed as a valuable framework for understanding and promoting sustainable dietary choices (Schösler et al., 2014). This theory highlights how motivations related to competence, autonomy, and connection to nature influence food choices, as well as the role of external motivations in shaping preferences.

Additionally, the social context surrounding dietary choices plays a significant role in motivating behavior and promoting well-being (Kadhim et al., 2020). Understanding the various types of motivation in dietary decisions can provide insights into why individuals make certain choices and how these choices impact their overall well-being. Further research is needed to explore the diverse motivations driving dietary behaviors and their implications for promoting sustainable food choices on a broader scale (Kadhim et al., 2020; Righi et al., 2023; Schösler et al., 2014).

POLICY IMPLICATIONS AND POTENTIAL FOR CHANGE

Transitioning to more sustainable diets necessitates significant changes in the organization, control, and regulation of the food system to ensure it aligns with human and environmental health, enhances democratic accountability, promotes food citizenship, and addresses existing power imbalances (Kenny et al., 2023). Consequently, achieving progress toward more sustainable diets will require multisectoral efforts that combine top-down policy interventions, such as incentivizing sustainable food production and consumption, with bottom-up, community-based approaches. These strategies will primarily focus on encouraging and supporting consumer behaviors and attitudes that align with sustainable dietary practices (Kenny et al., 2023)

Nudging, as outlined by Vigors (2018), encompasses a set of behavior change strategies aimed at guiding individuals towards choices aligning with their self-interests or intentions. These tools, including self-nudges, choice architecture, social norms, and pre-commitments, leverage behavioral biases to simplify decision-making environments (Vigors, 2018). The concept of nudging is proposed as a means to bridge the attitude-behavior gap prevalent among consumers, particularly concerning farm animal welfare (Vigors, 2018). By altering decision contexts and leveraging cognitive biases, nudges aim to prompt individuals to make choices congruent with their stated intentions (Hansen, 2016).

The attitude-behavior gap, identified by Akaichi et al. (2016), arises when consumers express concern for animal welfare but fail to translate this into their purchasing decisions. Nudging addresses this gap by

working in harmony with human decision-making limitations and unconscious behavioral drivers (Momsen & Stoerk, 2014; Thaler & Sunstein, 2008). It acknowledges that individuals often struggle to make choices in their best interests due to cognitive constraints and external influences (Moseley & Stoker, 2013). Therefore, nudging proposes deliberate changes to the choice environment to facilitate pro-animal welfare decisions (Moseley & Stoker, 2013).

The application of behavioral insights in policymaking challenges traditional approaches focused on information dissemination or incentivization (Thaler & Sunstein, 2008). As consumer demand increasingly shapes animal welfare standards, behavioral economics offers valuable tools to enhance consumer engagement with welfare concerns (Thorslund et al., 2017; Vanhonacker et al., 2016). Nudging, characterized by its low administrative burden and cost-effectiveness, seeks to increase navigability in decision-making environments, thereby supporting individuals in aligning their actions with their intentions (Sunstein, 2014).

FUTURE POSSIBILITIES

In their analysis, "Options for Keeping the Food System within Environmental Limits," Springmann and colleagues (2018) highlight the importance of future dietary shifts. The study suggests that adhering to planetary boundaries can be achieved through a mix of highly ambitious measures for reducing GHG emissions and managing nitrogen and phosphorus applications, along with moderately ambitious measures for cropland and blue-water use. The planetary option space analysis illustrates the possible combinations of these measures. It reveals that keeping GHG levels within the boundary's mean value necessitates a significant shift towards more plant-based, flexitarian diets, alongside reductions in food loss and waste or technological advancements (Springmann et al., 2018). Achieving the mean values for cropland and blue-water boundaries requires technological improvements paired with reductions in food loss and waste. For nitrogen and phosphorus boundaries, it calls for ambitious technological advancements, dietary shifts towards plant-based diets, reductions in food loss and waste, and, in some scenarios, a more favorable socioeconomic development pathway with lower population growth and higher income growth than currently projected. Integrating these measures synergistically involves adopting various technological changes specific to each environmental domain, along with dietary shifts towards plant-based diets, reductions in food loss and waste, and an optimistic socioeconomic development pathway (Springmann et al., 2018).

Blair et al. (2024) conducted an empirical study to delve into the intricate relationship between environmental worldviews, values, demographics, and future livestock perspectives among representatives within the livestock sector. Their findings shed light on the multifaceted nature of stakeholders' views and preferences regarding the trajectory of the livestock industry. Interestingly, a significant majority of participants expressed a strong inclination towards embracing small-scale, animal-friendly, local production as the most desirable scenario for the livestock sector by the year 2035. This preference was followed by a

noteworthy interest in meat reduction, continued meat consumption, and the introduction of artificial meat alternatives (Blair et al., 2024).

Moreover, the study unearthed diverse attitudes toward various policy scenarios associated with the future of livestock production. While there was a consensus on the need to transition towards smaller-scale, localized food production systems and the importance of drawing upon traditional knowledge, opinions diverged on the extent of government intervention in promoting meat reduction or continued consumption (Blair et al., 2024). This disparity underscores the complexity of stakeholder perspectives within the livestock sector, reflecting a tapestry of values, beliefs, and priorities.

In light of these nuanced findings, it becomes evident that formulating effective and sustainable policies for the livestock industry necessitates a comprehensive understanding of the plurality of worldviews and values held by stakeholders. Failure to recognize and reconcile these differences may lead to further polarization and entrenched positions, ultimately impeding the development and implementation of inclusive solutions that resonate with all stakeholders involved (Blair et al., 2024).

In another view, Lai et al. (2020) conducted a study to provide evidence supporting the predictive validity of the Values-Beliefs-Norms (VBN) constructs and social norms in explaining meat consumption. The findings also highlight the significant role of healthy eating concerns in individuals' food purchases and validate a simulated food purchase measure for the first time. These results emphasize the importance of addressing both health and environmental concerns in dietary interventions. As previously discussed by Verain et al. (2016), tailoring interventions based on consumers' cognitive mindsets can effectively promote sustainable food choices. The segmentation framework proposed in the study considers individuals' values and concerns, offering implications for future consumer policy.

According to the study's implications, consumers with a predominant environmental concern may benefit more from environmentally tailored communication, while those with a predominant health concern may respond better to communication focusing on the health consequences of dietary choices (Lai et al., 2020). Also, in the Righi et al., 2023 study, concerns about food (in)security both in terms of benefits to the environment but especially in terms of personal health are seen to lead to stable reductions in carbon emissions in diets (Righi et al., 2023).

To reach a wider population, it would be advantageous to develop an approach that integrates multiple values related to food choices, including both health and nature-related values, as suggested by de Boer et al. (2014). By emphasizing that reducing meat consumption aligns with environmental and health concerns shared by others, such an approach can effectively target individual values and tendencies to conform to social norms.

The human factor stands as a crucial determinant in crafting effective policies aimed at behavioral transformation, particularly in democratic societies undergoing systemic shifts (Reisch, 2021). Reisch underscores the necessity for a people-centric approach that actively involves individuals in policymaking

processes, leveraging their insights and expertise to address biases and contextual intricacies. A robust food policy, as advocated by Reisch (2021), should systematically integrate human and institutional behavior into its frameworks and practices.

It should be acknowledged that nudges (Vigors, 2018) represent just one facet of the behavioral toolkit, often complementing rather than substituting other policy instruments like legislation, taxation, or informational campaigns (Sunstein, 2020). The interconnected nature of climate change, land use, food production, and health underscore the imperative for holistic governance approaches (De Schutter et al., 2020).

Researchers and policymakers must increasingly embrace a systems-oriented approach to food policy, transcending disciplinary boundaries to focus on the intricate interplay of climate, water, land use, poverty, and health (Aleksandrowicz et al., 2016). Behaviorally informed policies recognize the pivotal role of individual decision-makers, such as farmers and consumers, in driving change and fostering innovation (Dessart et al., 2019). Transdisciplinary methodologies, as suggested by Creutzig et al. (2021), harness behavioral insights to identify demand-side solutions with significant climate-mitigation potential and inform policy frameworks and interventions. Ultimately, successful policies prioritize a people-centric perspective, identifying individual and contextual drivers and barriers to behavioral shifts (Creutzig, 2021; Reisch, 2021).

Behavioral Theories

The conversation related to sustainable dietary choices is increasingly gaining importance, given its growing relevance and clear implications for both individual health and environmental sustainability. To develop effective strategies for promoting these choices, it is crucial to understand the underlying psychological dynamics. There are several behavioral theories in the literature that provide structured frameworks for analyzing these drivers, revealing the motivations that influence individuals' dietary choices (Ajzen, 1991; Bagozzi et al., 2002; Perugini & Bagozzi, 2001). Five theoretical frameworks will be discussed in this section: the Theory of Planned Behavior (TPB) (Ajzen, 1991), the ABC Theory, the COM-B Model, the alphabet Theory and the Stage of Change model. According to existing research, these theories have the potential to offer valuable insights into the mechanisms that may influence sustainable dietary decisions.

THEORY OF PLANNED BEHAVIOR

The Theory of Planned Behavior (TPB), crafted by Icek Ajzen in 1991, offers a psychological framework to comprehend and predict human behavior. It suggests that an individual's inclination towards specific behaviors is shaped by three factors: attitude, subjective norms, and perceived behavioral control. According to Ajzen, these factors collectively mold a person's likelihood of engaging in a particular behavior. While emphasizing behavioral intentions as primary determinants of action, the TPB acknowledges the

influence of additional factors such as past experiences and situational constraints (Ajzen, 1991). TBP can help in deciphering consumer motivations toward embracing more sustainable dietary practices.

Perceived Behavioral Control (PBC), an extension of the TPB, revolves around an individual's perception of the ease or difficulty of executing a specific behavior (Ajzen et al., 1991). This perception is influenced by personal attitudes, societal norms, and problem-solving approaches related to environmental concerns. In the realm of pro-environmental consumer behavior, perceived behavioral control emerges as a critical determinant. Individuals with a robust sense of perceived behavioral control are more inclined to integrate ecological considerations into their consumption decisions (McDermott et al., 2015). As highlighted by Van Birgelen et al. (2009), consumer confidence in their capacity to contribute to environmental preservation significantly shapes their purchasing and disposal behaviors. Thus, nurturing and understanding perceived behavioral control can serve as a catalyst in fostering pro-environmental actions among consumers.

ABC THEORY (ATTITUDE, BEHAVIOR, CONTEXT)

The ABC theory (Attitude-Behavior-Context) as explained by Stern et al. (1995) and further expanded upon by Stern et al. (2000) offers insights into the transmission of attitudes into behaviors. This theory proposes that behaviors are an interactive outcome of personal attitudinal variables (A) and contextual factors (C) (Stern, 2000). Attitudinal variables encompass personal beliefs, norms, values, and predispositions towards pro-environmental conduct, while contextual factors include both objective elements such as monetary incentives, costs, regulations, and public policies, as well as subjective perceptions like the availability of resources (Ertz et al., 2016).

Furthermore, the Value-Belief-Norm (VBN) theory, derived from Stern's work (2000) and described by Hiratsuka et al. (2018), delves into how values influence pro-environmental behaviors through pro-environmental beliefs and personal norms. Stern emphasizes three primary value orientations—egoistic, altruistic, and biospheric—which can shape consumer behaviors in the environmental domain. Consumers with altruistic values prioritize the consequences for others beyond themselves, while those with egoistic values focus on personal consequences. However, biospheric values, which emphasize consequences for nature and the environment, are particularly pertinent to pro-environmental behaviors (Hiratsuka et al., 2018). Stern suggests that these value orientations impact consumers' ecological worldviews, influencing their relationship with the environment.

Moreover, Stern et al. (2000) assert that the VBN theory can predict pro-environmental behavior. They identify three key actions related to consumer behavior: willingness to sacrifice comfort for environmental protection, engagement in environmental citizenship, and adoption of pro-environmental practices. Beyond the value orientations, the awareness of adverse consequences, denoted by awareness of consequences (AC), perceived responsibility to mitigate these threats (AR), and the ensuing sense of moral obligation (PN), also play pivotal roles in influencing pro-environmental behaviors. Stern et al. (2000)

contend that values can influence not only these factors individually but also collectively shape behaviors toward environmental conservation efforts.

COM-B MODEL

The COM-B model, introduced by Michie et al. (2011) offers a comprehensive framework for understanding behavior change. COM-B stands for capability, opportunity, and motivation, which collectively influence the target action of behavior (B). This model facilitates a nuanced understanding of behavior by exploring the interplay among its components.

Capability refers to an individual's psychological and physical capacity to engage in a behavior. Psychological capability encompasses knowledge, skills, and cognitive abilities, while physical capability relates to strength and dexterity. In the context of sustainable food choices, capability may involve the ability to navigate grocery stores and discern environmentally sustainable products (Michie et al., 2011).

Opportunity encompasses external factors that shape behavior, including social norms, cultural differences, and environmental influences. These factors can either facilitate or hinder individuals' engagement in a behavior. For sustainable food choices, opportunities may include familial encouragement of pro-environmental behavior and the availability of sustainable options in nearby grocery stores (Michie et al., 2011).

Motivation comprises an individual's cognitive and emotional processes that drive behavior. It encompasses conscious decision-making based on beliefs, attitudes, and intentions (reflective motivation), as well as unconscious responses driven by emotions, habits, and impulses (automatic motivation), along with responses to rewards or punishments associated with the behavior (incentive motivation) (Michie et al., 2011). By addressing capability, opportunity, and motivation, interventions related to dietary choices can be tailored to facilitate behavior change and promote sustainable outcomes.

THE ALPHABET THEORY MODEL

The Alphabet theory has its roots in the Theory of Planned Behaviour (Ajzen, 1991), but is adding further relevant factors, which are demographic characteristics, such as age, income, education, information seeking behaviour, knowledge, context of decision-making and habits. The Alphabet theory is commonly applied in empirical studies that aim to explain sustainable consumer behaviour (Vermeir et al., 2020). It was chosen as framework for this study since it covers a large range of different consumer characteristics that can be used to identify and characterise consumer types.

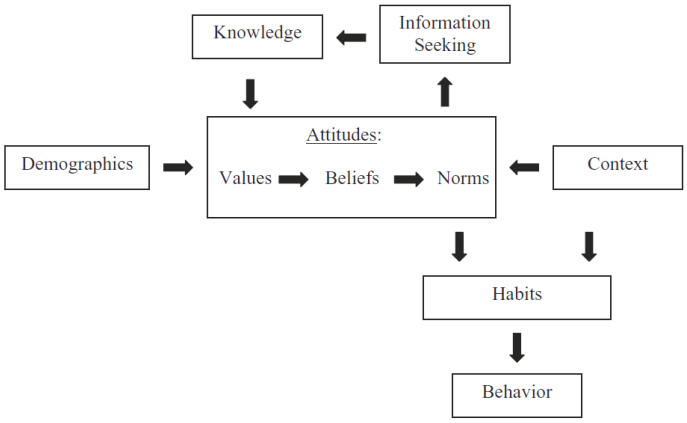

Figure 5 Conceptual framework of the Alphabet Theory (Zepeda & Deal, 2009)

According to the Alphabet theory, attitudes are the central psychological construct in determining habits and behaviours, as is confirmed by a huge amount of empirical behavioural studies from many difference research disciplines. Attitudes are formed by values, beliefs, and norms. Attitudes depend on several factors, which are, in particular, demographics, context and knowledge; whereas the latter is influenced by the information seeking behaviour of an individual that again depends on attitudes (values, beliefs, norms) of individuals, forming a circular connection. These dimensions are addressed in this research.

STAGE OF CHANGE MODEL

Given that positive attitudes and their influencing factors alone do not necessarily lead to a behavioural change, this research is furthermore looking at consumers motivation for sustainable food consumption since previous research has outlined the relevance of motivations in changing behaviour. Aschemann-Witzel (2015) stated that with the intention of creating a more sustainable system, consumer motivation for change can provide great answers. DeBoer et al. (2014) identified a strong relation with motivational level and willingness to reduce meat consumption. Therefore, this research following the Stage of Change Model (Prochaska et al., 1992), describing behavioural change as a process involving five separate motivational stages, namely precontemplation, contemplation, determination, action and relapse, until achieving a maintaining behaviour.

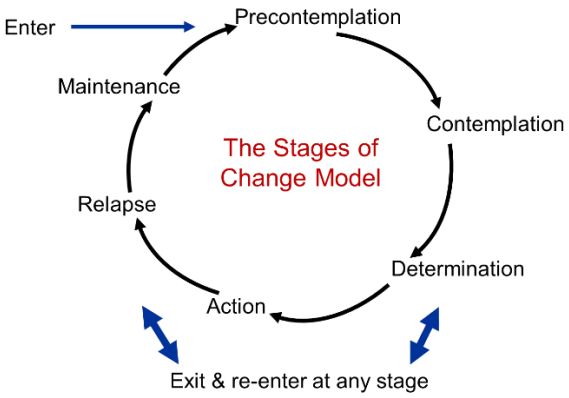

Figure 6 Stages of change model (Prochaska, DiClemente, and Norcross, 1992)

Accordingly, this research uses to Stage of Change model as a framework to test the acceptance and effectiveness of different interventions and policies that might lead to more sustainability in agri-food systems, depending on the level of individual motivation for (more) sustainable consumption of animal products. It is assumed that individuals may respond best to sustainability interventions and policies if these interventions match their stage of change towards sustainable consumption. Following the approach of Van Dam and Van Trijp, (2016), the interventions we refer to in this research will cover four dimensions:

- External Regulation: "External regulation of sustainable behaviour is a regulatory style where consumer behaviour is subject to an external locus of causality, and where consumers are moved by personal incentives. Consumers need external regulation of their consumption because they lack the self-control to take the distant consequences of their behaviour into consideration."
- Introjection: "Introjection of sustainable behaviour is a regulatory style where consumer behaviour is subject to an external locus of causality, and where consumers are moved by social incentives."
- Identification: "Identification with sustainable behaviour is a regulatory style where consumer behaviour is subject to an internal locus of causality, and where consumers are moved by social incentives."
- Integration: "Integration of sustainable behaviour is a regulatory style where consumer behaviour is subject to an internal locus of causality, and where consumers are moved by personal incentives." (van Dam & van Trijp, 2016).

Objectives, Scope and Research Questions

Objectives and Scope

The objectives of this study were to explore the potential for change towards greater sustainability in the food system on the consumer side and to identify leverage points and transition pathways for such change, considering that advances toward greater sustainability in the food system can only be successfully achieved if incorporated into a holistic system-wide transformation. The study focuses on dietary patterns that have reached unsustainable levels and therefore need to be considered and studied in more detail. In particular, the study emphasised on the interrelationship between dietary patterns (behaviour), psychological (including motivational levels, attitudes, and knowledge) and socio-demographic characteristics as determining factors identified being relevant in the context of food choice (see chapter background), as suggested by the alphabet theory (Zepeta et al., 2009). The primary objectives of this research were to:

- Identify different consumer archetypes regarding their dietary patterns, revealing differences in terms of impacts on the food system sustainability (to be further analysed in WP 4.2)
- Establish profiles of each archetypes regarding main socio-demographic characteristics, motivational levels, attitudes, knowledge regarding food sustainability, serving as background information on the consumers' position towards food system sustainability
- Analyse how consumers perceive their own role in a food system change towards greater sustainability
- Determine the potential and acceptance of selected intervention and policies, hereunder specific policies that were addressed in the Pathways project as visions, to receive information on how a shift in consumer demand and in the food system.
- Identify consumers' preferences and willingness to pay for selected sustainability innovations in livestock farming practices as envisioned in the Pathways project in the practice hubs
- Identify culturally-rooted differences between study countries regarding dietary, psychological factors, socio-demographics, acceptance of sustainability interventions and policies and willingness to pay for sustainability innovations on the livestock sector

Considering the complexity and multifaceted nature of consumer behavior and linkages of attitudes, knowledge, motivation and socio-demographic characteristics with consumer behavior in general and sustainable food choices and dietary patterns in particular, the aim of this research was to identify and map different consumer mainstreams, here so called consumer archetypes within the population of the EU, that show different levels of sustainability in their dietary patterns and in their position toward sustainability in the food system.

Centering this research around consumer behavior, reported as dietary patterns, and profiling consumers belonging to single archetypes based on factors that have been identified in previous research as being

related to sustainable consumer behaviour (see background section), the intention of this approach was, furthermore, to learn about the consumer archetypes and the potential (psychological) distance from changing the own behaviour. Furthermore, by confronting consumers with various sustainability interventions and policies, and by presenting them various (farm-practice based) sustainability innovations, we aimed to identify archetype-specific leverage-points and pathways towards greater food system sustainability and which archetypes need to be tackled by interventions and policies.

In addition, given that large differences in dietary patterns and attitudes towards food system sustainability can be expected within the EU population, another aim of this study was to analyze the differences between selected study countries representing the different regions of the EU. Particularly, the aim was to identify culturally-rooted differences between study countries in terms of dietary patterns, psychological factors, acceptance of interventions and policies and willingness to pay for sustainability innovations in the livestock sector, that need to be taking into account in the policy debate on improved food system sustainability.

This research approach aims to bridge the gap between consumer behaviour analysis and practical policy-making, offering a basis for decision makers in the food system and highlight the specific potential, leverage points as well as the limitations in moving towards greater sustainability in the food systems by considering the potential lying in the single archetypes. In addition, the consumer archetype typology identified in this research will serve as basis for the development of diets that are optimised in terms of nutritional supply and sustainability in WP 4.2 of the Pathways project.

Research Questions

The study is based on the following research questions:

1. **Consumer archetypes based on dietary patterns**

   1.1 What are the typical food consumption patterns with respect to key product categories, such as meat, eggs, milk, milk products, fish and seafood, fruit and vegetable, starch containing products, snacks, sweets, sweet drinks and legumes intake in the single case study countries?
   1.2 What consumer archetypes can be identified based on their reported dietary patterns?
   1.3 What is the share of the single archetypes in each country?

2. **Sociodemographic profiling of consumer archetypes**

   2.1 What are the socio-demographic characteristics (age, gender, income and educational level) that are typical for single consumer archetypes? What are the differences between countries?

3. **Profiling of consumer archetypes regarding psychological factors related to Sustainable food production and consumption**

   3.1. How do consumer archetypes differ in their motivational levels to improve the sustainability of their food consumption? What are the differences between countries?

   3.2. What are the differences in attitudes towards sustainable food consumption among consumer archetypes and countries?

   3.3. How do consumer archetypes vary in their knowledge of sustainable food consumption?

4. **Transition pathways for greater sustainability in the Food System**

   4.1. How do consumer archetypes perceive the role of different actors in improving the sustainability of livestock production? What are the country-specific differences?

   4.2. Which sustainability interventions have the highest acceptance among different consumer archetypes? How does this vary between study countries?

   4.3. Which future policies are most accepted by different consumer archetypes? What are the country-specific differences?

5. **Consumer Preferences and Willingness to Pay for Sustainability Innovations in the Livestock Sector**

   5.1 How do preferences for sustainability innovations differ among consumer archetypes and countries?

   5.2 For which sustainability innovations can the highest WTP among consumers be observed?

Methodology

In this chapter, the research framework, the data collection and analysis methods used in this study are described.

Research framework

This research is based on the Alphabet Theory (Zepeta at al. 2009), which describes attitudes as the central psychological construct in determining habits and behaviours, as confirmed by a large number of empirical behavioural studies from many difference research disciplines (see Background chapter). In terms of consumer behaviour, we looked at self-reported eating patterns. Other relevant determinants, namely consumers' knowledge of food system sustainability and sustainable practices, positive and negative attitudes towards food system sustainability, and socio-demographic characteristics were also included in this research. In addition, recognising that certain attitudes do not necessarily translate into behaviour (also referred to as the attitude-behaviour gap, see Background chapter), the level of motivation was also included in this research as a key determinant of behaviour, based on both theoretical and empirical evidence (see Background chapter). To provide a basis for decision-makers in the food system, we also analyse consumer acceptance of selected sustainability policies and interventions (partly described in the background chapter and partly derived from the project and expert opinions).

The survey concept consists of three main elements: i) the identification of consumer archetypes, ii) the profiling of these dietary types by various consumer characteristics, such as socio-demographic characteristics, psychological factors, buying habits and acceptance of transition towards sustainable food systems, resulting in consumer archetypes, and iii) identify the consumer archetypes' preferences and willingness to pay for a selection of sustainability innovations in the livestock sector (Figure 7).

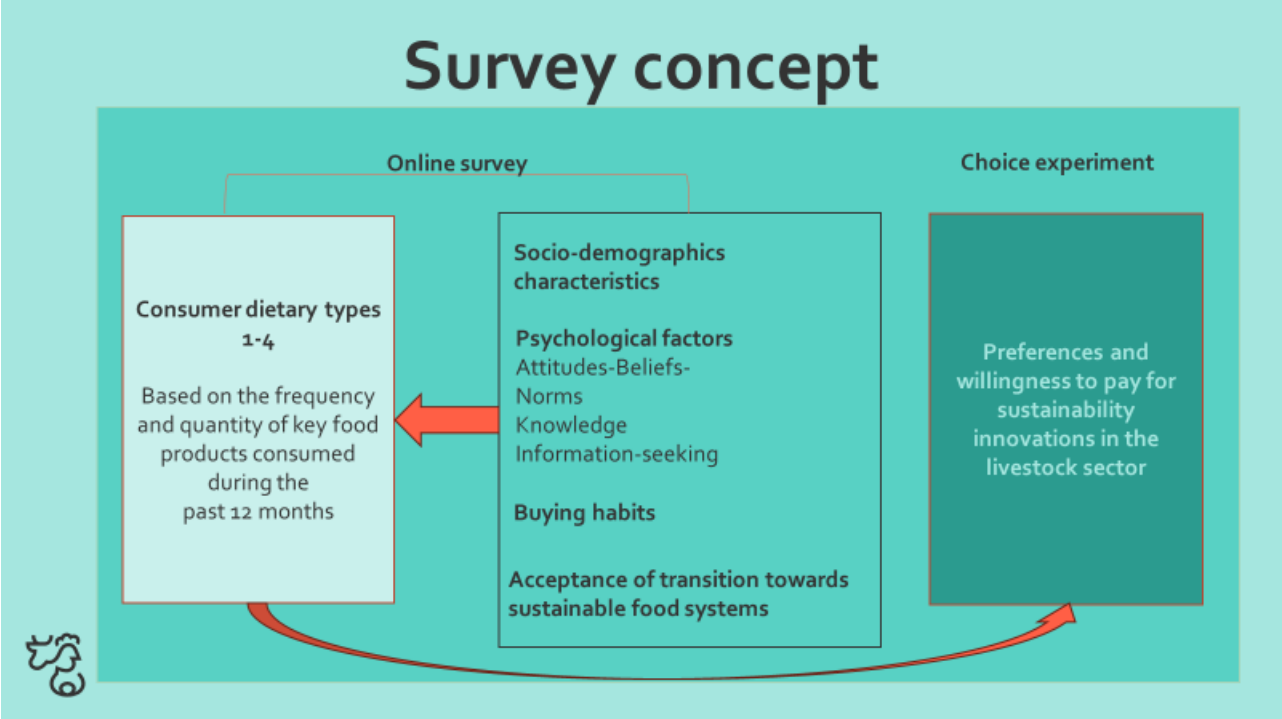

Figure 7 Consumer survey concept (own compilation)

Data collection and sampling

The online survey and choice experiment were carried out in five study countries, Germany, France, Italy, Sweden and Romania, with Sweden being added as an additional country at a later stage of the project. These countries were chosen to cover the different geographical regions with different cultural backgrounds and eating habits in the EU. The data was collected in autumn/winter 2023/2024. Two pilot rounds were carried out by the project partners in each of the case study countries, and the survey design and choice experiment were improved after each pilot round.

In each study country, about 500 respondents participated in the survey. The average time taken to complete the survey and choice experiment was 20 minutes. In Germany, France, Italy and Sweden, data collection took place in November. In Romania, data were collected from November to the first week of February 2024. In the first four countries the data collection was organised by Bilendi, an international marketing agency, while in Romania the data collection was organised by the project partners together with the marketing agency Bilendi. Quota sampling was used to draw representative samples in each country in terms of age, gender and region. The quota sampling was based on the distribution of age and gender in the total population in the NUTS 1 regions of each country (EUROSTAT 2023). Bilendi provided the consumer

panels in the five study countries, invited the participants and managed the quota sampling. Prior to data collection, the survey was approved by the Ethics Committee of the Research Institute of Organic Agriculture.

SURVEY CONCEPT AND STRUCTURE

The online survey and choice experiment consisted of the following 10 sections (see Appendix for the questionnaire):

1. **Introduction**: the survey began with an introduction including information about the survey topic, the ethical guidelines the survey is based on, data protection and rights of the respondents.
2. **Socio-demographics part 1**: This section included questions about age, gender, region. The data was collected by the marketing agency for the quota sampling
3. **Dietary patterns** (described in more detail in the next section): This part of the survey covered both frequency of consumption and quantity of key products. Frequency was measured on an 8-point scale ranging from 8 = several times a day to 1 = never in the last 12 months. In addition, this part of the survey included a question where consumers could choose the dietary style that most closely corresponded to their own dietary style.
4. **Level of motivation** (based on approach as described by De Boer et al, 2014): this section measured the level of motivation for sustainable food consumption, focusing on the three sustainability dimensions of environment and climate and animal welfare, with three items for each dimension measured on a 4-point scale from 1 = not motivated at all to 4 = doing so already.
5. **Attitudes** (partly based on approach as described by Mayerhof and Liebe, 2009): attitudes both towards and against sustainable food consumption were addressed in two separate sets of questions measured on a five-point scale from 5 = I fully agree to 1 = I fully disagree
6. **Knowledge**: In this section, the respondents' knowledge of sustainable food production and consumption was measured on a 4-point-scale from correct, partly correct, false, and I don't know.
7. **Preferences and willingness to pay** (described in more detail in the next sections): two different products were included in the choice experiment, milk (beef in Sweden) and ham. In a first step, information about the milk (beef) and ham that are preferred in daily life were collected including brand name, price and if is organic or non-organic. Then information about the choice experimental attributes and levels was provided to the participants, followed by an instruction on how to complete the choice experiment. Only consumers of the study products milk (beef) and/or ham took part in the consumer choice experiment.
8. **Role of sustainability labels in daily life**: this section included a set of (generic) labels and respondents were asked to report the frequency they choose food labels in daily life, measured on a 5-point-scale from regularly to I don't know the label
9. **Transition towards sustainable food consumption** (partly based on and adapted from Van Dam and Van Trijp, 2016 and Blair et al. 2024): the role of actors and acceptance of different

interventions/measures to achieve a higher sustainability in the food system, measured on a 5-point scale from 1= very low level of responsibility to 5= very high level of responsibility

10. **Demographics part 2**: education level, household size, number and age of children, living environment (urban, rural), net monthly household income.

DIETARY PATTERNS

Dietary patterns of the respondents were recorded in order to create different types of diet. The choice of a suitable method for recording the respondents' eating habits was a challenge, as the recording of eating habits had to take place within the consumer survey and was therefore limited in its detail. According to the overview of dietary assessment methods to estimate food and nutrient consumption at national, household and individual level provided by the FAO (2018), direct methods using individual-based dietary assessment can be classified into two categories:

- **Retro-spective methods**
  These methods collect information about past food intake and include: 24-hour Recall (individuals report everything they have eaten and drunk in the past 24 hours), food Frequency Questionnaires (FFQ) (individuals indicate how often they have consumed specific foods over a certain period i.e weeks, months) and Dietary History (a comprehensive assessment of an individual's past eating habits, often through detailed questionnaires and interviews).
- **Pro-spective methods**
  These methods assess current food intake and include: Food Records (individuals record everything they consume at the time of eating, usually for several consecutive days) and Duplicate Meal Method (individuals provide duplicate samples of all meals consumed, which are then analysed in a laboratory to determine nutrient content).

Given that the collection of dietary patterns had to be implemented in the consumer online survey and choice experiment, the data was collected by means of a retro-perspective method. However, both most commonly used standard procedures, the 24 hour-recall protocol and the Food Frequency questionnaire could not be implemented into the online survey. For using the 24 hour-recall protocol, the sample size envisaged in this survey was too large and the time effort of cleaning and analysing dietary data from such kind of survey far too high. The Food Frequency survey method was not feasible because it would have taken too long to be completed together with the other survey parts and choice experiments. In addition, Food Frequency Questionnaires do not consider the quantity of product uptake, which significantly limits the validity of the data collected (references to be included).

In this study, we used elements of the Food Frequency method, i.e. selected the most relevant product categories and consumers reported the frequency of consumption of these product categories on a scale reaching from "several times a day" to "never" within the past 12 months. These key product categories included were:

- meat (poultry, beef and veal, pork, lamb/goat/mouton, processed meat)
- eggs
- dairy (cow milk, butter, yogurt, cream/creme fraiche)
- fish and seafood
- fruits, berries and vegetables,
- Legumes, meat substitutes and unsalted nuts
- Starch products (bread and bakery products, noodles/rice/potatoes/maize, breakfast cereals)
- Snacks, sweets and drinks containing sugar
- Convenience food (ready-to-eat meals)

In addition, to overcome the major limitation of the FFQ methods, we collected the portion sizes in addition to the reported food frequencies. To improve the quality of the reported portion sizes, we added one or several pictures with real products and potion sizes for each product group, using similar units (most commonly 100g or ml) and in addition, we provided the sizes of plates and glasses shown on the pictures. This approach allowed us to understand consumption trends for the chosen countries and to identify different consumer types.

CHOICE EXPERIMENT

In this section, the method choice experiment and the procedure applied in this study are described. Choice experimentation is often designed and presented to consumers as a simulation of a purchasing experience (Hair et al., 2003), in which consumers are asked to choose ("purchase") a product option out of a range of differing product options in several choice set. Choice experiments are based on Random Utility Theory, which proposes that goods are not the direct objects of utility, but that utility is derived from the properties or characteristics of the goods instead (Lancaster, 1966). The key principle of choice experiments is systematic variation of a set of independent variables across the product options presented in each choice set, which affects the dependent variable (Aaker et al., 2006). McFadden (2001) established a theory-based econometric model for discrete responses, in which utilities are specified as a linear function of observed attributes of the alternatives. The model's function includes the measured attributes of the product options and the coefficients that reflect the choice of the decision-makers (McFadden, 2001).

Choice experiments can be either conducted independently from a certain animal category or be product-specific. While it might be appealing to design a choice experiment independently from a specific product, it is rather uncommon since consumers' preferences very much vary when it comes to product level. Accordingly, most consumer studies focus on one single product and design the choice experiment around

this product. Besides, willingness-to-pay estimates can only be calculated when choice experiments deal with specific products and market prices. Therefore, the Pathways choice experiment was done in the context of specific animal products.

The selection of products and labels (representing sustainable husbandry systems) was done in accordance with WP 1, the community of practice of the Pathways project. Altogether 16 practice hubs are included in the Pathways project, representing dairy, pork, beef, poultry meat, poultry eggs and sheep/goats. WP 1 deliverable 1.1 is the basis for the choice of animal categories, which includes a detailed description of the practice hubs and their visions for the future. The following table contains an overview of hubs and their visions as developed in WP 1 and described in Deliverable 1.1 of the Pathways project.

Table 1 Overview of visioning exercises carried out in the different Practice Hubs

Practice Hubs supporting holistic evaluation		**Cou ntr**	**Facilitator/ reporter**
1	100% pasture-fed cow-calf dairy systems	DE	FiBL
2	Management for maximisation of C sequestration in pasture	FR	ACTA
3	Dairy with agroforestry aiming for self-sufficiency in protein-based feed	RO	USAMVCN
4	More-from-less dairy systems utilising on-farm advice and carbon footprinting tool	SE	SLU
5	Conventional production utilising manure for biogas	FR	ACTA
6	Organic farmers utilising “green-protein” from grass/clover working with feed company and refinery	DK	AU
7	Indoor more-from-less production system with optimised diets and housing with ammonia capture	DK	L&F
8	Conventional pig production with innovative flooring (solid floor with a layer of material for rooting for all ages) and focus on biodiversity	NL	WR
9	100% pasture-fed beef systems utilising mob grazing, herbal leys and mobile slaughterhouses and Community Supported Agriculture	UK	UREAD
10	New breeding methodology for “mountain pasture” with own certification/label development	IT	UNIPI
11	Quality assured (IP SIGILL) production system for beef and sheep on HNV semi-natural pastures together with label development.	SE	NATUR
12	Agri-tech innovation for improved welfare	PL	IUNG
13	Farmer co-operative producing and sharing compost from plant-based litter	FR	ACTA
14	Closed-loop egg production feeding food processing waste and recycling manure	NL	AERES
15	Dehesa Mediterranean system of sheep rearing in silvopasture with different input levels	ES	CSIC
16	Individual animal data processing tool to increase the efficiency of resource management in dairy goats	ES	CSIC

To choose from this large range of product categories and visions covered by the practice hubs, a selection strategy we employed was to identify overlaps to make sure that the results from the consumer survey are interesting for as many practice hubs as possible. Another relevant selection criterion was to particularly focus of the specific study countries of this survey and to particularly select the visions and sectors in these countries. Taking these considerations into account, which were:

Table 2 : Sustainability innovation in the single case study countries

Country	**Sustainability vision**
Germany	Dairy: 100% pasture-fed cow-calf dairy systems
France	Dairy: management for maximisation of C sequestration in pasture Pork: Conventional production utilising manure for biogas Poultry: Farmer co-operative producing and sharing compost from plant-based litter
Italy	Beef: new breeding methodology for "mountain pasture" with own certification/label development
Romania	Dairy: agroforestry aiming for self-sufficiency in protein-based feed

The dairy sector was represented in each case study country (and also in the additional fifths study country Sweden) and therefore was addressed in the choice experiment. In addition, given the criticism of the sector in the context of the climate debate, which has recently led to some pressure and loss of image, it was considered relevant to look specifically at improvements in sustainability performance in this sector. Accordingly, in the project, the focus of the choice experiment is on the milk sector and secondly on the pork sector, which is a leading sector in Europe, to cover both dimensions, ruminants and monogastric. Within this setting, we included as many visions from the practice hubs as possible and additionally conducted expert interviews to identify relevant sustainability innovations in the livestock sectors of dairy and pork production. The product attributes price, geographical origin and production system were additionally included in the choice experiment because these production attributes are highly relevant in most food choices and therefore increased realism of the hypothetical choice scenarios. The selection of visions/innovations for the choice experiments conducted in the four case study countries Germany, France, Italy and Romania are presented in Table 3 and Table 4, same as the other product attributes included in the choice experiment.

Table 3: Overview on attributes and labels included in the choice experiment for milk in DE, FR, IT and RO

Attribute	Attribute levels
Improved animal welfare	1: No improved animal welfare 2: Pasture-based dairy cows (During summer 26 days per month on pasture, during winter at least 13 days per month access to outdoor run) 3: Pasture-based dairy cow with calf rearing: calf remains at least four months with cow
Reduction of climate and environmental impacts	1: no label 2: reduction of GHG emission through biogas production using manure 3: 100 percent grassland-based feeding (no concentrated feed)
Biodiversity	1: no label 2: Dairy cows are fed with grass from a nature conservation mountain area (mountain product) (biodiversity)
Production system	1: no label (conventional, indoor tie housing) 2: organic (EU Bio: 100% indoor loose housing with generous space and with access to outdoor run)
Geographical origin	1. From EU production 2. From domestic production 3: From local production
Consumer price	1: 30 percent higher than average (country-specific) market price for 1 litre fresh milk of conventional production 2: 60 percent higher than average market price 3: 90 percent higher than average market price

Table 4: Overview on attributes and labels included in the choice experiment for 200 g of cooked ham in DE, FR, IT and RO

Attribute	Attribute levels
Improved animal welfare	1: No improved animal welfare (indoor in groups on little space) 2: More space and designed in and outdoor area 3: Free-range-based mobile housing
Reduction of climate and environmental impacts	1: No label 2: Reduction of GHG emission through biogas production using manure 3: Reduction of GHG emission through food waste/by-products-based feeding
Production system	1: No label 2: organic (organic fodder and solid floor with a layer of material for rooting and high resting comfort, access to outdoor run)
Geographical Origin	1: From EU production and processing 2: From domestic production and processing 3: From local production and processing
Consumer price	1: 30 percent higher than average (country-specific) market price for 200g of cooked ham of conventional production 2: 60 percent higher than average market price 3: 90 percent higher than average market price

In the case study country Sweden, which was included as an additional country at a later stage of the concept development, the choice experiment differed from the other case study countries in that some of the attributes and levels could not be applied in the Swedish context due to country-specific agricultural policies that already covered some of the sustainability innovations tested in the other countries. This was the case for the innovation "pasture-based dairy cows" (in the case of dairy cows), which is required by Swedish agricultural policy. Against this background, the first choice experiment in Sweden dealt with scenarios for beef from dairy production instead for milk. For the attribute level referring to animal welfare, "on-farm slaughter" instead of "pasture-based dairy cows" was used (see Table 5: Overview on attributes and labels included in the choice experiment for minced meat comes from dairy production with simultaneous meat production in SETable 5). Because of these differences, the results of the choice experiment in Sweden are not comparable with other countries.

The following table include the attributes and levels applied in the choice experiments conducted on minced meat instead of milk in Sweden.

Table 5: Overview on attributes and labels included in the choice experiment for minced meat comes from dairy production with simultaneous meat production in SE

Attribute	Attribute levels
Improved animal welfare	1: No improved animal welfare 2: On-farm slaughter 3: More time for cow and calf
Reduction of climate and environmental impacts	1: No label 2: reduction of GHG emission through biogas production using manure 3: 100 percent grassland-based feeding (no concentrated feed)
Biodiversity	1: No label 2: Natural pasture meat production
Production system	1: Beef from conventional production: Beef from conventional dairy production 2: Pasture-based dairy cow with calf rearing: calf remains at least four months with cow
Geographical origin	1. From EU production 2. From domestic production 3: From local production
Consumer price	1: 30 percent higher than average (country-specific) market price for 1 kg minced meat of conventional production 2: 60 percent higher than average market price 3: 90 percent higher than average market price

Based on the attributes and levels as described above, an experimental design for each product was created using the software NGene 1.4 (ChoiceMetrics 2023). The choice experiment was designed as an unlabeled experiment (Hensher et al., 2015), and thus does not contain any option specific description (such as a specific brand name). Instead, the options are listed as "option 1" and "option 2", and the single attributes of interest are distributed across the three options following a d-efficient experimental design. In contrast to orthogonal designs that attempt to minimize the correlation in the data, d-efficient designs aim to generate parameter estimates with the smallest standard errors.

For each product, 12 different choice scenarios were created including two choice options respectively plus a no choice option, whereas by means of block design, each respondent only faced 6 of the 12 scenarios per product. The block design was chosen to reduce the cognitive burden of the respondents when completing the choice experiment task. The additional no choice option was included because in a previous study by Dhar & Simonson (2003), evidence was found that under forced choice, participants tend to choose alternatives with average attribute levels.

DATA ANALYSIS

Before starting the data analysis, the data was cleaned by removing incomplete responses from the data set. Furthermore, the survey included questions to check the validity of the answers and accordingly, a small number (less than 30 per country) of responses were removed from the data set before starting the main analysis. In addition, speed responders, how completed the survey within an unrealistically little time were removed already during the data collection process (not affecting the target quota for age, gender and region).

ANALYIS OF DIETARY TYPES

The data obtained from the online survey section "dietary patterns" was analysed in several steps:

1. Calculation of frequency of daily intake per product per respondent in grams
2. Calculation of total intake per day in grams across all product categories per respondent
3. Calculation of share of daily intake per product in the total intake per day
4. K-means Cluster analysis to identify different consumer dietary types (Johnson and Wichern, 1998).

K-means clustering uses vector quantization that aims to divide observations into k clusters, whereas each observation belongs to the cluster with the nearest mean, as measured by the cluster centres (Johnson and Wichern, 1998). To select the final solution, several k-means cluster analyses with varying cluster numbers were conducted and the outcomes compared with each other. Cluster solutions based on two, three, four, five and six clusters were created and compared. To identify the final solution, two criteria were applied: i) blocking/similar patterns of products belonging to the same broader product category (i.e. similar patterns in fruit, vegetables and salads, or in milk, cheese, yogurt/cream) to sharpen the dietary profiles of the different archetypes, and ii) cluster size distribution; we opted for cluster solutions with rather even group sizes, avoiding too large and too small clusters, by applying thresholds of 15 % as lower and 50 % as upper limit. The final cluster solution included four clusters. The four identified clusters will be described in section Dietary patterns under the resultsDietary patterns.

ANALYISIS OF COUNTRY DIFFERENCES REGARING FOOD INTAKE

Country differences in daily intakes in grams per product category were analysed using the Kruskall-Wallis test for significance. This non-parametric method is used to test whether samples come from the same distribution and is used to compare two or more independent samples of equal or different sizes (Field, 2005).

ANALYSIS OF MOTIVATIONAL LEVEL SCALES

The Cronbach alpha test was used to test for the reliability of the scale(s) measured by single items referring to the motivation for sustainable food consumption. The Cronbach's alpha is calculated by taking a score from each scale item and correlating it with the total score for each observation and the resulting correlations are compared with the variance of all the individual item scores (Johnson and Wichern,1998).

The Cronbach alpha test was applied in two steps.

1. Measuring the reliability of the scales formed by three items for the three dimensions environment, climate and animal welfare separately. In all countries except in Romania, the Cronbach alpha was higher than the threshold of 0.7 within all three dimensions.
2. The three dimensions were summarised on a single factor measuring the motivational level across the three dimensions and the Cronbach alpha was applied to test for the reliability of the scale in each study country. The Cronbach alpha was higher than 0.7 in all countries except in Romania, where it was slightly lower.

ANALYIS OF CHOICE EXPERIMENTS

Data from choice experiments are analysed using econometric models. There is a wide range of models available, and the choice of the most appropriate model depends on several factors, such as the nature of the dependent (discrete) variable and the purpose and objectives of the study. In this study, random parameter logit models were used to analyse data from a choice experiment to estimate consumer preferences and willingness to pay for sustainability innovations in the dairy and pork sectors. Random parameter logit models (also called mixed logit models) assume that the relevance of attributes vary from one individual to another. It is therefore a model that takes into account the heterogeneity of the population (Hensher et al., 2015). In this study, as differences were expected both within and between countries, the random parameter logit model was considered the most appropriate data analysis model. A detailed description of the model can be found in Hensher & Greene (2003).

In the data analysis, the choice was defined as the dependent variable and the attribute levels that varied between the two choice options were defined as the independent variables. The attributes and levels were effect coded because effect coding is expected to provide more realistic willingness-to-pay estimates than dummy coding because it allows estimation of all attribute levels and for uncorrelated estimates with the intercepts. We used a uniform distribution for all attributes except price levels, for which we used a normal distribution.

Results

Sample description

Table 6: Sample description of single study countries (n=2551)

	DE	FR	IT	SE	RO
Sample size n	530	510	538	495	488
Age group					
18-34 years	24.80%	30.60%	22.30%	28.30%	36.20%
35-54 years	39.80%	38.40%	40.90%	42.80%	43.10%
55-75 years	35.40%	31.00%	36.80%	28.90%	20.60%
Gender					
Male	48.3%	49.6%	50.6%	49.0%	49.8%
Female	51.7%	50.4%	49.4%	51.0%	50.2%
Household size	2.71	2.66	2.81	5.12	4.89
Number of children	0.48	0.71	0.62	0.55	1.20
Level of education					
No degree	1.7%	2.7%	5.0%	0.8%	4.6%
Vocational certificate or apprenticeship with certificate of proficiency	30.4%	17.1%	3.2%	1.4%	3.6%
Basic vocational training/vocational baccalaureate	11.5%	22.2%	3.5%	5.3%	42.8%
High school diploma	25.2%	21.0%	55.9%	22.5%	10.1%
Bachelor's degree from a college/university	11.5%	15.3%	19.1%	42.4%	28.1%
Master's degree/diploma or doctorate from a college or university	19.6%	21.8%	13.2%	27.5%	10.7%
Level of monthly household Income before tax deduction*					**
1	6.5%	6.9%	9.1%	45.5%	4.2%
2	32.3%	35.5%	45.2%	15.4%	11.9%
3	29.8%	32.5%	22.9%	7.8%	14.9%
4	13.7%	12.9%	7.6%	5.3%	28.5%
5	7.1%	2.7%	2.2%	5.9%	16.4%
6	2.3%	0.4%	0.6%	6.1%	9.1%
7	0.8%	0.8%	1.3%	4.5%	3.2%
No answer	7.5%	8.2%	11.2%	9.4%	11.7%

*Country-specific income levels were used, whereas the medium income class 4 corresponded to the average monthly household income class in the single countries

**in Romania the household income after tax deduction was reported

The survey was completed by n = 2551 participants total, with Germany n = 520, France n = 510, Italy n = 538, Romania n = 488, and Sweden n = 494. An overview of the relevant socio-demographic characteristics of all five countries is provided in Table 6. The average sample number of females was 51.7% for Germany, 50.4% for France, 49.4% for Italy, 51.0% for Romania, and 50.2% for Sweden, showing that the quota for gender of 50% male and 50% female was fulfilled in each study country. Given the variation between countries and the according quota sampling, sample ages varied in each country. The percentage of 18-34 year olds was 33.7%, 35-54 year olds was 44.2%, and 55-74 year olds was 22.1%.

The average monthly household income for Germany, France, and Italy was rather similar and ranged between the first- and fourth-income class (between 1000-4999 euro). For Romania and for Sweden the average income levels were higher than in the other countries. As for the level of education, Romania had the highest educated participants out of the sample population. Germany had 31.1% of the sample population that had completed a bachelor's degree or above, France with 37.1% having a bachelor's degree or above, Italy with 32.3% having a bachelor's degree or above, Romania with 69.9% having a bachelor's degree or above, and Sweden with 38.8% having a bachelor's degree or above.

In Germany, the general population of females is 50.7%, slightly lower than the sample population (Statistisches Bundesamt, 2024). In 2023, the average age was 44.6 years, lower than the sample population's age of 47.0 (Statistisches Bundesamt, 2024). The average household monthly income in 2021 was 4,100 euro, which falls within the range of most common income in the sample population (Statistisches Bundesamt, 2024). And in 2019, the percentage of people with a bachelor's degree or above was 18.5%, which makes the sample population on average more educated than the general population (Statistisches Bundesamt, 2024).

In France, the population of females was 51.7% in 2023, which is slightly higher than the sample population (Trading Economics, 2024a). The average age was 42.4 years in 2023, slightly lower than the sample population's average age of 45.2 (Statista, 2024a). The average household monthly income is 2,640 euro, which falls in the range of the most common income in the sample population (Worldmetrics, 2024). And the percentage of people with a bachelor's degree or above was 50.3% in 2021, which makes the general population more educated compared to the sample population (European Commission, 2022).

In Italy, in 2022 the population of females was 51.3%, slightly higher than the sample population (European Commission, 2023). The average age is 46.6 years, slightly lower than the sample population's average age of 48.5 (Statista, 2024b). The average household monthly income was 2,963 euro in 2023, which falls in the range of the most common income in the sample population (OECD, 2024). And the percentage of people with a bachelor's degree or above was 27.6% in 2019, which makes the sample population slightly higher educated compared to the general population (European Commission, 2020a).

In Romania, the population of females was 51.6% in 2023, which reflects the sample population well (Trading Economics, 2024). The average age is 41.3 years (Worldometer, 2024a). Due to the difference in the age reporting compared to the sample, this is difficult to compare but this age falls into the range of the most

commonly reported in the sample population. The average household monthly income was 6634 leu (1332 euro) in 2022, which is higher than the sample population's most common income (National Institute of Statistics, 2024) and the percentage of people with a bachelor's degree or above was 25.8% in 2019, which makes the sample population much more educated than the general population (European Commission, 2020b).

In Sweden, the population of females was 49.6% in 2023, similar to the sample population (Trading Economics, 2024c). The average age is 39.7 years, slightly lower than the sample population's age of 42.4 (Worldometer, 2024b). The average household monthly income was 45,000 SEK (3827 euro) in 2022, which is on the lower end of the most common monthly household income from the sample population, but still within reason (Statista, 2024c). And the percentage of people with a bachelor's degree or above was 40.7% in 2023, which is reflective of the sample population (Statista, 2024d).

To conclude, we assume no major bias between the national population and the samples in this research.

Dietary patterns

The following section reports the results of the daily intake per product category, taking into account country differences.

DAILY MEAT CONSUMPTION

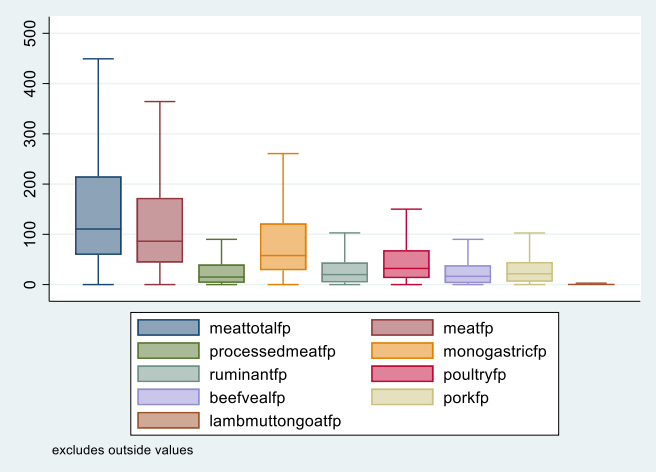

Figure 8 Daily meat consumption in grams (own compilation)

The boxplot shown in Figure 8 reports daily intake results in grams for different categories of meat, which are:

- beefvealfp that indicate Beef/veal
- lambmuttongoatfp that indicate Lamb/mutton/goat
- poultryfp that indicate Poultry
- porkfp that indicate Pork
- processedmeatfp that is processed meat like ham, sausages, salami etc,
- meatfp refers to the daily uptake in grams of unprocessed meat
- meattotalfp that is the sum of the last two.
- monogastricfp that is the sum of poultry and pork,
- ruminantfp that is the sum of beef/veal and lamb, mutton, goat.

The graph depicts nine categories, each represented by a distinct block. The median value is indicated by the line in the middle of each rectangle. The blue block, representing the sum of total meat consumption, shows the greatest dispersion of data and is centred around 110g per day. This block combines processed meat (green) and unprocessed meat (red). The central 50% of values for total meat consumption falls between approximately 75g and 205g, a range of about 140g.

Within the meat categories, processed meat has a median of 20g, while unprocessed meat has a higher median of 90g. Unprocessed meat also exhibits more data dispersion, with its central range spanning about 120g.

Meat consumption from monogastric animals (poultry and pork), represented by the orange block, shows one of the highest median values at approximately 60g. This can be further broken down into poultry at 35g and pork at 25g. In contrast, meat from ruminants (teal block) has a lower median of about 30g.

The ruminant category is predominantly composed of beef and veal, accounting for about 25g of the 30g median. Meat from goat, lamb, and mutton contributes a much smaller portion, approximately 5% of the ruminant meat consumption.

Table 7 Comparison of daily meat intake per country and meat type

Types of meat	Country	n	Daily intake (mean)	Std
Total meat	Germany	489	127.43	124.27
	France	482	120.74	95.00
	Italy	500	121.10	107.74
	Sweden	460	147.70	126.93
	Romania	439	173.03	136.03
	Total	**2370**	**137.17**	**119.98**
Unprocessed meat	Germany	503	103.93	119.28
	France	485	101.54	87.12
	Italy	516	110.40	112.80
	Sweden	469	126.27	119.06
	Romania	453	151.13	129.52
	Total	**2426**	**117.96**	**115.55**
Processed meat	Germany	519	44.4	80.38
	France	509	30.43	65.58
	Italy	537	32.55	64.15
	Sweden	490	36.53	68.70
	Romania	487	44.61	66.91
	Total	**2542**	**37.62**	**69.60**
Poultry	Germany	512	42.95	64.12
	France	499	49.02	64.45
	Italy	531	51.34	70.00
	Sweden	487	50.72	74.19
	Romania	480	84.12	95.43
	Total	**2509**	**55.31**	**75.48**
Pork	Germany	515	36.08	58.18
	France	505	33.12	60.00
	Italy	533	33.57	67.49
	Sweden	487	39.17	61.09
	Romania	479	68.59	87.10
	Total	**2519**	**41.73**	**68.61**
Beef / veal	Germany	515	24.76	39.43
	France	505	35.21	67.04
	Italy	537	41.04	67.60
	Sweden	488	48.11	71.02

	Romania	386	21.81	43.46
	Total	**2531**	**34.23**	**60.06**
Lamb, mutton, goat	Germany	518	9.60	37.21
	France	505	11.37	45.21
	Italy	537	13.82	50.56
	Sweden	489	16.43	59.28
	Romania	488	9.39	42.96
	Total	**2537**	**12.12**	**47.68**

For total meat the country with the highest intake is Romania 173g/d followed by Sweden with 147g/d with a significant difference between countries (see Table 7). However, it's important to note that these findings do not entirely align with other available data. For instance, according to Our World in Data (2024), the ranking for total meat consumption among the five countries considered differs substantially. Their data suggests that France and Germany occupy the top two positions, while Romania and Sweden rank at the bottom. This discrepancy between our study's findings and the Our World in Data information raises interesting questions. It could potentially be attributed to various factors such as differences in data collection methods, sample characteristics, or temporal variations in consumption patterns, which was very likely the case in Romania, where meat consumption is higher during winter season than during summer season and thus might have led to higher values in our study than in other data sources that report data for the whole year.

In our study the trend remains similar for unprocessed meat where Romania has the lead with 151g/d and Sweden is in second place with 126g/d (see Table 7). For processed meat, on the other hand, we can see that the hierarchies change, and we also find Germany in first place as intake with Romania. For poultry meat there is also in this case a significant difference between countries is the biggest consumer is always Romania followed however in this specific case by Italy. In this case our study reflects reality quite closely in fact Romania and Italy are among the top consumers of poultry meat although along with them we have France in first place. However, in this case the mean of the total consumption is similar between our study and reality.

For pork, the consumption in Romania was almost twice as high as for other countries. Also in other data sources, Romania is among the top consumers of pork along with Germany. In the case of beef/veal the consumption record is held by Sweden with 48g/d followed by Italy with 41g /d. In this case our data reflect the actual trend with Sweden and Italy among the top consumers although again together with France (Our world in data, 2024). Finally, the consumption of Lamb/Mutton and goat follow the same trend as the previous category with Sweden in first place with a not too high value of 16g/d and Italy in second with about 14g /d (see Table 7).

OTHER ANIMAL PRODUCTS

Daily Egg consumption

This graph represents the consumption of eggs or egg dishes which from the block we see that goes does not have a high dispersion of the data which in fact range from 0.5 to 2 with a median value of 0.6 eggs consumed per day.

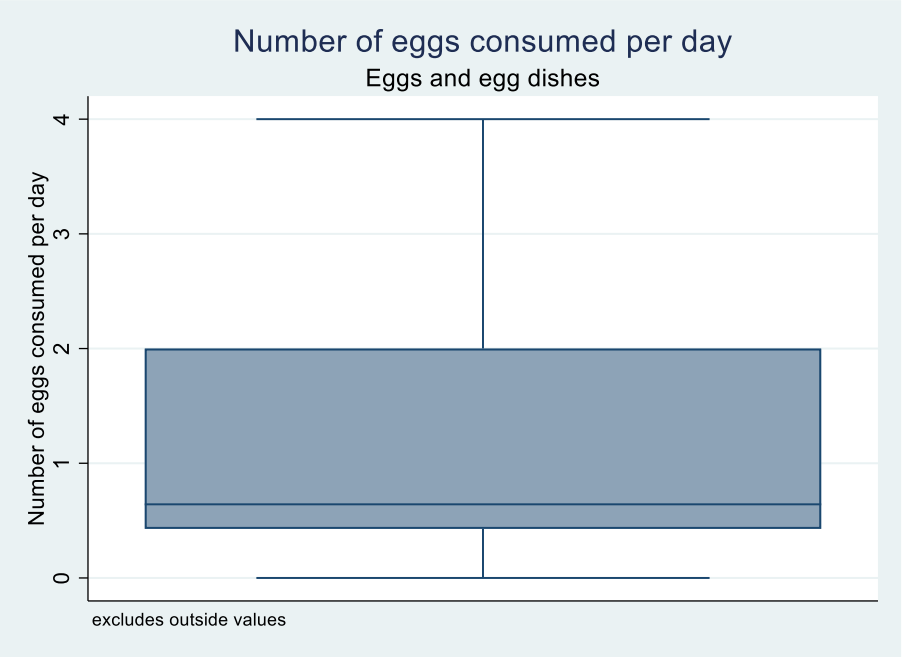

Figure 9: Number of eggs consumer per day (own compilation)

Error! Not a valid bookmark self-reference. shows the differences between countries in the daily intake of eggs. Romania is in first place with 1.5 eggs per day, while Italy is in last place with a value of almost half, 0.72.

Table 8 Comparison of daily egg intake per country (number of eggs per day)

Type of product	Country	n	Mean Intake*	Std
	Germany	483	1.00	0.96
Eggs	France	486	0.83	0.8
	Italy	510	0.72	0.74
	Sweden	457	1.20	1.01
	Romania	468	1.50	1.06

Total	**2404**	**1.03**	**0.95**

Daily MILK consumption

Figure 10 reports the daily intake of cow's milk in ml, which has a fairly high dispersion of data, with values ranging from 10 to 170 ml with a median value of 55 ml per day.

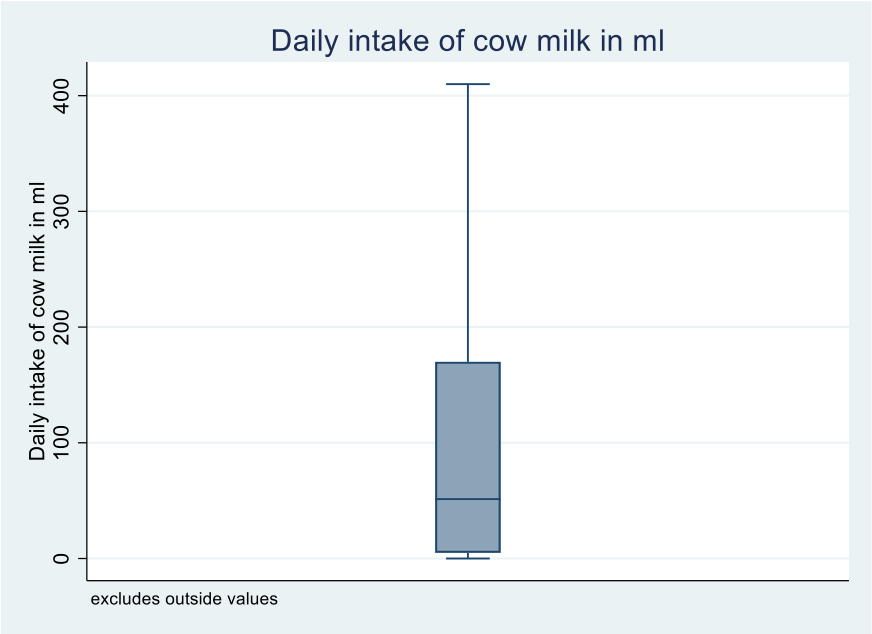

Figure 10: Daily consumption of milk (in ml) (own compilation)

Daily cheese consumption

Regarding cheese, the dispersion is slightly lower with values ranging from 20 to 80 and an average value of about 35 g per day (see Figure 11).

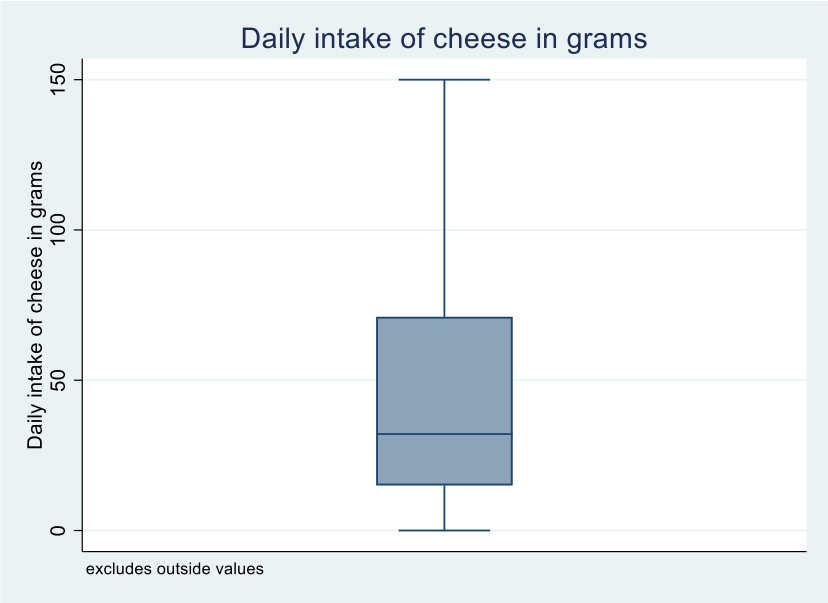

Figure 11: Daily consumption of cheese (in g) (own compilation)

Daily butter consumption

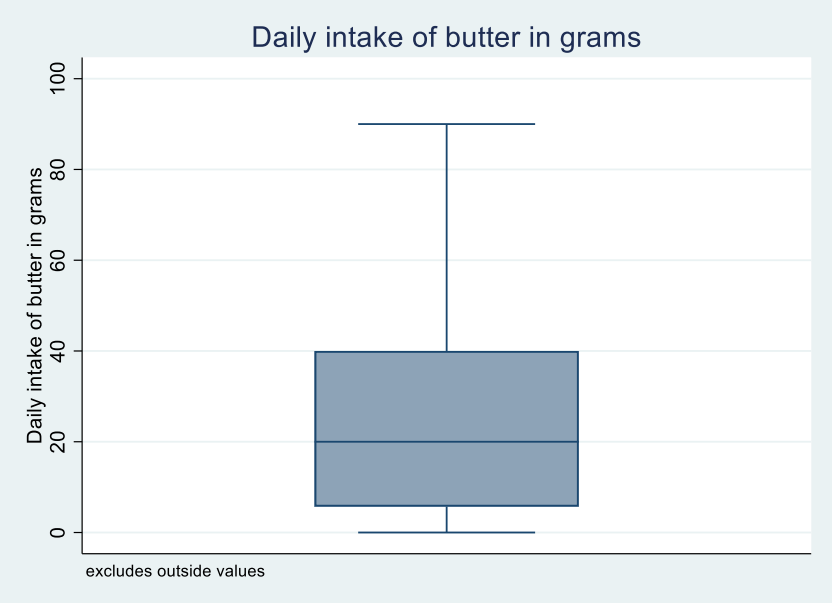

Figure 12: Daily consumption of butter (in g) (own compilation)

Figure 12 represents the daily intake of butter in grams, which shows a low dispersion of the data with values ranging from 10 to 30 grams with a median value of about 20.

Other dairy products consumption

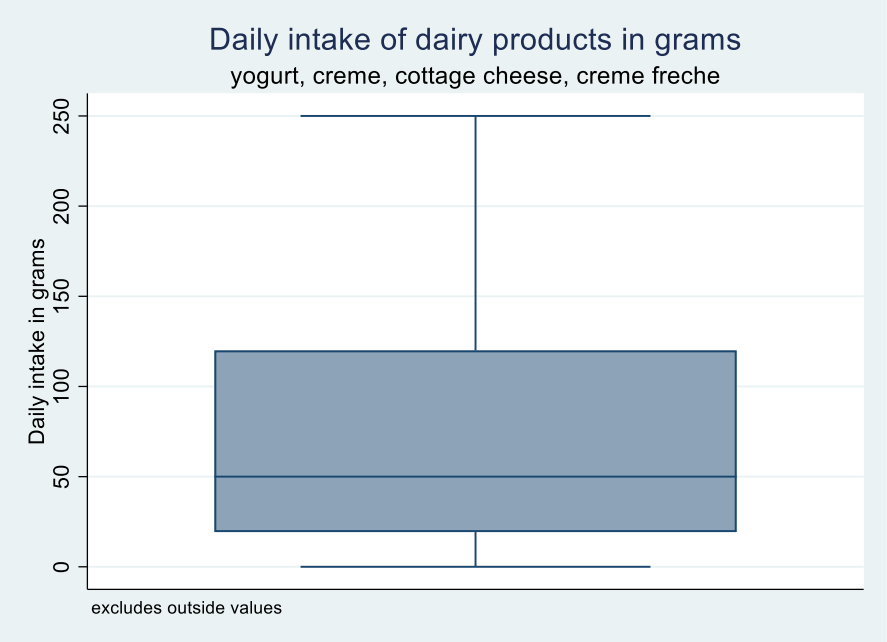

Figure 13: Other dairy products (in g) (own compilation)

Figure 13 reports the consumption of other dairy products. It shows minor dispersion with values ranging from 20 to 125 grams with a median value of about 45.

Table 9 Comparison of daily dairy product consumption per country

Types of product	Country	n	Mean intake in ml[1]/grams[2]	Std
Cow milk	Germany	478	88.35	104.12
	France	383	68.27	91.67
	Italy	528	83.95	93.21
	Sweden	436	97.3	110.44
	Romania	470	99.85	99.46
	Total	**2394**	**87.23**	**100.23**
Butter	Germany	462	21.32	20.04
	France	436	21.8	19.27
	Italy	514	12.17	15.03
	Sweden	397	20.06	22.35
	Romania	439	21.99	18.91
	Total	**2248**	**20.29**	**19.64**
Cheese	Germany	490	43.68	39.29
	France	482	45.26	40.16
	Italy	529	32.04	31.75
	Sweden	450	46.96	41.9
	Romania	453	47.17	38.41
	Total	**2404**	**42.7**	**38.7**
Other dairy (yogurt, cream	Germany	466	67.93	60.19
	France	419	65.39	54.47
	Italy	529	43.37	43.41
	Sweden	433	67.75	61.42
	Romania	460	66.77	56.1
	Total	**2307**	61.57	55.97

1cow milk

2*other products

Table 9 show the differences between countries in terms of average intakes of different dairy products. The first country for cow's milk consumption, as can be seen from the column for average intake, is Romania with 99.85 g per day, followed by Sweden with a very similar value (97 g), and lastly France with a value of 68.27 g. The other two countries have similar values of around 85 g. In Europe Our world in data, 2024), milk consumption is higher in France with 742g, followed by Italy with 631g. Romania and Sweden have a similar consumption of around 600g, and in last place is Germany with 570g. A possible reason for these large differences between the survey data and the Our world data is that consumers reported their milk consumption without thinking of the use of milk when cooking meals. Furthermore, milk is a very frequent ingredient in processed food, which was not covered by the survey.

In the database, the quantities were reported in kg per year, which we converted to g per day to compare with our data. Regarding butter consumption the first three countries with similar values of 21g per day are Romania, France and Germany. Sweden consumes slightly less, about 20g, and Italy is last with a much lower consumption of 12g. This is possibly because of the prevalence of other types of fats (especially extra virgin olive oil, a quality Italian product). The first country by consumption for cheese as we can see from the column of mean intake is Romania with 47.17g per day with Sweden in second place with a very similar value (46.96g) while last is Italy with a value of 32g. The other 2 countries, Germany and France have similar values of about 45g. The other dairy products all have in the four countries (Germany, Sweden, France and Romania) 4 similar values of about 66g while Italy is the only one with a lower value of 43g.

Fish consumption

Daily fish consumption in grams, as reported in Figure 14 has a rather low dispersion, with values ranging from 10 to 30 grams with a median value of about 18 g per day.

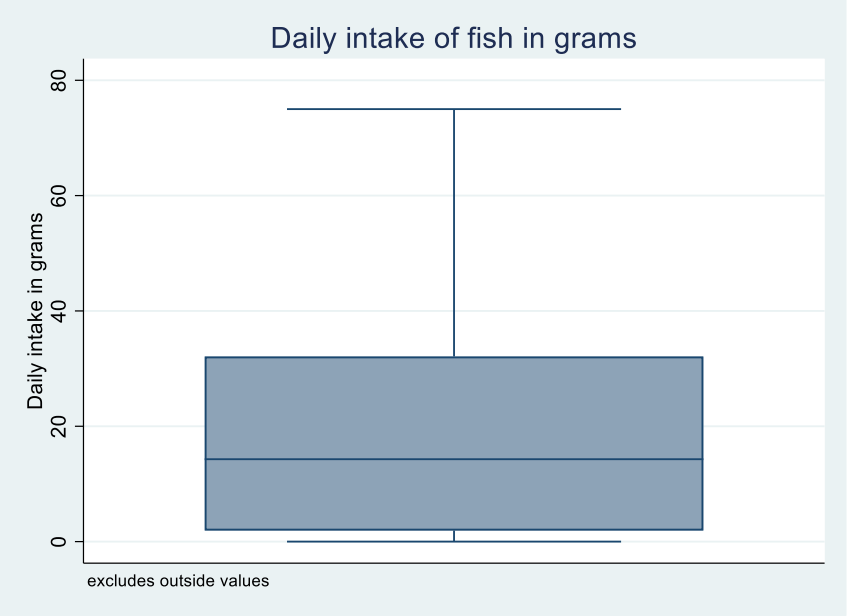

Figure 14: Fish consumption per day (in g) (own compilation)

Table 10 Comparison of daily fish consumption per country

Types of product	Country	n	Mean intake in g	Std
Fish	Germany	477	14.6	16.94
	France	478	18.18	17.19
	Italy	473	23.25	20.03
	Sweden	441	19.23	18.29
	Romania	449	14.73	16.89
	Total	**2318**	**18.01**	**18.18**

Table 10 shows that the country with the highest intake of fish is Italy with 23 g/d, followed by Sweden with 19 g/d, with Germany and Romania at the bottom with 14 g/d.

As compared to data as reported in Our world of data (2024). the situation is quite similar, in fact the ranking is almost the same, with 92g, Sweden in second with 85g and Italy in third with 80g. The last two places are occupied by Romania and Germany, with much lower consumption (22g for the former and 36g for the latter) according to Our world of data (2024).

FRUITS AND BERRIES, SALADS AND VEGETABLES

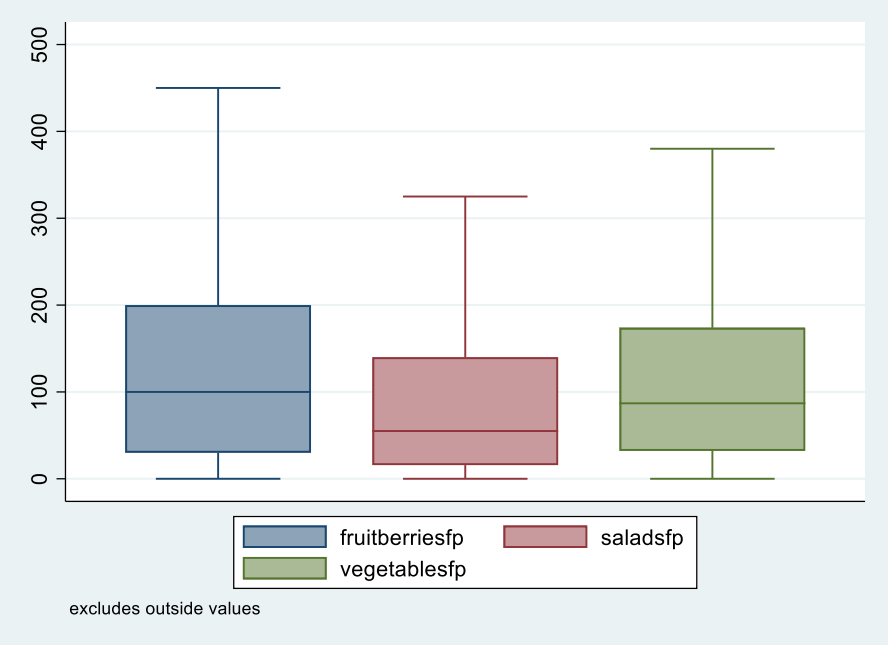

Figure 15: Fruit, vegetables and salads consumption per day (in g) (own compilation)

Figure 15 represents three blocks representing the consumption of fruits and berries, vegetables, and salads. All three show a rather low dispersion. Fruit and berries have values ranging from 20 to 200 g, with an average of about 100g. Vegetables has values ranging from 10 to 150 and an average of 30, and finally, the salads have values ranging from 20 to 180 with an average of 85.

Table 11: Daily comparison of fruits, berries, salads and vegetable consumption per country

Types of product	Country	n	Mean intake in ml	Std
Fruits and berries	Germany	457	115.1	102
	France	429	105	103.8
	Italy	490	121.4	104.4
	Sweden	419	98.6	98.1
	Romania	407	97.1	92.2
	Total	**2202**	**108.1**	**100.8**
Salads	Germany	438	73.1	72.1
	France	431	63.6	70.9
	Italy	479	76.2	77
	Sweden	430	78	77.45
	Romania	409	87.1	76.3
	Total	**2187**	**75.5**	**75.1**
Vegetables	Germany	468	101.1	85.22
	France	431	115.4	87.1
	Italy	485	103.1	90
	Sweden	428	82.2	86
	Romania	435	98.6	87.3
	Total	**2247**	**100.2**	**87.6**

The first country by consumption for fruits and berries is Italy with 121 g per day with Germany with a similar amount (115 g), while the other three country have similar values of about 100 g per day. In the data source Our world in data (2024), similarly, fruit consumption Italy is in first place (352 g), followed by France (346 g) and Romania (296 g), and in the last two places are Sweden (289 g) and Germany (280 g). For the salad category, the first in consumption is Romania with 87 g, followed by Sweden and Italy with a similar value of about 77 g, Germany slightly lower with 73 g France is in 'last place with 63 g. For the vegetable category, in our data, France in first place, followed by Italy, Germany and Romania with about 100 g and in last place Sweden with 82g (see Figure 15). The data source Our world in data (2024) shows that for vegetable, Germany is in first place with 550g, followed by Sweden and Romania with about 470g, and Italy and France are in the last two places with 374g and 329g, respectively. In the survey consumers obviously did not report all the fruits, berries, vegetables and salads. One reason for this is the complexity of the food category and the large range of different fruits, berries, vegetables and salads available, that might make it difficult to report each single item consumed from the large range of products available. Another possible reason is that processed fruits, berries, salads and vegetables were less likely to be reported by consumers.

LEGUMES, MEAT SUBSTITUTES, UNSALTED NUTS

Regarding legumes, nuts and meat substitutes products, all three categories have low dispersion especially nuts and meat where the averages are close to zero Figure 16.

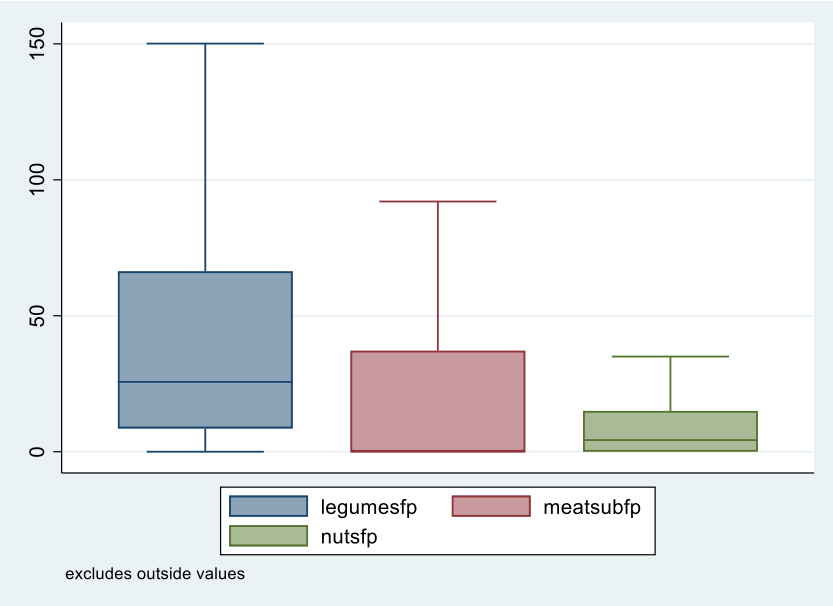

Figure 16: Daily consumption of legumes, meat substitutes and unsalted nuts (in g) (own compilation)

Table 12: Comparison of daily fruits, berries, salads and vegetable consumption per country

Types of product	Country	n	Mean intake in g	Std
Legumes	Germany	379	23.92	29.18
	France	378	32.00	33.19
	Italy	428	32.79	29.32
	Sweden	342	29.65	36.29
	Romania	358	38.15	33.49
	Total	**1885**	**31.3**	**32.51**
Meat substitutes	Germany	379	10.39	20.08
	France	382	9.06	19.36
	Italy	401	17.43	23.72
	Sweden	332	11.63	20.72
	Romania	310	12.14	20.43
	Total	**1804**	**12.2**	**21.16**
Unsalted nuts	Germany	344	6.37	8.27
	France	335	4.93	7.37
	Italy	415	7.74	9.25
	Sweden	326	5.36	7.44
	Romania	335	8.85	9.08
	Total	**1775**	**6.69**	**8.47**

Regarding legumes, Romania ranks first with about 38g followed by France and Italy with 32g, Sweden 30g and Germany with 24g (see

Table 12). The value of daily intake of meat substitutes shows that the first consumers of these products are Italians with 17g, followed by Romanians and Swedes with 12g, Germans 10g and France in last place with 9g. For unsalted nuts the first one for consumption is Romania with 9 g, Italy follows with similar value of about 8 g, Germany slightly less with 7 g while France and Sweden are the least consumers with 5 g.

SNACKS, SWEETS AND DRINKS CONTAINING SUGAR

The following two figures report the daily intake of snacks, sweets and drinks containing sugar in grams/ml. Particularly regarding the daily consumption of drinks containing sugar, large dispersions were found in our data.

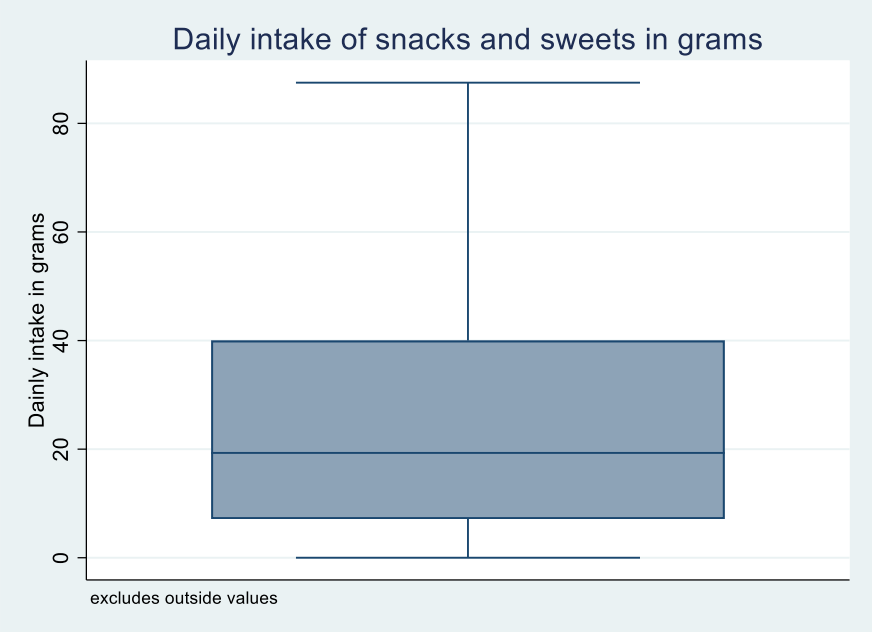

Figure 17: Daily intake of snacks and sweets (in g) (own compilation)

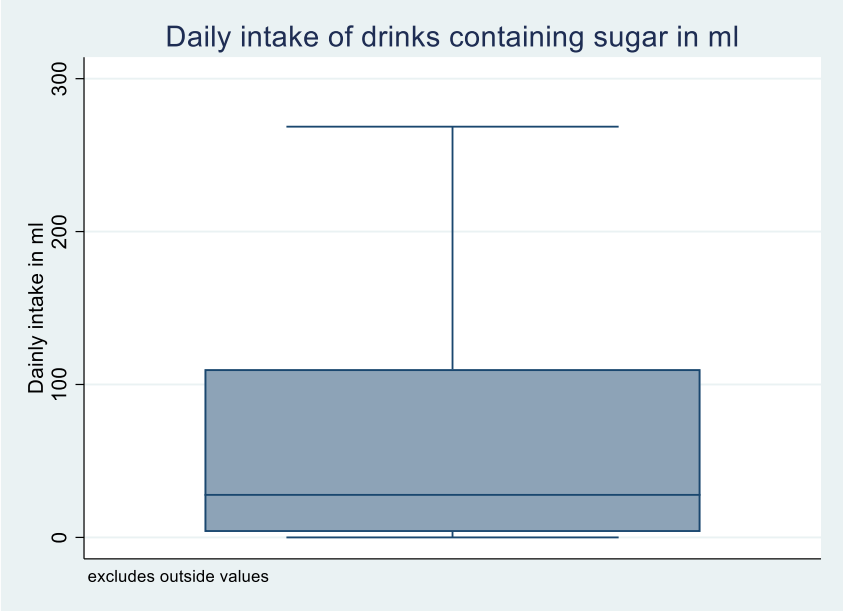

Figure 18: Daily intake of drinks containing sugar (in g/ml) (own compilation)

Table 13: Comparison of daily snacks, sweets and drinks containing sugar consumption per country

Types of product	Country	n	Mean intake in g/ml	Std
Snacks (in g)	Germany	520.00	40.11	72.92
	France	510.00	24.90	70.57
	Italy	538.00	26.90	52.01
	Sweden	495.00	40.84	76.82
	Romania	488.00	36.40	74.53
	Total	**2551.00**	**33.71**	**69.96**
Sweets (in g)	Germany	520.00	47.66	75.36
	France	510.00	31.32	65.41
	Italy	538.00	24.30	37.65
	Sweden	495.00	33.42	78.22
	Romania	488.00	52.40	86.10
	Total	**2551.00**	**37.61**	**70.86**
Drinks containing sugar (in ml)	Germany	520.00	114.06	221.31
	France	510.00	65.26	174.76
	Italy	538.00	43.85	93.33
	Sweden	495.00	93.97	226.99
	Romania	488.00	115.26	250.22
	Total	**2551.00**	**85.83**	**201.58**

Regarding snacks, consumers Germany and Sweden report the highest intakes (40 g per day in Germany and 41 g per day in Sweden). The lowest intakes are found in France and Italy (24 g in France and 27 g in Italy). Consumers in Romania report the highest daily intake of sweets (53 g per day), followed by consumers in Germany (48 g per day), whereas consumers in Italy report the lowest intakes (24 g per day). Similar to the intake of sweets, consumers in Germany and Romania reported the highest intakes of drinks containing sugar (114 ml per day in Germany and 115 ml per day in Romania).

Consumer dietary archetypes

In this section, the dietary types are described. Four general dietary clusters were identified based the cluster analysis (see Table 14).

Table 14: Consumer dietary types

Cluster membership	1	2	3	4
Main characteristics/type	**Dairy**	**Starch**	**High protein**	**Fibres**
Number of cluster members	594	473	809	674
Percentage of cluster members	23.29	18.55	31.73	26.43
Food categories				
Poultry	3.50	4.05	8.52	2.75
Beef and veal	2.49	2.07	4.84	1.78
Pork	2.87	3.99	5.54	1.91
Meat from lamb, mutton, goat	0.34	0.25	1.61	0.22
Processed meat	2.76	3.14	3.93	1.55
Fish	1.86	1.68	3.59	2.11
Milk	21.75	6.42	5.85	4.23
Butter, Cheese, Yogurt, Cream	24.25	12.55	9.50	10.52
Eggs	3.82	3.96	5.41	3.07
Fruits and berries	7.45	6.39	5.67	22.56
Salads	5.57	5.61	7.91	14.14
Vegetables	5.93	6.36	9.67	16.64
Legumes	1.89	2.25	5.94	3.72
Meat substitutes	0.63	1.21	4.32	1.74
Nuts	0.42	0.42	0.85	0.86
Starch	10.04	33.91	9.48	9.04
Sweet	2.59	3.27	3.80	1.81
Snacks	1.84	2.47	3.44	1.38

n total = 2550

The final cluster analysis solution includes four consumer clusters, that are characterised by different dietary patterns. The main characteristics for each cluster are as following:

Cluster 1: "Dairy" The first cluster is characterised by a high uptake of milk and dairy products. With a share of 23.29 %, Cluster 1 is the second smallest of all clusters.

Cluster 2: "Starch" Typical for consumers in Cluster 2 is the high uptake of starch containing products, such as bread and bakery products, pasta, rice, etc. With a share of 18.55 %, it is the smallest of all the clusters.

Cluster 3: "Protein" Consumers in the third cluster are characterised by a high uptake of all types of meat, fish eggs and by protein-rich plant food. In addition, the cluster is characterised by a high uptake of sweets and snacks. With a share of 31.73, the cluster is the largest of all the clusters. It is also characterized by the highest intake of meat substitutes.

Cluster 4 "Fibres" Consumers in the fourth cluster have a high uptake of the fibre-rich and plant-based food categories fruit, berries, vegetables and salads. With a share of 26.43 %, it is the second largest of all the clusters. It is also characterized by the lowest consumption of sweet and snacks.

CONSUMER DIETARY ARCHETYPES – PROFILES OF SINGLE TYPES

The following section includes a profiling of each dietary type regarding socio-demographic characteristics and level of motivation for sustainable food consumption, altogether forming the consumer archetypes.

Socio-demographic profiles of dietary types

Table 15: Socio-demographic profile of dietary types

Consumer cluster		**1**	**2**	**3**	**4**
Dietary main characteristics		**Dairy**	**Starch**	**Protein**	**Fibres**
Share of total sample %		23.29	18.55	**31.73**	26.43
Country differences %	DE	26.3	22.1	24.2	27.3
	FR	25.5	10.6	31.0	32.9
	IT	15.1	11.5	**36.8**	**36.6**
	SV	**34.2**	13.2	33.0	19.6
	RO	15.8	**36.3**	33.6	14.3
Gender %	female	**24.0**	14.5	27.7	**33.8**
	male	22.7	**22.7**	**35.8**	18.9
Agegroup %	18-34 years	20.8	15.4	**42.8**	21.1
	35-54 years	**24.8**	17.5	33.7	24.0
	55-75 years	23.6	**22.9**	18.9	**34.6**
Level of education %	1	26.0	**23.4**	31.2	19.5
	2	27.2	20.9	29.3	22.6
	3	**33.3**	14.9	28.9	22.8
	4	19.6	17.9	**33.8**	28.8
	5	18.2	22.8	**33.7**	25.2
	6	23.1	15.3	30.4	**31.2**
Level of income %	1	20.2	**29.6**	31.6	18.6
	2	23.8	16.7	29.8	29.8
	3	23.6	18.2	29.5	28.8
	4	**27.5**	13.d	34.5	24.1
	5	22.5	17.9	38.7	20.8
	6	18.5	20.7	**45.7**	15.2
	7	22.6	18.9	34.0	24.5
	8	22.1	14.8	28.3	**34.8**
Motivational level		2.41	2.36	2.50	**2.82**

Consumer archetype 1 "Dairy": This archetype is particularly strong in Sweden. Germany and France also have a high proportion of this type of consumer. Males and females are almost equally represented, while younger consumers are slightly less represented than middle and older consumers. People with a low or medium level of education are more likely to belong to this archetype than consumers with a high level of education, while there is no clear trend in income level despite the rather high level of medium education in this archetype. It furthermore has the second lowest average level of motivation for more sustainable food consumption.

Consumer archetype 2 "Starch": The second archetype is particularly represented in Romania, where it is the largest archetype (36.3%). In the other countries, this archetype is much less represented, ranging from 22.1% in Germany to only 10.6% in France and 11.5% in Italy. The cluster is clearly represented by male consumers (22.7%) rather than female consumers (14.5%). The higher the age group, the more consumers are likely to belong to the archetype. Conversely, higher levels of income and education are associated with lower levels of representation in this archetype. In addition, consumers in this archetype have the lowest average level of motivation for more sustainable food consumption, while it is the most relevant archetype in Italy.

Consumer archetype 3 "Protein": This archetype is the most common of the four archetypes, with 31.73% of the total sample belonging to this archetype. It is the most common archetype in Italy (closely followed by archetype 4 in Italy). In Germany, however, it is less represented than in the other countries. More men than women belong to this archetype, and younger than older consumers. There is no clear trend in terms of education and income level. Consumers in this archetype have the second highest average level of motivation for more sustainability in food consumption.

Consumer archetype 4 "Fibres": With a total share of 26.43 %, this consumer archetype is the second largest of all archetypes and particularly consumers in Italy are likely to belong to this archetype. The archetype is clearly represented by female consumers and is more common in the medium and especially in the highest age group. The higher the level of education and income, the more likely consumers are to belong to this archetype. Consumers in this archetype also have the highest average level of motivation for more sustainability in food consumption and for high nutritional quality (fibre, less sweets and snacks).

Attitudinal profile of dietary types

In Table 16, an overview on how different consumer archetypes evaluate statements towards information, support and willingness to pay regarding food sustainability is provided. A clear pattern is that consumers belonging to the archetype "Fibres" show positive attitudes towards food sustainability. These consumers would like to have more information and practical tips on sustainable food consumption. They are also in favour of more support for animal friendly, environmentally friendly, climate friendly production systems, and the preservation of natural landscapes, whereas the latter had the highest level of agreement in this archetype. Consumer in this archetype also should the highest willingness to pay for animal welfare, climate and environmentally friendly production, whereas their stated willingness to pay was highest for climate

friendly production, closely followed by animal friendly production. For the other archetypes, no clear patterns could be identified. The average attitudes in the other dietary types are lower. Consumers in these types tend to neither agree nor disagree with most of the statements except consumers in the dairy and starch types, which, on average, slightly disagree with the statements "I am willing to pay higher prices for climate friendly food production" and with "I am willing to pay higher prices for environmentally friendly food production".

Table 16 Attitudes towards information, support and willingness to pay regarding sustainable food (mean values)

	Dietary Type			
	1	2	3	4
Positive attitudes towards food sustainability	**Dairy**	**Starch**	**Protein**	**Fibres**
I would like to receive more information and practical tips on the sustainable consumption	3.23	3.04	3.24	**3.57**
Food companies should provide consumers with detailed information on food sustainability.	3.57	**3.68**	3.33	3.42
More support should be given to animal friendly food systems.	3.63	3.22	3.41	**3.94**
More support should be given to environmentally friendly food systems.	3.69	3.72	3.63	**4.04**
More support should be given to climate friendly food systems.	3.67	3.79	3.65	**4.05**
More support should be given to the preservation of natural landscapes	3.89	3.75	3.75	**4.18**
More support should be given to reduce animal-based food production and con	3.25	3.41	3.43	**3.70**
I am willing to pay higher prices for higher farm animal welfare in food production	3.26	3.35	3.40	**3.59**
I am willing to pay higher prices for climate friendly food production.	2.96	3.30	3.33	**3.42**
I am willing to pay higher prices for environmentally friendly food production.	2.81	2.97	3.19	**3.32**

Single attitudes were measured on a scale from 1 = I totally disagree to 5 = I totally agree

Consistent with their high mean scores for food sustainability, consumers of archetype 4 'Fibres' have the lowest mean scores for negative attitudes towards food sustainability (see Table 16). Consumers of archetype 1 'Dairy' appear to be the most price sensitive and least willing to pay for food sustainability. They have the highest level of agreement with the statements 'I already pay enough for other things', 'I refuse to pay more for food sustainability' and 'When I buy food, I always look for the cheapest option', and the second highest level of agreement with the statement 'Above all, food should be cheap'. Consumers belonging to archetype 2 'starch' also show high levels of agreement with the above attitudes. However, even archetype

3 'protein' consumers are not necessarily in favour of more sustainability in food. These consumers (together with archetype 1) showed the highest levels of agreement with the statements 'I refuse to pay more for food sustainability', for 'I am not interested in food sustainability' and for 'The current level of sustainability in food production and consumption is sufficient. There is no need to increase it. Obviously, consumers in this archetype are the least aware of food sustainability and see no need for action.

Table 17: Negative attitudes regarding food sustainability and willingness to pay (mean values)

	Dietary Type			
	1	2	3	4
Negative attitudes regarding food sustainability	**Dairy**	**Starch**	**Protein**	**Fibres**
I am not interested in the sustainability of food.	2.57	2.81	**2.88**	2.33
I already pay enough for other things.	**3.58**	3.49	3.39	3.52
I doubt that food products with sustainability labels are truly more sustainable than other food products.	3.25	**3.30**	3.23	3.16
I refuse to pay more for food sustainability.	**3.02**	2.96	**3.02**	2.79
It is not my responsibility to increase sustainability of food systems by paying higher prices.	3.29	**3.45**	3.21	3.07
Above all, food should be cheap.	3.19	**3.24**	3.15	2.97
When buying food, I always look for the cheapest options.	**3.23**	3.16	3.17	2.93
The topic of sustainability in the context of food is over-rated.	2.80	2.95	**2.99**	2.52
It is my right to have a high level of sustainability of food and not something I should have to pay extra for.	3.47	**3.61**	3.37	3.54
The current level of sustainability in food production and consumption is sufficient. There is no need to increase.	2.74	2.89	**2.95**	2.49

Single attitudes were measured on a scale from 1 = I totally disagree to 5 = I totally agree

Knowledge profile of dietary types

The following section outlines the lack of consumer knowledge on issues that are related to European agricultural regulations and practices.

Regarding the statement "By EU legislation, all farm animals in Europe have access to outdoor runs several months a year", it is striking that about one third of the consumers in the study countries and particularly consumers belonging to the type "dairy" believe that all farm animals have access to outdoor runs several months a year and only a small portion of consumers know that the statement is false, whereas the answer" I don't know was the most frequently chosen answer (Figure 19).

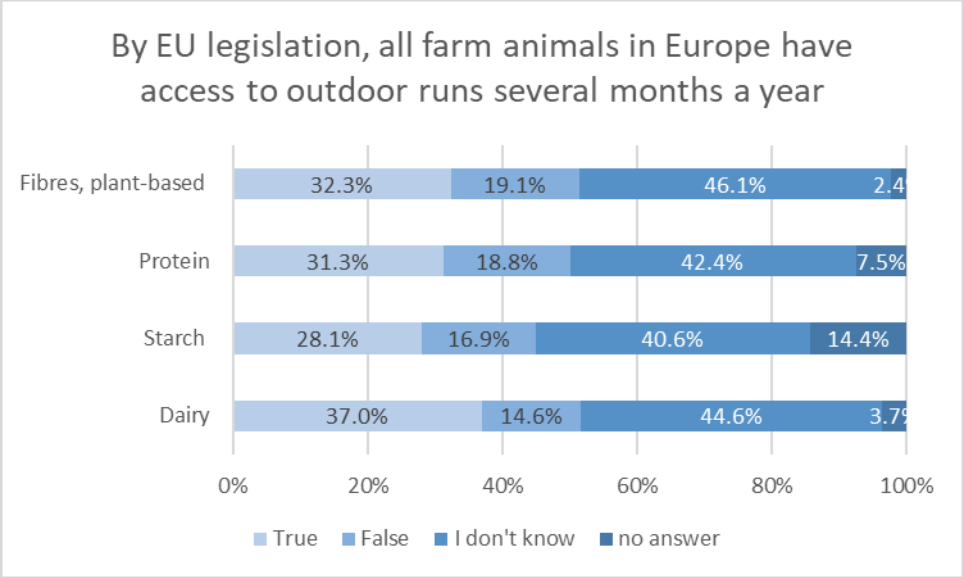

Figure 19 Knowledge 1: By EU legislation, all farm animals in Europe have access to outdoor runs several months a year

Similarly, the share of consumers, who believe that by EU legislation, dairy cows must be kept on pastures several months a year is mandatory is high for all consumer types and particularly high among consumers belonging to the consumer type "dairy", whereas only a small portion of consumers in the study countries believe that this statement is false. Again, the answer" I don't know was the most frequently chosen answer and was chosen by more than 40% of the respondents across all consumer types (see Figure 20).

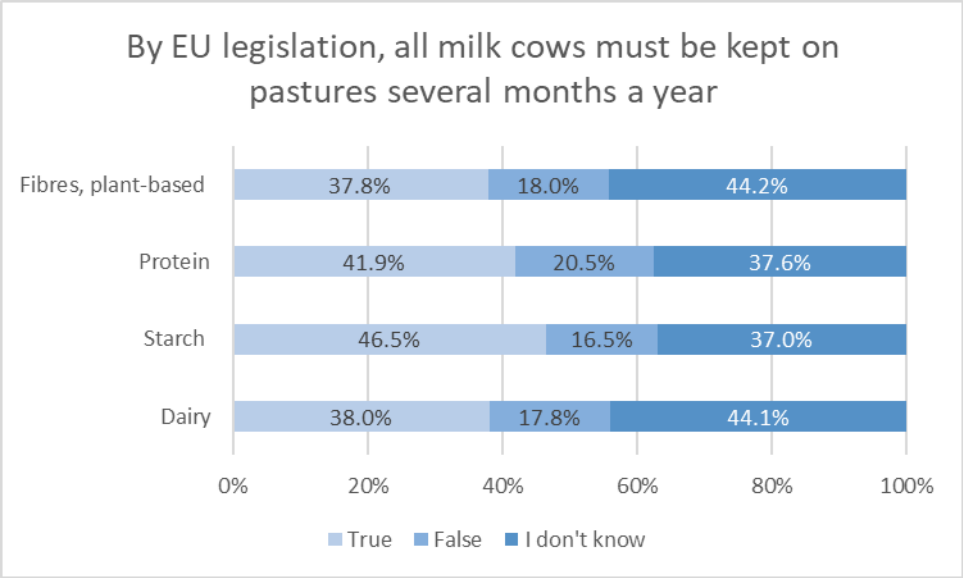

Figure 20 Knowledge 2: By EU legislation, all milk cows must be kept on pastures several months a year

Particularly consumers in consumer type "Fibres" believe that reducing a high level of animal product consumption significantly reduces negative impacts in GHG emissions, whereas it is much lower in the other archetypes and lowest among consumers belonging to the consumer types "protein" and "starch". The share of consumers who chose the answer "I don't know" was considerably lower for this consumption related statement than for the two previous production related statements (see Figure 21).

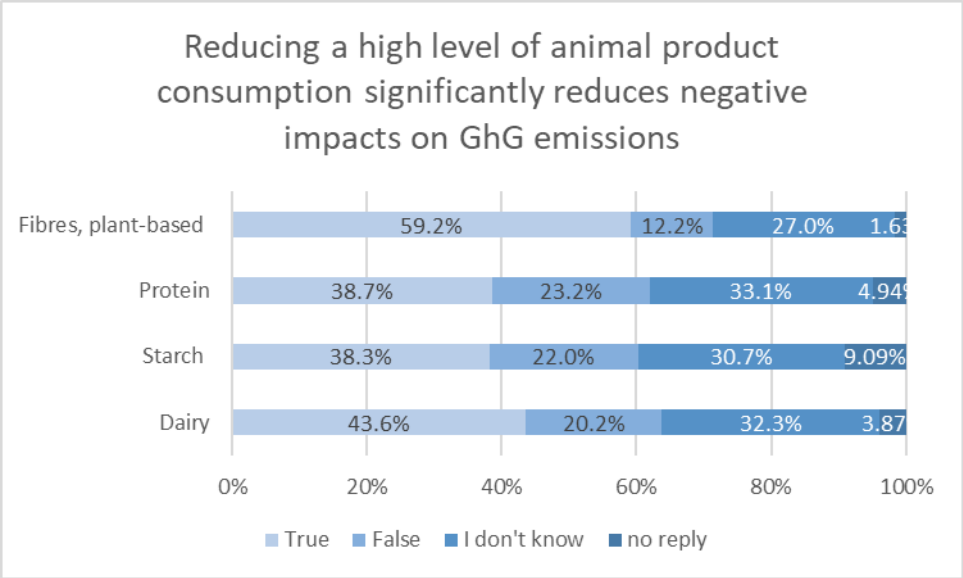

Figure 21: Knowledge 3: Reducing a high level of animal product consumption significantly reduces negative impacts GhG emission

Similar to the first two production-related statements, about one third of the consumers believe that by EU legislation, pig stables include bedding material, whereas only a very small portion of consumers, ranging from 14.5 % in the consumer type "Dairy" to 22.1% in the consumer type "Protein" stated that this statement is false. Again, the answer "I don't know" was the most frequently chosen answer across all consumer types (see Figure 22).

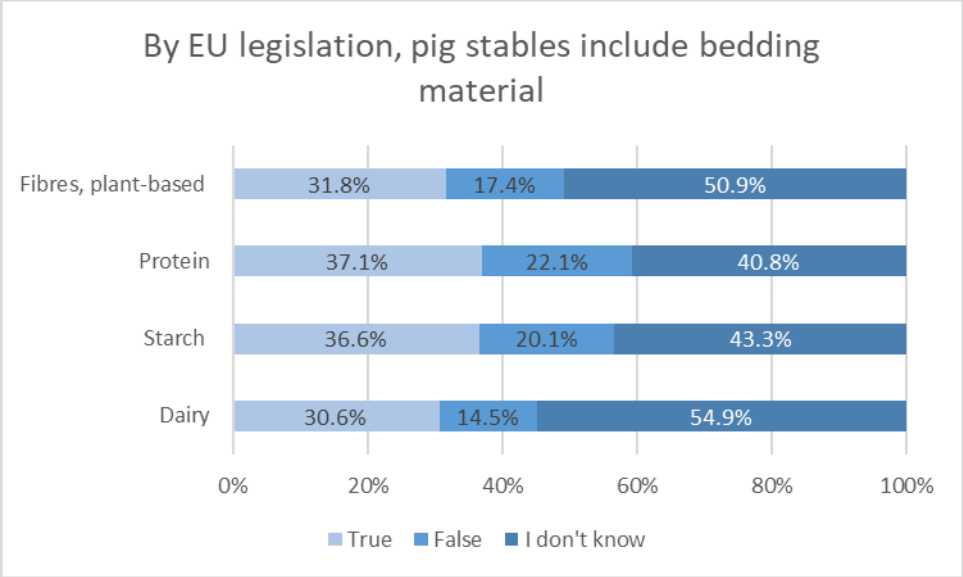

Figure 22: Knowledge 4: By EU legislation, pig stables include bedding material

Same as for the other production-related statements, the level of consumers who believe that per EU legislation, calves must remain with the mother cows several months after birth, is relatively high and ranges between 31.8% in the consumer type "Fibres to 37.1% in consumer type "Protein". Same as for the other production-related statements, the answer "I don't know" was the most frequently chosen answer and was chosen by more than 40%t in consumer types "Protein" and "starch" and even by more than 50% of consumers in the consumer types "Fibres " and "Dairy" (see Figure 23).

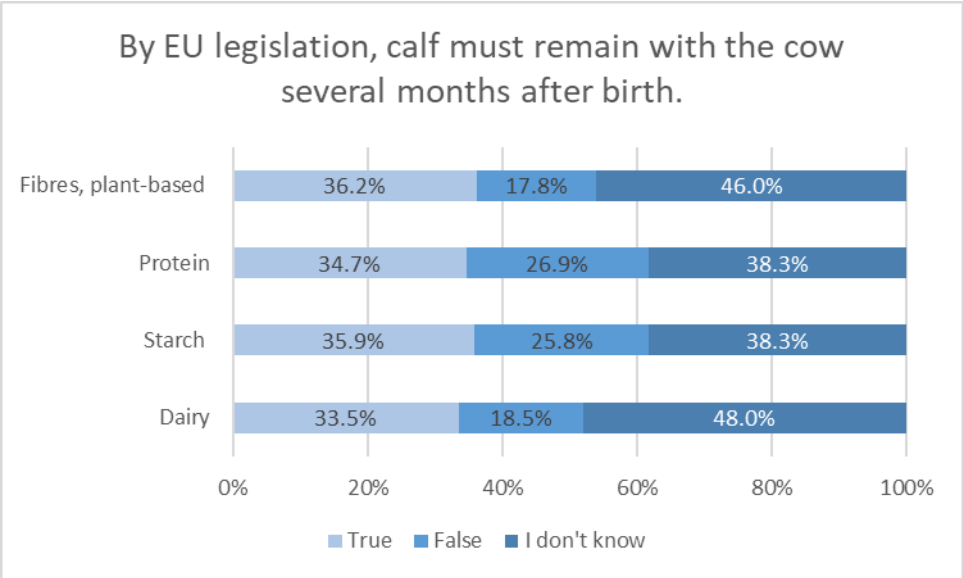

Figure 23: Knowledge 5: By EU legislation, calf must remain with the cow several months after birth

Potential for change towards greater sustainability in the food system

LEVEL OF MOTIVATION FOR SUSTAINABILITY OF FOOD CONSUMPTION

The overall level of motivation of more sustainability in food consumption regarding environment, climate and animal welfare was in the total sample of this study was 2.54 which is between "I am maybe motivated" to "I am certainly motivated". The study reveals regional differences in the average levels of motivation for sustainable (i.e. environment, climate and animal welfare) food consumption (see Table 18). The Kruskall-Wallis test revealed that these differences were statistically significant. Consumers in Italy showed the highest scores, followed by consumers in France and Germany, whereas the scores were lower among consumers in Sweden and Romania. In all countries, however, the scores were univocally highest for animal welfare. In Germany and France, the level of motivation for environmentally friendly food consumption showed the second highest scores after animal welfare.

Table 18: Motivational level in single dimensions and in total in each study country (mean values)

	Country					
Scales	**DE**	**FR**	**IT**	**SE**	**RO**	**Total**
Motivational level for environmentally friendly consumption	2.56	2.66	**2.72**	2.50	2.31	2.56
Motivational level for climate friendly consumption	2.53	2.63	**2.74**	2.43	2.31	2.53
Motivational level for animal friendly consumption	2.72	2.74	**2.82**	**2.55**	2.56	2.53
Motivational level Total	2.62	2.69	**2.78**	2.22	2.37	2.54

The chi-square tests of the Kruskal-Wallis rank sums revealed that the differences observed between countries are significant (see Table 19).

Table 19: Chi-squares of rank sums of motivational level in single dimensions in each study country

	Motivational level for environmentally friendly consumption	Motivational level for climate friendly consumption	Motivational level for animal friendly consumption
Chi-Squares	80.386	87.276	546.015
df	4	4	4
Asymptotic significance	.000	.000	.000

Looking at the scores of the single dietary types, consumers in the "Fibres" type have the highest scores for all three scales, consumers in Protein type the second highest scores (expect for animal welfare), whereas consumers in the starch type show the lowest scores (see Table 20).

Comparing the scores of the single sustainability scales within the single dietary types, consumers belonging to the "Dairy" type show slightly higher scores for animal friendly consumption for the other motivational scales, whereas consumers belonging to the "Starch" type show slightly higher scores for environmentally friendly consumption for the other motivational scales. The scores for environmentally friendly and climate friendly food consumption are the same among the "Protein" and "Fibres" types.

Table 20: Motivational level in single dimensions and in total in each dietary type (mean values)

	Dietary type				
Scales	**1 Dairy**	**2 Starch**	**3 Protein**	**4 Fibres**	**Total**
Motivational level for environmentally friendly consumption	2.40	**2.44**	**2.52**	**2.81**	**2.56**
Motivational level for climate friendly consumption	2.37	2.39	**2.52**	**2.80**	2.53
Motivational level for animal friendly consumption	**2.47**	2.26	2.45	2.85	2.53
Motivational level Total	2.40	2.38	2.51	**2.83**	2.54

Items referring to motivational scales were measured on a four-point scale reaching from 1= I am not motivated at all to 4 = I am doing so already

The chi-square tests of the Kruskal-Wallis rank sums revealed that the differences in motivational levels observed between dietary types are significant (see Table 21).

Table 21: Chi-squares of rank sums of motivational level in single dimensions in each dietary type

	Motivational level for environmentally friendly consumption	Motivational level for climate friendly consumption	Motivational level for animal friendly consumption
Chi-Squares	91.960	100.333	151.478
df	3	3	3
Asymptotic significance	.000	.000	.000

CONSUMER PERCEPTION OF RESPONSIBILITY OF DIFFERENT ACTORS TO FOSTER SUSTAINABILITY IN THE FOOD SYSTEM

Although the survey respondents consider all listed actors in the food system as being responsible, policy makers are ascribed a special role in moving towards more sustainability, while consumers – according to the respondents – bear the lowest responsibility, apart from for the archetype "Fibers" which is undoubtedly the most committed group (see Table 22).

Table 22: Consumer perception of responsibility of different actors to foster sustainability in the food system by dietary type

	Dietary type				
	1	**2**	**3**	**4**	
	Dairy	**Starch**	**Protein**	**Fibres**	**Total**
Consumers (e.g. by making responsible food choices and paying higher prices, etc.)	3.34	3.33	3.25	3.62	3.39
Retailers/distributors/shop owners	3.66	3.66	3.45	3.80	3.63
Farmers	3.90	**3.91**	3.64	4.04	3.86
Policy makers	**4.00**	**3.91**	**3.68**	**4.23**	**3.94**

The chi-square tests of the Kruskal-Wallis rank sums revealed that the differences in the evaluation of the role of different actors between countries are significant (see Table 23).

Table 23: Chi-squares of rank sums of evaluation of role of different actors in different dietary types

	Consumers	Retailers/distributors/ shop owners	Farmers	Policy makers
Chi-Squares	14.045	38.142	19.106	13.054
df	4	4	4	4
Asymptotic significance	.007	.000	.001	.011

Similarly, the policy makers were ascribed the highest responsibly by the respondents in all countries except by consumers in Sweden. The latter ascribed farmers the highest and policy makers the second highest responsibility. The responsibility of farmers according to the survey participants, is also very high and very close to policy makers.

In all countries, the consumers were ascribed the lowest responsibility by the survey respondents (see Table 24).

Table 24: Consumer perception of responsibility of different actors to foster sustainability in the food system by country

	Country					
	DE	**FR**	**IT**	**SE**	**RO**	**Total**
Consumers (e.g. by making responsible food choices and paying higher prices, etc.)	3.52	3.35	3.33	3.40	3.32	3.39
Retailers/distributors/shop owners	3.57	3.75	3.50	3.54	3.80	3.63
Farmers	3.84	3.78	3.81	**3.98**	3.88	3.86
Policy makers	**3.86**	**3.95**	**3.93**	3.87	**4.11**	**3.94**

The chi-square tests of the Kruskal-Wallis rank sums revealed that the differences in the evaluation of the role of different actors between countries are significant (see Table 25).

Table 25: Chi-squares of rank sums of evaluation of role of different actors in different countries

	Consumers	Retailers/distributors/shop owners	Farmers	Policy makers
Chi-Squares	54.333	41.471	59.769	98.585
df	3	3	3	3
Asymptotic significance	.000	.000	.000	.000

ACCEPTANCE OF INTERVENTIONS AND POLICIES TO FOSTER SUSTAINABILITY IN THE FOOD SYSTEM

Consumer acceptance of interventions to achieve greater sustainability in livestock production and consumption is higher for pull rather than push mechanisms, as the study results clearly show, and for those that do not require consumers to act themselves. The relatively high scores for sustainability labelling indicate that consumers need more guidance on sustainability in their food choices at the point of sale.

There were only small differences in the ranking of interventions when comparing diet types. Imposing taxes or paying compensation for unsustainably produced food is the least accepted, while financial incentives for sustainable food choices are clearly the most accepted by consumers across all diet types. However, the scores were generally higher among Fibres consumers than among other diet types (see Table 26).

The chi-square tests of the Kruskal-Wallis rank sums revealed that the differences in the evaluation of the policies related to meat and other animal product consumption between dietary types are significant (see Table 27).

Table 27

Table 26: Acceptance of interventions related to sustainable food consumption single consumer types

	Dietary type				
	1	2	3	4	
	Dairy	**Starch**	**Protein**	**Fibres**	**Total**
Labelling of sustainable products (traffic light)	3.72	3.81	3.63	4.00	3.78
Release concrete instructions for sustainable food choices and communicated to	3.60	3.63	3.52	3.93	3.67
Labelling of benefits of sustainable foods.	3.75	3.80	3.57	4.01	3.77
Financial incentives for sustainable food choices (e.g. VAT reduction for sustainable alternatives).	**3.82**	**3.86**	**3.60**	**4.05**	**3.82**
Impose taxes/monetary compensation for unsustainable products.	3.03	3.12	3.20	3.38	3.19
The introduction of binding agricultural regulations to promote greater sustainability in the food system.	3.49	3.60	3.53	3.86	3.62

Table 27: Chi-squares of rank sums of evaluation of role of different actors in different dietary types

	Chi-Squares	df	Asymptotic significance
Labelling of sustainable products	54.457	3	0.000
Release concrete instructions for sustainable food choices	65.999	3	0.000
Labelling of benefits of sustainable foods	67.804	3	0.000
Financial incentives for sustainable food choices	68.218	3	0.000
Impose taxes/monetary compensation for unsustainable products	29.271	3	0.000
The introduction of binding agricultural regulations to promote greater sustainability	53.465	3	0.000

Consumers' acceptance of interventions to improve sustainability differs between countries. Consumers in Germany, Italy and Romania show the highest level of acceptance for financial incentives, while consumers in France are more in favour and consumers in Sweden slightly more in favour of labelling of both sustainable products and sustainability benefits than other interventions. Only in the latter countries are the interventions ranked similarly, while in every other country the ranking of the interventions was different from the other countries. However, the imposition of taxes/monetary compensation for unsustainable products and binding agricultural regulations to promote greater sustainability in the food system received rather low levels of acceptance by consumers in all countries (see Table 29).

Table 28: Acceptance of interventions related to sustainable food consumption in single countries

	Country					
	DE	**FR**	**IT**	**SE**	**RO**	**Total**
Labelling of sustainable products (traffic light)	3.74	**3.81**	3.73	**4.01**	3.64	3.78
Release concrete instructions for sustainable food choices and communicated to	3.37	3.65	3.84	3.87	3.62	3.67
Labelling of benefits of sustainable foods.	3.77	3.79	3.74	3.91	3.65	3.77
Financial incentives for sustainable food choices (e.g. VAT reduction for sustainable alternatives).	**3.78**	3.68	**3.89**	**4.00**	**3.74**	**3.82**
Impose taxes/monetary compensation for unsustainable products.	3.18	3.15	3.32	3.27	3.05	3.19
The introduction of binding agricultural regulations to promote greater sustainability in the food system.	3.63	3.34	3.77	3.81	3.55	3.62

The chi-square tests of the Kruskal-Wallis rank sums revealed that the differences in the evaluation of the different interventions to foster greater sustainability between countries are significant (see Table 29).

Table 29: Chi-squares of rank sums of evaluation of role of different actors in different countries

	Chi-Squares	df	Asymptotic significance
Labelling of sustainable products	41.145	4	0
Release concrete instructions for sustainable food choices	68.498	4	0
Labelling of benefits of sustainable foods	22.468	4	0
Financial incentives for sustainable food choices	30.815	4	0
Impose taxes/monetary compensation for unsustainable products	16.842	4	0.002
The introduction of binding agricultural regulations to promote greater sustainability	70.844	4	0

More diversity was found regarding the acceptance of future policies to improve the sustainability in the livestock sector, whereas a "Shift to consumption of locally produced meat (and other animal-based products)" and a "Shift to consumption of meat (and other animal-based products) from animal friendly production systems" where the policies with the highest acceptance among consumers.

In contrast to other consumer archetypes, consumers in the **Protein and Dairy** archetypes are in favour of "more artificial lab-grown meat as an alternative to meat. However, even for these groups it is the least preferred option. Typical among consumers of the starch archetype is their high acceptance of "Significant reduction of meat (and other animal-based products) consumption" and for "Shift to consumption of meat (and other animal-based products) from animal friendly production systems". Also, their support of the policy "More meat and other animal-based products from organic production" is relatively high (see

Table 30).

Table 30: Acceptance of policies related to sustainable food consumption in different consumer dietary types

	Dietary type				
	1	2	3	4	
	Dairy	**Starch**	**Protein**	**Fibres**	**Total**
Continued meat (and other animal-based products) consumption: Meat consumption patterns cannot and should not be moderated.	3.23	3.29	3.22	2.84	3.13
More efficient meat (and other animal-based products) production through improved production systems.	3.69	3.68	3.52	3.64	3.62
More artificial lab-grown meat as an alternative to meat.	2.24	2.16	**2.65**	2.33	2.38
More protein-rich foods from plants and algae as an alternative to meat (and other animal based-products).	3.03	3.09	3.25	3.52	3.24
Shift to consumption of locally produced meat (and other animal-based products).	3.78	**3.87**	3.61	**3.90**	**3.78**
Significant reduction of meat (and other animal-based products) consumption.	**2.99**	3.00	3.20	3.55	3.21
Shift to consumption of meat (and other animal-based products) from animal friendly production systems.	3.80	**3.87**	3.62	3.92	**3.79**
More meat and other animal-based products from organic production.	3.60	3.72	3.52	3.74	3.63

Table 31: Chi-squares of rank sums of evaluation of role of different actors in different dietary types

	Chi-Squares	df	Asymptotic significance
Continued meat (and other animal-based products) consumption: Meat consumption	62.636	3	0.000
More efficient meat (and other animal-based products) production through improved production techniques	15.483	3	0.001
More artificial lab-grown meat as an alternative to meat	62.528	3	0.000
More protein-rich foods from plants and algae as an alternative to meat and other animal-based products	66.925	3	0.000
Shift to consumption of locally produced meat (and other animal-based products)	44.950	3	0.000
Significant reduction of meat (and other animal-based products) consumption	96.620	3	0.000
Shift to consumption of meat (and other animal-based products) from animal friendly production systems	44.245	3	0.000
More meat and other animal-based products from organic production.	22.613	3	0.000

Regarding potential future sustainability policies related to animal-based food, a shift towards higher animal welfare scored highest among consumers in Germany, France and Italy. A shift towards local food systems scored highest among consumers in Sweden and Romania. In contrast, a shift towards more artificial lab-grown meat or a shift towards more plant-based protein products was least accepted by consumers in all countries (see Table 32). The differences regarding the acceptance of different policies related to sustainable animal product consumption were statistically significant (see Table 33

Table 30).

Table 32: Acceptance of policies related to sustainable food consumption in different countries

	Country					
	DE	**FR**	**IT**	**SE**	**RO**	**Total**
Continued meat (and other animal-based products) consumption: Meat consumption patterns cannot and should not be moderated.	2.97	3.09	3.15	3.31	3.17	3.13
More efficient meat (and other animal-based products) production through improved production systems.	3.55	3.55	3.65	3.79	3.57	3.62
More artificial lab-grown meat as an alternative to meat.	2.30	2.16	2.67	2.04	2.72	2.38
More protein-rich foods from plants and algae as an alternative to meat (and other animal based-products).	3.16	3.26	3.29	3.15	3.35	3.24
Shift to consumption of locally produced meat (and other animal-based products).	3.69	3.82	3.72	**3.96**	**3.70**	**3.78**
Significant reduction of meat (and other animal-based products) consumption.	3.23	3.29	3.42	2.96	3.12	3.21
Shift to consumption of meat (and other animal-based products) from animal friendly production systems.	**3.74**	**3.85**	**3.83**	3.93	3.58	**3.79**
More meat and other animal-based products from organic production.	3.61	3.54	3.63	3.82	3.58	3.63

Table 33: Chi-squares of rank sums of evaluation of role of different actors in different countries

	Chi-Squares	df	Asymptotic significance
Continued meat (and other animal-based products) consumption: Meat consumption	23.902	4	0.000
More efficient meat (and other animal-based products) production through improved production techniques	18.632	4	0.001
More artificial lab-grown meat as an alternative to meat	114.654	4	0.000
More protein-rich foods from plants and algae as an alternative to meat and other animal-based products	12.360	4	0.015
Shift to consumption of locally produced meat (and other animal-based products)	31.185	4	0.000
Significant reduction of meat (and other animal-based products) consumption	47.086	4	0.000
Shift to consumption of meat (and other animal-based products) from animal friendly production systems	40.149	4	0.000
More meat and other animal-based products from organic production.	19.503	4	0.001

POTENTIAL AND WILLINGNESS TO PAY FOR INNOVATIONS IN LIVESTOCK PRODUCTION – RESULTS FROM CONSUMER CHOICE EXPERIMENTS

Consumer preferences regarding sustainability innovations in the dairy sector

The random parameter logit models for the milk (1 litre of cow milk) choice experiment were estimated separately for each country. The models for the milk choice scenarios show that all parameters representing sustainability innovations or improvements (organic) were significant in all countries, except for the parameter estimated for biogas production, which was not significant in the models estimated for the data from Germany, France and Italy. In Romania, the parameter was significant but with a negative sign, indicating that the choice of a milk option in the choice experiment was less likely in the presence of this attribute, while in the countries mentioned above the attribute was rather irrelevant. In contrast, the parameter estimated for this attribute was significant and with a positive sign in Sweden. The price parameter was negative and significant, implying that the higher the price level of a choice option, the lower the probability of choosing that option in the choice experiment.

The standard deviations of the parameters indicate if consumers in the single countries differed in their preferences, which is the case when the parameters estimated for the standard deviations are significant. The standard deviations were significant for "organic" in all countries, suggesting that sample differences exist regarding this attribute. The similar applied to the parameter of the standard deviations estimated for "price", showing that the consumers differed regarding their price sensitivity. Regarding the other attributes, country differences were found. For instance, the standard deviations for "Pasture-based dairy cows with calf rearing" were significant in Germany, France and Italy, but non-significant in Romania. For all countries, the standard deviations were non-significant for "pasture-based dairy cows", suggesting that within all countries, consumers univocally preferred this product options with this attribute.

The multicollinearity that was found for origin and no choice suggests that any time an option showed the origin "produced and processed in the EU outside the country", a very high share of consumers rejected the options completely and chose the no choice option or the other option offered in the choice experiment, revealing the strong rejection of milk being produced and processed in other places than the own country or region.

Table 34

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cows with calf rearing" were significant in Germany, France and Italy, but non-significant in Romania. For all countries, the standard deviations were non-significant for "pasture-based dairy cows", suggesting that within all countries, consumers univocally preferred this product options with this attribute.

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Table 34: Random parameter logit model for 1 litre of milk based on relative price levels

Parameters	**DE**	**FR**	**IT**	**RO**	**SE**[1]
Pasture-based dairy cows	.51983***	.44218***	.33758***	.41540***	.44148***
Pasture-based dairy cows with calf rearing	.65341***	.60734***	.40756***	.53391***	.43677***
biogas production	0.01	0.02	0.04	-.15589***	.12393**
reduction of water pollution	.23062***	.45555***	.26952***	.17979***	.23706***
Organic	.28744***	.35627***	.28499***	.22666***	.26406***
Mountain Biodiversity	.32221***	.29686***	.22473***	.25889***	.17872***
domestic	17.23	17.17	17.20	17.2651	17.1715
local	17.22	17.12	17.15	17.2399	17.1191
Price	-.64515***	-.71074***	-.36359***	-.36166***	-.33367***
No choice	35.98	35.84	35.84	35.9027	35.8832
Standard deviations					
Pasture-based dairy cows	0.01	0.27	0.01	0.00651	.62540***
Pasture-based dairy cows with calf rearing	46249***	.69263***	0.06	0.30648	0.30046
biogas production	0.31	1.05963***	.72803***	.86372***	0.36223
reduction of water pollution	4354.00	0.06	0.01	0.07583	0.05067
Organic	54963***	.64798***	.49060***	.56857***	.56007***
Mountain Biodiversity	.42905***	0.23	0.20	.26922*	.58052***
domestic	0.00[2]	0.00[2]	0.00[2]	0.00[2]	0.00[2]
local	0.00[2]	0.00[2]	0.00[2]	0.00[2]	0.00[2]
Price	.64515***	.71074***	.36359***	.36166***	33367***
No choice	0.00[2]	0.00[2]	0.00[2]	0.00[2]	0.00[2]

***, **, * ==> Significance at 1%, 5%, 10% level

[1] Country-specific differences: 1 kg of minced meat from dairy system with meat-production, differing attribute levels for improved animal welfare: 2. On-farm slaughter instead of "pasture-based dairy cows"; due to these differences, there is no comparability with other countries

The willingness-to-pay values were estimated by the Random Parameter Logit models for each country separately, presented in Table 35, are based on the relative price levels. For the interpretation of these results, it is relevant to take into consideration that willingness-to-pay values derived from stated preference data are context-specific and therefore might differ in real markets. Still, the values indicate the relative importance of the single innovations both within and between countries. In all countries, consumers rated the sustainability innovations related to animal welfare higher than the other sustainability innovations, whereas the innovation "pasture-based dairy cows with calf rearing" had the highest willingness to pay scores in all countries (see Table 35 and Table 36). The values related to mountain biodiversity are relatively low.

Table 35: Willingness to pay for sustainability innovations in the dairy sector, tested on 1 litre of milk, based on relative price levels

Sustainability innovations	DE	FR	IT	RO	SE*[1]
Pasture-based dairy cows	0.81	0.62	0.93	1.15	1.32
Pasture-based dairy cows with calf rearing	1.01	0.85	1.12	1.48	1.31
Biogas production	x	x	x	-0.43	0.37
Reduction of water pollution	0.36	0.64	0.74	0.50	0.71
Organic	0.45	0.50	0.78	0.63	0.79
Mountain Biodiversity	0.50	0.42	0.62	0.72	0.54

x= non-significant, no WTP estimate to be derived from non-significant parameters

* Country-specific differences: 1 kg of minced meat from dairy system with meat-production, differing attribute levels for improved animal welfare: 2. On-farm slaughter instead of "pasture-based dairy cows"; due to these differences, there is no comparability with other countries

Looking at the willingness to pay in the single consumer types, the willingness to pay more for "pasture-based dairy cows" is highest among consumers in the Dairy type, closely followed by consumers in the Fibers type. For "Pasture-based dairy cows with calf rearing" the relative willingness was similar across all dietary types. Same applies to "Reduction of water pollution" and "Biogas production", whereas the latter had the lowest willingness to pay scores. Interestingly, the willingness to pay scores were relatively low in all country and only about half as high as the ones estimated for "pasture-based dairy cows" and for "Pasture-based dairy cows with calf rearing", although products produced in organic production systems provide a large range of sustainability improvements, such as reduction of water pollution, maintaining biodiversity, higher animal welfare standards, etc. (see Table 37).

However, since the context of making choices for 1 litre of fresh milk is very country-specific, data pooling across countries does not provide robust results. Therefore, the results of the choice experiment comparing different dietary types can only show tendencies and should be treated with caution.

Table 36: Willingness to pay for sustainability innovations in the dairy sector, tested on 1 litre of milk, based on market price levels in respective currencies

Sustainability innovations	DE in EUR	FR in EUR	IT * in EUR	RO in Lei	SE*[1] in SEK
Pasture-based dairy cows	2.77	1.93	2	43.52	1
Pasture-based dairy cows with calf rearing	3.26	2.02	1	53.89	2
biogas production	x	x	x	x	x
reduction of water pollution	1.11	1.38	4	18.65	5
Organic	1.68	1.05	3	25.91	3
Mountain Biodiversity	1.61	1.10	5	27.98	4

*Ranking provided since price parameter was non-significant

x= non-significant, no WTP estimate to be derived from non-significant parameters

[1] Country-specific differences: 1 kg of minced meat from dairy system with meat-production, differing attribute levels for improved animal welfare: 2. On-farm slaughter instead of "pasture-based dairy cows"; due to these differences, there is no comparability with other countries

Table 37: Willingness to pay for sustainability innovations in the dairy sector, tested on 1 litre of milk, in the single dietary types based on relative price levels

Sustainability innovations	Dietary type 1 Dairy	2 Starch	3 Protein	4 Fibres	Total
Pasture-based dairy cows	1.58	1.41	1.45	1.53	1.51
Pasture-based dairy cows with calf rearing	1.47	1.47	1.46	1.47	1.47
biogas production	0.41	0.41	0.40	0.40	0.41
reduction of water pollution	0.77	0.77	0.77	0.77	0.77
Organic	0.89	0.85	0.84	0.86	0.86
Mountain Biodiversity	0.65	0.56	0.59	0.61	0.61

Consumer preferences regarding sustainability innovations in the pork sector

The random parameter logit models for the ham (200g of cooked ham) choice experiment were estimated for each country separately (see Table 38). These random parameter logit models show that all parameters representing sustainability innovations or improvements (organic), and interestingly and in contrast to the milk scenarios, also the parameters estimated for "biogas production using manure" were significant and show a positive sign in all countries, showing that the likelihood of choosing an option increased in the presence of any of the sustainability innovations/improvements included in the choice experiment. The price parameter was negative and significant, implying that the higher the price level in a choice option, the lower was the probability. The willingness to pay for "food waste-based feeding" was relatively high.

Same as for milk, the standard deviations estimated on the data of the ham choice experiments were significant for "organic" in all countries, suggesting that sample differences exist regarding this attribute. The similar applied to the parameter of the standard deviations estimated for "price", showing that the consumers differed regarding their price sensitivity. For the other attributes, most of the parameters of standard deviations are not significant, except for those for "More space and designed indoor and outdoor areas" in Germany and for "Food waste-based feeding" in Italy and Romania.

The multicollinearity found for origin and no choice in the choice experiment for ham suggests that whenever an option indicated the origin "produced and processed in the EU outside the country", a very high proportion of consumers rejected the options altogether and chose the no choice option or the other ham option offered in the choice experiment, revealing the strong rejection of ham produced and processed in places other than consumers' own country or region (see Table 38).

The willingness-to-pay values estimated by the Random Parameter Logit models for each country separately based on the relative price levels and real market price levels showed that in all countries, consumers rated the sustainability innovations related to animal welfare higher than the other sustainability innovations, whereas the innovation "Free range with mobile housing" had the highest willingness to pay scores in all countries. Same as for milk, the innovation "biogas production on farm" had the lowest willingness to pay (see Table 39 and Table 40).

Table 38: Random parameter logit model for 200 g of cooked ham based on relative price levels

Parameters	DE	FR	IT	RO	SE
More space and designed indoor and outdoor area	.53012***	.46297***	.31255***	.39005***	.39244***
Free range with mobile housing	.64186***	.61544***	.37475**	.63066***	.41802***
biogas production	.28259***	.27713***	.20299***	.17766***	.27080***
food waste-based feeding	.24007***	.18286***	.16269***	.13260***	.31729***
Organic	.48410***	.35016***	.29943***	.24596***	26811***
domestic	17.01	17.20	16.87	17.2399	17.2157
local	17.07	17.07	16.81	17.1291	17.137
Price	-.60329***	-.41134***	-.36690***	-.06742*	-.26511***
No choice	35.87	35.86	34.96	35.9740	35.9136
Standard deviations					
More space and designed indoor and outdoor area	.59556***	0.09	0.08	0.00166	0.22718
Free range with mobile housing	0.28	0.02	0.03	0.08697	0.01473
biogas production	0.06	0.07	0.03	0.00087	0.00743
food waste-based feeding	0.08	0.18	0.401***	0.45***	0.03418
Organic	0.88***	0.78***	0.64***	0.76***	0.641***
domestic	0.00[2]	0.00[2]	0.00[2]	0.00[2]	0.00[2]
local	0.00[2]	0.00[2]	0.00[2]	0.00[2]	0.00[2]
Price	.60329***	.41134***	.36690***	.06742*	.26511***
No choice	0.00[2]	0.00[2]	0.00[2]	0.00[2]	0.00[2]

[1]country-specific attributes levels, parameters not comparable to other country results

[2]the parameters for origin and no choice could not be estimated due to multicollinearity that was found between the origin and the no choice option

***, **, * ==> Significance at 1%, 5%, 10% level

[1] Country-specific differences: 1 kg of minced meat from dairy system with meat-production, differing attribute levels for improved animal welfare: 2. On-farm slaughter instead of "pasture-based dairy cows"; due to these differences, there is no comparability with other countries

Table 39: Willingness to pay for 200 g of cooked based on relative price levels

Sustainability innovations	WTP DE	WTP FR	WTP IT	WTP RO	WTP SE
More space and designed indoor and outdoor area	0.88	1.13	0.85	5.79	1.48
Free range with mobile housing	1.06	1.50	1.02	9.35	1.58
Biogas production	0.47	0.67	0.55	2.64	1.02
Food waste-based feeding	0.40	0.44	0.44	1.97	1.20
Organic	0.80	0.85	0.82	3.65	1.01

Table 40: Willingness to pay for 200 g of cooked based on market price levels in respective currencies

Sustainability innovations	WTP DE in EUR	WTP FR in EUR	WTP IT in EUR	WTP RO in Lei	WTP SEK in SEK
More space and designed indoor and outdoor area	0.18	0.20	x	19.46	0.96
Free range with mobile housing	0.38	0.40	1.09	32.44	4.47
Biogas production	0.12	0.16	x	18.18	4.47
Food waste-based feeding	0.09	0.08	x	19.85	x
Organic	0.30	0.27	1.31	21.62	3.07

x= non-significant, no WTP estimate to be derived from non-significant parameters

Looking at the willingness to pay in the single consumer types, the willingness to pay more for "More space and designed indoor and outdoor area" is highest among consumers belonging to the "Protein" type, closely followed by consumers belonging to the "Dairy" type and lowest among consumers belonging to the "Starch" type. The same pattern holds for all the other attributes, except for "organic", where the willingness to pay is highest among consumers belonging to the "Fibers" type. As with milk, the willingness-to-pay values for organic were significantly lower than for individual attribute improvements, which is surprising given the range of sustainability added values that organic production fulfils (see Table 41).

Table 41: Willingness to pay for 200 g of cooked ham in the single dietary types based on relative price levels

	Dietary type				
	1	2	3	4	
Sustainability innovations	**Dairy**	**Starch**	**Protein**	**Fibres**	Total
More space and designed indoor and outdoor area	2.17	2.01	2.19	2.14	2.15
Free range with mobile housing	2.33	2.16	2.34	2.30	2.31
biogas production	1.51	1.40	1.52	1.49	1.49
food waste-based feeding	1.77	1.64	1.78	1.75	1.75
Organic	1.66	1.44	1.67	1.68	1.64

However, same as for the choice experiment for milk, the context of making choices for 200g of cooked ham is very country-specific, data pooling across countries does not provide robust results. Therefore, the results of the choice experiment comparing different dietary types can only show tendencies and should be treated with caution.

Synthesis and conclusions

Consumer archetypes

In this study, four dietary archetypes were identified on the basis of self-reported dietary patterns. In a second step, these dietary types were characterised by socio-demographic and psychological characteristics that show the position of consumers with regard to sustainability in the food system. To our knowledge, this detailed way of consumer profiling of consumers by means of dietary patterns, socio-demographic characteristics and psychological factors is unique and adds significant knowledge to the scientific debate about food system sustainability. Particularly through the detailed insights into the archetypes' attitudes towards sustainability in the food systems, their level of motivation to achieve higher sustainability in their food consumption – all factors that have been identified to be relevant determinants for sustainable choices – provides a comprehensive map of difference consumer mainstreams. Furthermore, by linking the archetypes and associated profiles with their perceived own role in moving towards more sustainability as compared to other actors in the food system, together with their acceptance of interventions and policies related to sustainability in the food system, the study provides knowledge that may serve as a decision-making basis for different actors in the food sector in implementing more sustainability in EU food system. The results of this study may, furthermore, support the identification of target group specific leverage transition pathways towards more sustainability particularly in the livestock sector by providing knowledge on their preferences and willingness to pay for selected sustainability innovations in the dairy and pork sector. Furthermore, the identified consumer archetypes, will be the starting point for an optimisation of diets in terms of nutrition supply and sustainability (reduction of climate impact) in WP 4.2 of this project.

Regional and cultural differences

The four consumer dietary types are represented in each study country although the shares vary between the different countries. The way of these variations reflects and underlines the country-specific context and eating cultures as referred to in (Loopstra, 2018; Rayner et al., 2008). While the share of the dietary type "Dairy" is particularly high in Sweden, the share of consumers belonging to the "Fibres" type is relatively high in Italy, a country with typically high shares of salads, fruits and vegetables in the diets.

Similarly, regional and cultural differences were identified in relation with level of motivation to achieve more sustainability in food consumption as well as in relation with the perceived role of different actors to achieve a greater sustainability in the food system, and with the acceptance of sustainability interventions and policies that are relevant for country-level agricultural policies, production and marketing. These differences are relevant to be taken into account in debates about future national policies.

Potential for transition

The results of this study suggest that there is a strong heterogeneity between the consumer archetypes when it comes to dietary patterns, level of motivation, attitudes and acceptance of interventions and policies to foster sustainability in the food system. Accordingly, the potential for transition towards more sustainability varies between the consumer archetypes.

POTENTIAL FOR CHANGE REGARDING DIETS

Shifts in dietary patterns towards more plant-based protein rich diets represent particularly relevant measures for consumers belonging to the **Protein** archetype, forming about 32% of the consumers in this study. Showing the highest share of animal-based protein intakes and plant-based proteins at the same time, the barrier for a shift towards higher intakes of plant-based products is potentially low since it could be easily performed by these consumers by decreasing frequencies and portion sizes of animal-based products and by increasing the frequency and portion size of the plant-based protein products at the same time. This strategy of reducing the overall share of animal-based products in diets is also promoted by DeBoer et al. (2014), who tested different meat reduction strategies and found that a focus that is too narrow is less promising because it can scare-off consumers. Instead, the strategies of promoting meat-free days and switching to smaller meat portions are more promising (de Boer et al., 2014). The rather medium level of motivation for more sustainability in food consumption within this consumer archetype suggests that the potential for change towards healthier and more sustainable diets needs to be induced by interventions, strategies and policies.

The animal product intake in the **Starch** and **Dairy** archetypes is moderate, and consumers in this group could decrease the intake of animal-based products and thus positively influence their health and the environmental impacts emerging from their diets. The relatively low levels of motivation for more sustainability in food consumption among consumers belonging to the two archetypes, however, suggest that the potential for change towards more sustainability by changing diets is rather low.

Finally, consumers in the **Fibres** archetype already show a high level of a healthy and sustainable diet and therefore, the potential for change expected from this consumer group is more related to supporting interventions and policies rather than from shifting the already mostly optimal diets.

POTENTIAL FOR CHANGE REGARDING PSYCHOLOGICAL FACTORS

The overall level of motivation of more sustainability in food consumption regarding environment, climate and animal welfare in the total sample of this study was moderate, and with a mean value of 2.54 corresponding to an average position between "I am maybe motivated" to "I am certainly motivated". Although the values are not directly comparable with the findings from DeBoer et al. (2014) due to

differences in reference of the motivational level (we asked about more sustainability related to environment, climate and animal welfare, whereas DeBoer et al looked at the motivational level regarding reducing levels of meat reduction for the sake of more environmental and climate friendly diets), the mean value we found is considerably higher than the one identified by DeBoer et al. (2014), who found that two third of the respondents were maybe motivated or not motivated and one third was certainly motivated or doing so already (having already reduced their meat consumption). However, the relatively higher average levels of consumer motivation in the European Union identified in our study are expected to be still too low to have a positive consumer-induced sustainability impact on the food systems in the near future. These results suggest that accompanying interventions, marketing strategies and policies are needed for achieving a greater impact on the sustainability in the food system.

As mentioned before, differences in motivational levels were identified between the consumer archetypes and in the way of how they evaluate the topic of food sustainability. Consumers in the **Protein** archetype show moderate levels of motivation, but same as consumers belonging to the archetype Starch, when looking at their attitudes towards sustainability in the food system, they show low interest in the topic and high level of agreement with statements that relativise or neglect the relevance of sustainability in the food systems. An example is the high levels of agreement of **Protein** consumers with the statement "The current level of sustainability in food production and consumption is sufficient. There is no need for increase.", which proves the limits regarding the potential willingness to change among consumers in this large, and therefore important consumer archetype. Another example is that those consumers show the highest level of agreement with the statement "The topic of sustainability in the context of food is over-rated", proofing the rather low involvement of this consumer archetype in sustainability.

Consumers in the **Fibres** archetype, mainly represented by female, show high levels of motivation, and positive attitudes and acceptance of interventions and policies to foster sustainability in food systems. And together with consumers in the **Dairy** type, these consumers also show the highest level of knowledge about agricultural regulations and practices. Furthermore, they are clearly in favour of receiving more information and practical instructions regarding sustainable food consumption and in supporting sustainability in the food system. This aligns with findings indicating women's stronger feelings of social responsibility towards the environment and their pro-social motivations for following vegetarian diets (Rosenfeld, 2020; Trocchia & Janda, 2003; Zelezny et al., 2000). Furthermore, gender differences extend beyond adoption rates of vegetarian diets to their maintenance over time. Rosenfeld (2020) found that women vegetarians are more socially motivated to adhere to their diets and less likely to deviate from them, highlighting the influence of social factors on dietary behavior among women. A study of Righi et al., 2023 indicates that women have diets with lower carbon footprint than men (Righi et al., 2023).

Consumers in the **Starch** archetype, particularly represented by male, in contrast, show the lowest levels of motivation and acceptance of interventions and policies to foster sustainability in food systems. This corresponds to findings of other studies. Men often exhibit self-enhancing values incongruent with pro-environmentalism, associated with environmentally detrimental behaviors like meat consumption and car

ownership (Dietz et al., 2002; Polk, 2004; Rozin et al., 2012). Their knowledge of agricultural regulations and practices is the lowest and they particularly expressed low levels of interest in the sustainability of food. In addition, they do not see need for sustainability improvements. Given the small household incomes in this consumer group, the stated willingness to pay for sustainability improvements (here we refer to the stated willingness to pay in the attitudes section and not to the willingness to pay for specific sustainability innovations as identified in the choice experiments) is rather low, also reflected by the high level of agreement with the statement "above all, food should be cheap". Interestingly, the claim for consumers in this group for "Food companies should provide consumers with detailed information on food sustainability" is much higher than among other consumer archetypes. Furthermore, typical for consumers in this group is their high level of doubt that food products with sustainability labels are truly more sustainable than other food products.

Consumers in the **Dairy** archetype show a rather low level of motivation for more sustainability in their food consumption. Furthermore, looking at their attitudes towards paying more for sustainability, consumers in this archetype have the overall lowest stated willingness to pay more for higher sustainability of food and are the most price sensitive of the consumer archetypes. They particularly agree with the statements "When buying food, I always look for the cheapest options." The relatively low stated willingness to pay for sustainability improvements could at least partly be explained by the rather moderate level of income in this consumer archetype.

These psychological profiles of the different consumer archetypes related to food sustainability underline the lacking willingness to change, particularly when these changes come along with higher consumer costs. This conclusion is underlined by the finding that across all consumer archetypes and countries, consumers perceive their own role in changing the system lower than those of other actors, such as farmers, marketers/distributors and policy makers. Our findings therefore confirm that consumers might not be the starting point of sustainable food system change-making. Since consumers perceived their own role in changing the system lower than those of other actors, a significant change of this actor group should be expected, although some of the consumer archetypes indeed show a medium or high level of motivation and involvement to improve the sustainability in their food consumption. This finding, however, does not limit their important role in a food system change towards greater sustainability.

Furthermore, the results confirm that the ecological impact of diet is not well understood by consumers as identified in the knowledge section of the survey. In parallel with our findings, studies from the UK, Australia, and Portugal justified this belief system further by finding that many people do not want to reduce meat consumption because they believe meat is necessary, healthy, and pleasurable, or that the responsibility to shift the food system should not be in the hands of the consumer (Graça et al., 2015; Macdiarmid et al., 2016; Malek & Umberger, 2023).

SUPPORT OF FUTURE INTERVENTIONS AND POLICIES

Among the interventions to promote more sustainability in the food system, consumers' acceptance is highest for financial incentives for sustainable food choices (e.g. VAT reduction for sustainable alternatives) recommended, followed by labelling of sustainable products (traffic light), whereas imposing taxes/monetary compensation for unsustainable products had the lowest level of acceptance in all four consumer archetypes. This result suggests that structural changes towards financial incentivisation of sustainable food choices in the food environment and particularly at the point of sale, e.g. by introducing payback systems for sustainable food choices, might be welcomed by consumers.

More diversity was found regarding the acceptance of future policies to improve the sustainability in the livestock sector, whereas a "Shift to consumption of locally produced meat (and other animal-based products)" and a "Shift to consumption of meat (and other animal-based products) from animal friendly production systems" were the policies with the highest acceptance among consumers. In contrast to other consumer archetypes, consumers in the **Protein** and **Dairy** archetypes are in favour of "more artificial lab-grown meat as an alternative to meat. Typical among consumers of the **Starch** archetype is their high acceptance of "Significant reduction of meat (and other animal-based products) consumption" and for "Shift to consumption of meat (and other animal-based products) from animal friendly production systems". Also, their support of the policy "More meat and other animal-based products from organic production" is relatively high. In general, information and financial incentives for sustainable food choices (e.g. VAT reduction for sustainable alternatives) have the highest acceptance. These conclusions are confirmed by previous findings pointing out the role of nudging in fostering sustainable consumption (Vigors, 2018).

POTENTIAL OF AND WILLINGNESS TO PAY FOR SUSTAINABILITY INNOVATIONS IN THE DAIRY AND PORK SECTOR

The choice experiments on dairy revealed a strong preference for sustainability innovations related to animal welfare, whereas the innovation "pasture-based dairy cows with calf rearing" had the highest willingness to pay scores in all countries and consumer archetypes. The innovation "biogas production on farm" had the lowest willingness to pay. These results suggest that there is a market for this still very uncommon production system and that the additional costs that arise from the much lower milk yields in such production systems might be compensated by higher consumer prices. In Sweden, where the experimental setting differed, we found an almost equally strong preferences for "on-farm slaughtering" as for "pasture-based cow-calf systems".

Same as for milk, regarding cooked ham, consumers in all countries and of all consumer archetypes preferred the sustainability innovations in favour of higher to animal welfare more than the other sustainability innovations, whereas the innovation "Free range with mobile housing" had the highest willingness to pay scores in all countries. Same as for milk, the innovation "biogas production on farm" had the lowest willingness to pay, whereas stronger differences between consumer archetypes were identified

for pork than for dairy. The willingness to pay for "food waste-based feeding" war relatively high and represents an interesting innovation (a lot of biomass would be available) despite some sanitary issues.

Interestingly, the attribute "organic" showed relatively low willingness to pay values. This may have several reasons. The survey was tailored around diets, food sustainability and specific innovations in the livestock sector, whereas "organic" was almost not addressed. This might have led to biased the results in that "organic" was out of the radar, whereas consumers more focussed on the "newly" introduced innovations (although also the concept "organic was carefully introduced to the consumers, same as the other attributes employed in the choice experiment).

Looking at the willingness to pay in the single consumer types, the willingness to pay more for "More space and designed indoor and outdoor area" is highest among consumers in the **Protein** type, closely followed by consumers in the **Dairy** type and lowest in the **Starch** type. The same pattern applied for all other attributes except for "organic", where the willingness to pay was highest among consumers belonging the **Fibre**s type.

To conclude, when it comes to select between sustainability innovation in the livestock sector, consumers' willingness to pay is highest for animal welfare improvements.

Limitations of this research

LIMITED GENERALISABILITY OF COUNTRY RESULTS TO EUROPEAN CONTEXT

Although we intended to achieve a high level of coverage of the different regions in the European Union by defining case study countries representing the central, western, eastern and southern and northern regions, and having included Sweden as an additional case study country as country representing the northern regions in the European Union, the results of this research formally apply only to the study countries and the respective, country-specific consumption cultures, while the generalisability of these country-specific results to a European Union wide context is limited. This particularly applies for the pooled willingness to pay data from the choice experiments, that were collected in a country-specific context and therefore cannot show more than a rough tendency.

LIMITED RELIABILITY OF DATA OBTAINED ON DIETARY PATTERNS AND LIMITATIONS REGARDING THE ARCHETYPES IDENTIFIED

After having conducted a review on existing survey tools to collect data on consumer dietary patterns, we decided to use a shortened version of a Food Frequency Questionnaire by focussing on a choice of relevant product groups and representative products. Additionally, to overcome the limitations of the method Food

Frequency Questionnaire, that focus only on frequencies, while excluding quantities of food intake, we asked for the average portion sizes consumed in the single product groups and key products. It should also be mentioned that, for the sake of the overall survey length, the survey part collecting information on consumers' dietary pattern was only built on a selection of products and categories whereas some categories, such as alcoholic beverages or plant-based dairy substitutes, were not covered, although this might have been very innovative and providing new insights for the food industry in particular. Other categories, namely ready-to-eat meals, although having been included in the survey, were removed in the data analysis section after careful reflexion. Despite the fact, that this product category is very relevant when looking at dietary patterns, it is also a very heterogenous group at the same time, and therefore limiting the explanatory power of this category.

This survey method has not been validated, and the comparability of our study results with results of other studies, based on different methods is limited. In additions, tools for self-reported food intake generally differ from actual food intake. Accordingly, the intake in grams per day per respondent we calculated from reported frequencies and portion sizes is likely to differ from the actual food intake of the respondents. One reason for this discrepancy is that the reported frequencies may be over- or underestimated. Another reason could be that some of the consumed products belonging to a product group were forgotten and therefore not reported under the respective product groups. Finally, reported portion sizes are likely to differ from actual portion sizes.

Given these methodological limitations, the daily intakes in grams for the key are only a rough estimate. This position is underlined by the comparison of our survey data with food intake statistics for individual countries, and particularly the ranking of individual countries. For example, we found that for total meat, the country with the highest intake is Romania with 173g/d, followed by Sweden with 147g/d. There is a significant difference between countries, which does not entirely reflect reality, as the ranking for total meat consumption was different, with France and Germany in the first two places, while Romania and Sweden were the last two of the five countries considered. For other products, on the other hand, the ranking was similar to that shown in the national statistics, as in the case of poultry.

In spite of these considerations, we conclude that the approach to identify major differences in food consumption patterns between consumers and countries and to identify consumers' dietary types from the data is worth the effort, given that the values for daily intakes in grams obtained from the survey are generally close to the values reported in the country statistics. Finally, the approach we have chosen is much more informative than simply asking consumers one or few single questions about their diet. However, given that all data are affected by this bias, the relative findings of the analysis are not or much less affected by this than statements based on absolute levels.

Finally, it should be stated that consumers are very heterogenous regarding their dietary patterns, psychological profiles, socio-demographic-characteristics, their willingness to pay and their acceptance of sustainability interventions and policies. The attempt to identify and map consumer mainstreams and describe them as archetypes as done in this research is only one out of various possibilities to identify and

characterise consumers. Same applies to the methods applied to pool the data. In this research, k-means cluster analysis was used, however, other statistical methods very likely would have resulted into different consumer archetypes/consumer mapping.

LIMITED TRANSFERABILITY OF WILLINGNESS-TO-PAY ESTIMATES OBTAINED FROM CHOICE EXPERIMENTS TO REAL MARKET CONDITIONS

The method choice experiment is a powerful and state-of-the-art tool to elicit the willingness to pay for product attributes and Random Parameter Logit models is an advanced method in the field of econometric research in that the model accounts for behavioural differences within samples (Hensher et al. 2015).

Still, the transferability of willingness-to-pay estimates to real market conditions is limited. The following aspects are responsible for this limitation: firstly, the consumer choices in a choice experiment are hypothetical choices with hypothetical expenditures that are likely to differ from consumer choices in real markets. Particularly the social desirability, often related with the topic of sustainable food consumption (Zhu et al., 2024), might have led to exaggerated willingness-to-pay estimates for the sustainability innovations. However, the ranking of sustainability innovations based on average willingness-to-pay provides valuable insights for farmers and marketers of dairy and pork products. This information highlights the potential of various sustainability innovations in the food market and serves as a robust indicator of the relative importance of individual product attributes examined in this research.

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Appendix

Survey questionnaire (English Version)

Pathways - Sustainable production and consumption of food

Welcome to our survey!

In this survey, we are looking at sustainable food production and consumption in Europe. The survey is part of the European Commission funded research project Pathways (https://pathways-project.com) and is organised by the Research Institute of Organic Agriculture (FiBL) in Switzerland.

The survey will take approximately 20 minutes to complete. Your participation is voluntary. If you are participating using your cell phone, please consider turning the screen horizontally for some questions, as this may make it easier to view some questions. It is possible to leave the survey and continue with it later.

The data will be completely anonymized and used exclusively for scientific purposes. You have the right to withdraw from this survey after completion. If you have any questions about the survey, please contact Hanna Stolz (hanna.stolz@fibl.org)

This survey complies with the rules of the international ICC / ESOMAR International Code Of Market And Social Research that can be downloaded using the following link: https://esomar.org/code-and-guidelines/icc-esomar-code

There are 76 questions in this survey.

Consumption habits

Please write your answer here:

The next part of the survey is about your food consumption habits with regard to 9 different food product groups. Regarding each product group, please think about your food consumption frequency during the past four weeks. How often do you estimate you have eaten the following products during the past four weeks? And second question, which quantities of each product, on average do you think you have eaten each time you consume it?

The default quantity for each product is set to zero. Please move the slider to select the average quantity for each product. If you have never consumed a product in the last 12 months, please confirm that the quantity was zero by clicking on the slider.

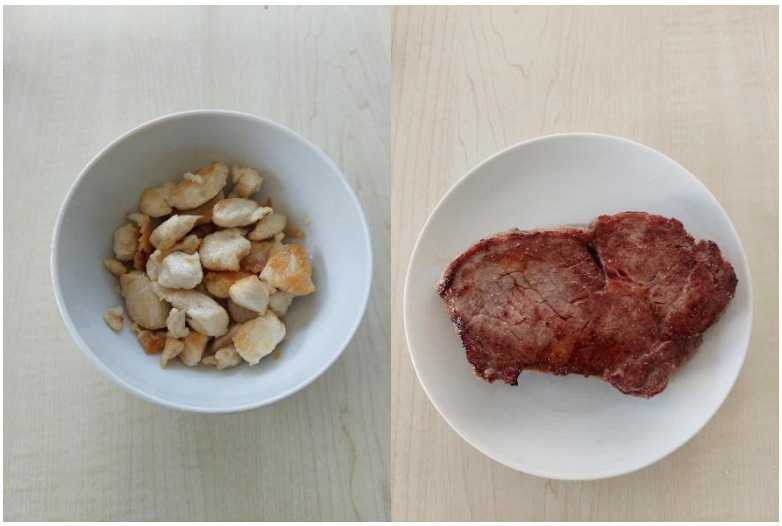
In order to estimate the average portion sizes, sample products with quantity data are available, which make it easier to estimate the consumed average quantities. Please note that the weight of some foods changes due to cooking or frying.

The first questions are related to unprocessed meat. How frequently did you consume meat (poultry, beef, veal, pork, lamb, etc.) (excluding sausages, etc.) during the past four weeks?
*

Please choose the appropriate response for each item:

	Four times a day and more	Two to three times a day	Once per day	Five to six times a week	Three to four times a week	Once or twice a week	One to three times a month	Less than once a month	Never (within the past 12 months)
Poultry meat									
Beef and/or veal									
Pork									
Meat from lamb, mutton, and/or goat									

What is the average portion of different meat (poultry, beef and/or veal pork, lamb, mutton and/or goat) in grams that you usually consume in the frequency of consumption you chose? Please select the average quantity. If you have never consumed a product in the last 12 months, please confirm that the quantity was zero by clicking on the slider.



Sliced chicken: 100g **Beef entrecote: 180g**
Diameter of bowl = 12 cm **Diameter of plate = 16 cm**
*

Only numbers may be entered in these fields.
Each answer must be between 0 and 400
Please write your answer(s) here:

- Poultry
- Beef and/or veal
- Pork
- Lamb, mutton and/or goat

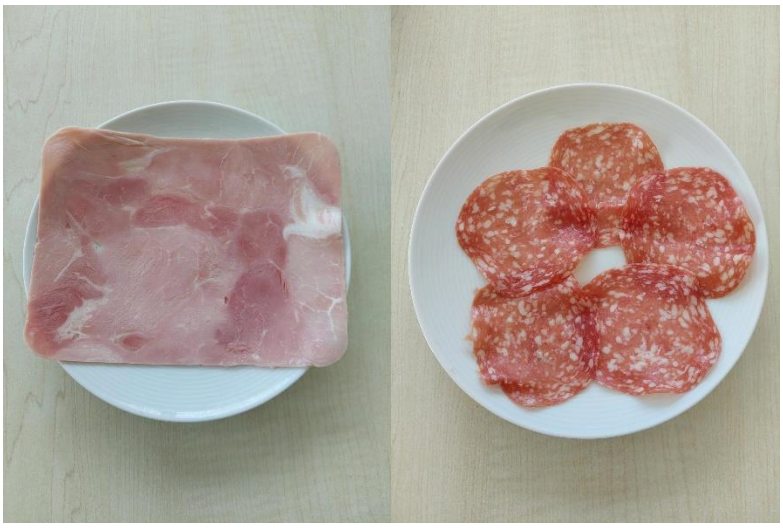
Processed meat: How frequently did you consume processed meat (sausage, bacon, ham, etc.) during the past four weeks?

*

Please choose the appropriate response for each item:

	Four times a day and more	Two to three times a day	Once per day	Five to six times a week	Three to four times a week	Once or twice a week	One to three times a month	Less than once a month	Never (within the past 12 months)
Processed meat									

Processed meat: What is the average portion of processed meat (sausage, bacon, ham, etc) in grams that you usually consume? Please select the average quantity.



Cooked ham: 32g **Salami: 12g**

*

Only numbers may be entered in these fields.

Each answer must be between 0 and 300

Please write your answer(s) here:

- Processed meat (sausages, bacon, ham, etc.)

How frequently did you consume eggs, milk, dairy products, fish and seafood during the past four weeks? *

Please choose the appropriate response for each item:

	Four times a day and more	Two to three times a day	Once per day	Five to six times a week	Three to four times a week	Once or twice a week	One to three times a month	Less than once a month	Never (within the past 12 months)
Eggs or egg dishes									
Cow milk									
Dairy products (butter, yogurt, cream, cheese, etc.)									
Fish and seafood									

Eggs and egg-based dishes: When consuming eggs, how many eggs do you usually consume? *

Choose one of the following answers

Please choose **only one** of the following:

- less than one egg
- one egg
- two eggs
- three eggs and more

Cow milk: What is the average portion of cow milk in ml that you usually consume? Please select the average quantity.

Milk: 100ml (~100g)

*

Only numbers may be entered in these fields.

Each answer must be between 0 and 500

Please write your answer(s) here:

- Cow milk

Dairy products: What is the average portion of different dairy products in grams that you usually consume? Please select the average quantity.

Butter: 30g

Cheese: 22g

Yogurt: 125g

*

Only numbers may be entered in these fields.
Each answer must be between 0 and 200
Please write your answer(s) here:

- Cheese
- Butter
- Yogurt, cream, cottage cheese, crème fraîche, sour cream

Fish and seafood: What is the average portion of fish and seafood in grams that you usually consume? Please select the average quantity.

Salmon: 130g

*

Only numbers may be entered in these fields.

Each answer must be between 0 and 400

Please write your answer(s) here:

- Fish and seafood

How frequently did you consume fruits and berries, salads and cooked vegetables during the past four weeks? *

Please choose the appropriate response for each item:

	Four times a day and more	Two to three times a day	Once per day	Five to six times a week	Three to four times a week	Once or twice a week	One to three times a month	Less than once a month	Never (within the past 12 months)
Fruits and berries									
Salads (raw vegetables, e.g. lettuce, carrots, cucumbers, etc.)									
Cooked vegetables (carrots, leek, spinach, mushroom, etc.), excluding potatoes									

Fruits and berries: What is the average portion of fruits and berries in grams that you usually consume? Please select the average quantity.

Apple: 200g

Strawberries: 100g

*

Only numbers may be entered in these fields.

Each answer must be between 0 and 300

Please write your answer(s) here:

- Fruits and berries

Salads (raw vegetables, e.g. lettuce, carrots, cucumbers, e.g.): What is the average portion of salads in grams that you usually consume? Please select the average quantity.

Mixed salad: 100g

*

Only numbers may be entered in these fields.

Each answer must be between 0 and 400

Please write your answer(s) here:

- Salads (raw vegetables, e.g. lettuce, carrots, cucumbers, e.g.)

Cooked vegetables: What is the average portion of cooked vegetables in grams that you usually consume? Please select the average quantity.

Cooked carrots: 100g

Green beans: 100g

*

Only numbers may be entered in these fields.

Each answer must be between 0 and 600

Please write your answer(s) here:

- Cooked vegetables

How frequently did you consume legumes, meat substitutes from grains or legumes and unsalted nuts during the past four weeks? *

Please choose the appropriate response for each item:

	Four times a day and more	Two to three times a day	Once per day	Five to six times a week	Three to four times a week	Once or twice a week	One to three times a month	Less than once a month	Never (within the past 12 months)
Legumes (peas, soy beans, lentils, lupines, etc.)									
Meat substitutes made from grains or legumes									
Unsalted nuts									

Legumes (peas, soy beans, lentils, lupines, etc.) and meat substitutes from legumes: What is the average portion of legumes (peas, soy beans, French beans, lentils, lupines, etc.) and meat substitutes from legumes in grams that you usually consume? Please select the average quantity.

Lentils: 100g **Peas: 100g**

*

Only numbers may be entered in these fields.

Each answer must be between 0 and 600

Please write your answer(s) here:

- Legumes (peas, soy beans, lentils, lupines, etc.)
- Meat substitutes from legumes or grains

Unsalted nuts: What is the average portion of unsalted nuts in grams (e.g. walnuts, hazelnuts, pecans, cashews) that you usually consume? Please select the average quantity.

Unsalted nuts: 30g

*****

Only numbers may be entered in these fields.

Each answer must be between 0 and 100

Please write your answer(s) here:

- Unsalted nuts

How frequently did you consume starch containing products, such as bread, pasta, rice, potatoes, etc. during the past four weeks? *

Please choose the appropriate response for each item:

	Four times a day and more	Two to three times a day	Once per day	Five to six times a week	Three to four times a week	Once or twice a week	One to three times a month	Less than once a month	Never (within the past 12 months)
Bread and bakery products									
Starch containing products (pasta, rice, potatoes, corn, etc.)									

Bread, bakery products, breakfast cereals: What is the average portion of bread, bakery products and/or breakfast cereals in grams that you usually consume? Please select the average quantity.

Bread roll: 55g

*

Only numbers may be entered in these fields.

Each answer must be between 0 and 300

Please write your answer(s) here:

- Bread and bakery products
- Breakfast cereals

Starch containing products (pasta, rice, potatoes, maize, etc.): What is the average portion of starch containing products in grams that you usually consume? Please select the average quantity.

Pasta: 100g

Rice: 100g

*

Only numbers may be entered in these fields.
Each answer must be between 0 and 600
Please write your answer(s) here:

- Starch containing products (pasta, rice, potatoes, maize, etc.)

How frequently did you consume snacks (crisps, salted nuts, etc`), sweets (chocolate, ice cream, cake, **fruit jellies, etc.)** and soft drinks **during the past four weeks?**

*

Please choose the appropriate response for each item:

	Four times a day and more	**Two to three times a day**	**Once per day**	**Five to six times a week**	**Three to four times a week**	**Once or twice a week**	**One to three times a month**	**Less than once a month**	**Never (within the past 12 months)**
Snacks									
Sweets									
Sweet drinks									

Snacks and sweets**: What is the average portion of** snacks and sweets **in grams during that you usually consume? Please select the average quantity.**

Crisps: 30g

Ice cream: 85g

*

Only numbers may be entered in these fields.
Each answer must be between 0 and 200
Please write your answer(s) here:

- Snacks and sweets

Drinks containing sugar (e.g. lemonade, fruit juice, ice tea, etc.): What is the average portion of drinks containing sugar in ml that you usually consume? Please select the average quantity.
100 ml (~100g)
*

Only numbers may be entered in these fields.
Each answer must be between 0 and 500
Please write your answer(s) here:

- Drinks containing sugar

How frequently did you consume ready-made meals (pizza, lasagne, asia noodle soups, etc.) during the past four weeks?

*

Please choose the appropriate response for each item:

	Four times a day and more	Two to three times a day	Once per day	Five to six times a week	Three to four times a week	Once or twice a week	One to three times a month	Less than once a month	Never (within the past 12 months)
Ready-made meals									

Ready-made meals: What is the average portion of ready-made meals that you usually consume? Please select the average quantity.

Pizza: 330g

*

Only numbers may be entered in these fields.

Each answer must be between 0 and 600

Please write your answer(s) here:

- Ready-made meals

Food supplements: Did you take food supplements during the past four weeks? *
Choose one of the following answers
Please choose **only one** of the following:

- No
- Yes

What kind of food supplements did you use? *
Only answer this question if the following conditions are met:
Answer was 'Yes' at question '27 [Q2191]' (Food supplements: Did you take food supplements during the past four weeks?)
Please write your answer here:
Cooking fat: What kind of fat did you most often use for frying, roasting, grilling etc? *
Choose one of the following answers
Please choose **only one** of the following:

- Butter
- Lard/dripping
- Vegetable oil
- Solid vegetable fat
- Margarine
- None

Which of the eating styles listed below do you most closely associate yourself with? *

Choose one of the following answers

Please choose **only one** of the following:

- Mixed diet: This diet consists of plant and animal products and includes all foods.
- Flexitarianism: This diet includes less meat and fish and is more plant-based, although meat and fish is consumed occasionally.
- Vegetarianism: This diet eliminates meat. Some vegetarian diets, however, include fish and/or eggs.
- Veganism: In the vegan diet, only plant foods are eaten: fruits and vegetables, grains, legumes, nuts, seeds and oils. Honey, eggs, milk and other products from animals are avoided.
- Paleo: The term Paleo stands for eating as in the Stone Age (Paleolithic). Accordingly, everything that our ancestors were able to fish, hunt, pick and collect is put on the plate. These are fruits and vegetables, berries, seeds and nuts, fish, meat and poultry, eggs, vegetable oils and honey. Sugar, coffee and alcohol are avoided, as well as grains, legumes, milk and dairy products, additives and processed foods - these were unknown at the time.
- Low Carb: has the goal of eating as few carbohydrate-rich foods as possible and replacing them with protein- and fat-rich products. The low-carb diet reduces carbohydrates. Mainly fish, meat, vegetables and dairy products are on the menu, while bread, cereal products and potatoes are rarely served. Many people rely on low carb to lose weight. There are several forms of low carb nutrition, respectively low carb diet. Keto is also one of them.

Level of motivation for sustainable food consumption
The following questions are related to environmental, climate and animal friendly food consumption. The first statements are related to environmentally friendly food consumption. Environmentally friendly means as little impact as possible on soil, water and air. Please indicate your level of motivation to comply with the following statements.
*

Please choose the appropriate response for each item:

	I am not motivated at all.	**I am maybe motivated.**	**I am certainly motivated.**	**I am doing so already.**
To harm the environment as little as possible through conscious food consumption.				
When shopping, choose food that is as environmentally friendly as possible.				
Accept inconveniences in order to consume products that are more environmentally friendly.				

The next questions are related to climate friendly food consumption. Climate-friendly means reducing, avoiding or offsetting greenhouse gas emissions through production/consumption. Please indicate your level of motivation to comply with the following statements.
*
Please choose the appropriate response for each item:

	I am not motivated at all.	**I am maybe motivated.**	**I am certainly motivated.**	**I am doing so already.**
To harm the climate as little as possible through conscious food consumption.				
When shopping, choose food that is as climate friendly as possible.				
Accept inconveniences in order to consume products that are more climate friendly.				

Attitudes towards sustainable food production and consumption
The following statements are about sustainable (regarding environment, climate and animal welfare) food production and consumption in general. How much do you agree or disagree with the following statements? Please answer spontaneously.
*
Please choose the appropriate response for each item:

	1 = I completely disagree	**2 = I rather disagree**	**3 = I neither agree nor disagree**	**4 = I rather agree**	**5 = I fully agree**
I would like to receive more information and practical tips on the sustainable consumption of food.					
Food companies should provide consumers with detailed information on food sustainability.					
More support should be given to animal friendly food systems.					

	1 = I completely disagree	2 = I rather disagree	3 = I neither agree nor disagree	4 = I rather agree	5 = I fully agree
More support should be given to environmentally friendly food systems.					
More support should be given to climate friendly food systems.					
More support should be given to the preservation of natural landscapes.					
More support should be given to reduce animal-based food production and consumption.					
I am willing to pay higher prices for higher farm animal welfare in food production					
I am willing to pay higher prices for climate friendly food production.					
I am willing to pay higher prices for environmentally friendly food production.					

The following statements are critical of sustainable (in terms of environment, climate and animal welfare) food production and consumption and food prices in general. To what extent do you agree or disagree with the following statements? Please answer spontaneously.
*
Please choose the appropriate response for each item:

	1 = I completely disagree	2 = I rather disagree	3 = I neither agree nor disagree	4 = I rather agree	5 = I fully agree
I am not interested in the sustainability of food.					
I already pay enough for other things.					
I doubt that food products with sustainability labels are truly more sustainable than other food products.					
I refuse to pay more for food sustainability.					
It is not my responsibility to increase sustainability of food systems by paying higher prices.					
Above all, food should be cheap.					
When buying food, I always look for the cheapest options.					
The topic of sustainability in the context of food is over-rated.					
It is my right to have a high level of sustainability of food and not something I should have to pay extra for.					
The current level of sustainability in food production and consumption is sufficient.There is no need to increase.					

Level of knowledge on livestock production practices

To what extent do you believe that the following statements on animal welfare, climate and environmental aspects of livestock production and sustainable food consumption are correct/incorrect? *

Please choose the appropriate response for each item:

	True	False	I don't know
By EU legislation, all farm animals in Europe have access to outdoor runs several times a year.			
Reducing a high level of animal product consumption significantly reduces negative impacts on human health.			
Reducing animal product consumption significantly reduces negative impacts on global warming.			
By EU legislation, all milk cows must be kept on pastures several months a year.			
By EU legislation, pig stables include bedding material.			
By EU legislation, calf must remain with the cow several months after birth.			
Keeping milk cows in mountain areas contributes to the preservation of cultural landscapes and biodiversity.			
Cattle, belonging to the group of ruminants, whose diet may be exclusively grass-based, are no food competitors to humans.			

The next questions are related to farm animal welfare. Animal welfare is a term for the health and well-being of animals, especially farm animals. Animal welfare includes the aspects of physical health, the ability of natural behaviours and the emotional well-being of the animals. Please indicate your level of motivation to comply with the following statements.
*****

Please choose the appropriate response for each item:

	I am not motivated at all.	**I am maybe motivated.**	**I am certainly motivated.**	**I am doing so already.**
To harm the farm animal welfare as little as possible through conscious food consumption.				
When shopping, choose food that is as animal friendly produced as possible.				
Accept inconveniences in order to consume products that are more animal friendly produced.				

What type of cow milk do you usually buy? *
Only answer this question if the following conditions are met:
Answer was NOT 'Never (within the past 12 months)' at question '7 [Q213]' (How frequently did you consume eggs, milk, dairy products, fish and seafood during the past four weeks? (Cow milk))
Choose one of the following answers
Please choose **only one** of the following:

- conventionally produced
- organically produced
- other

What is the average price per liter of the cow milk in euros that you usually buy? Please report the price without currency.
*****
Only answer this question if the following conditions are met:
Answer was NOT 'Never (within the past 12 months)' at question '7 [Q213]' (How frequently did you consume eggs, milk, dairy products, fish and seafood during the past four weeks? (Cow milk))
Only numbers may be entered in this field.
Please write your answer here:

-

What is the brand name of the milk you usually buy? *
Only answer this question if the following conditions are met:
Answer was NOT 'Never (within the past 12 months)' at question '7 [Q213]' (How frequently did you consume eggs, milk, dairy products, fish and seafood during the past four weeks? (Cow milk))
Please write your answer here:

What type of cooked ham do you usually buy? *

Only answer this question if the following conditions are met:
Answer was NOT 'Never (within the past 12 months)' at question '3 [Q211]' (The next part of the survey is about your food consumption habits with regard to 9 different food product groups. Regarding each product group, please think about your food consumption frequency during the past four weeks. How often do you estimate you have eaten the following products during the past four weeks? And second question, which quantities of each product, on average do you think you have eaten each time you consume it? The default quantity for each product is set to zero. Please move the slider to select the average quantity for each product. If you have never consumed a product in the last 12 months, please confirm that the quantity was zero by clicking on the slider. In order to estimate the average portion sizes, sample products with quantity data are available, which make it easier to estimate the consumed average quantities. Please note that the weight of some foods changes due to cooking or frying. The first questions are related to unprocessed meat. How frequently did you consume meat (poultry, beef, veal, pork, lamb, etc.) (exluding sausages, etc.) during the past four weeks? (Pork))
Choose one of the following answers
Please choose **only one** of the following:

- conventionally produced
- organically produced
- other

What is the average price of 200 g of cooked ham in euros that you usually buy? Please report the price without currency.
**

Only answer this question if the following conditions are met:
Answer was NOT 'Never (within the past 12 months)' at question '3 [Q211]' (The next part of the survey is about your food consumption habits with regard to 9 different food product groups. Regarding each product group, please think about your food consumption frequency during the past four weeks. How often do you estimate you have eaten the following products during the past four weeks? And second question, which quantities of each product, on average do you think you have eaten each time you consume it? The default quantity for each product is set to zero. Please move the slider to select the average quantity for each product. If you have never consumed a product in the last 12 months, please confirm that the quantity was zero by clicking on the slider. In order to estimate the average portion sizes, sample products with quantity data are available, which make it easier to estimate the consumed average quantities. Please note that the weight of some foods changes due to cooking or frying. The first questions are related to unprocessed meat. How frequently did you consume meat (poultry, beef, veal, pork, lamb, etc.) (exluding sausages, etc.) during the past four weeks? (Pork))
Only numbers may be entered in this field.
Please write your answer here:

What is the brand name of the cooked ham you usually buy? *
Only answer this question if the following conditions are met:
Answer was NOT 'Never (within the past 12 months)' at question '3 [Q211]' (The next part of the survey is about your food consumption habits with regard to 9 different food product groups. Regarding each product group, please think about your food consumption frequency during the past four weeks. How often do you estimate you have eaten the following products during the past four weeks? And second question, which quantities of each product, on average do you think you have eaten each time you consume it? The default quantity for each product is set to zero. Please move the slider to select the average quantity for each product. If you have never consumed a product in the last 12 months, please confirm that the quantity was zero by clicking on the slider. In order to estimate the average portion sizes, sample products with quantity data are available, which make it easier to estimate the consumed average quantities. Please note that the weight of some foods changes due to cooking or frying. The first questions are related to unprocessed meat. How frequently did you consume meat (poultry, beef, veal, pork, lamb, etc.) (exluding sausages, etc.) during the past four weeks? (Pork))
Please write your answer here:

Choice experiment on milk

The next section is about milk buying scenarios including different milk options with varying product attributes. Firstly, the milk attributes will be explained. Please read them carefully before continuing.
Production system
In the buying scenarios, milk from two different production systems will be included.

1. Milk from conventional production: access to outdoor is not mandatory. Accordingly, some dairy cows are kept in stalls. In addition, on some farms the dairy cows are kept in tethers throughout their lives without the possibility of movement.

2. Milk from organic production: According to the EU Regulation (EU) 2018/848 on organic production and labelling of organic products, organic milks cows need to have access to outdoor or pastures. Tethering or isolating of animals is prohibited aside from individual animals for a limited period of time and only for welfare, safety or veterinary reasons.

Increased animal welfare
In the buying scenarios, different measures to increase the animal welfare in milk production are included that go beyond organic standards.

1. Pasture-based dairy cows: during summer, the milk cows have access to pastures at least 26 days per month, while during winter, they have access to outdoor run at least 13 days per month.

2. Pasture-based dairy cows with calf rearing: On dairy farms, usually the separation between dairy cows and calves takes place within the first few hours after the birth of a calf. Afterwards, cow and calf are kept permanently separated from each other. The separation is practiced in both conventional and organic milk production. In the pastured-based dairy cow with calf rearing, the calf remains at least four months with cow, resulting in lower milk yields during this stage.

Reduction of climate and environmental impacts

In the buying scenarios, different measures to reduce greenhouse gas (GHG) emissions in milk production are in included

1. Reduction/compensation of GHG emissions through biogas production using manure: The production of cow's milk generates greenhouse gas emissions. These can be reduced/compensated for by various measures. One such measure is the production of biogas with cow dung on the farm. Agricultural biogas plants not only reduce climate-damaging emissions, but also produce renewable energy. Compared to conventional farmyard manure storage, biogas plants reduce considerable parts of the methane emissions that would otherwise be emitted uncontrollably into the atmosphere.
2. Reduction of water pollution through 100 percent of fodder from grassland: the milk cows are solely grass-fed, reducing high nitrogen accumulations in soils and water, resulting from feeding cows with concentrates.

Biodiversity

Pasture-based dairy system from nature conservation mountain area: the milk cows are kept in mountain regions and fed with grass from the area. Grazing of the cows contributes to the conservation of cultural landscape and biodiversity in the mountain area.

Geographical origin

In the buying scenario, the milk options vary regarding the geographical origin of production

1. Produced and processed in the EU outside the country
2. Produced and processed in the country, but outside the own region of residence
3. Locally produced and processed: produced within the own region of residence

Price

In the buying scenario, the milk options vary regarding the milk price per liter.

1. Price level: 1.40 €
2. Price level: 1.70 €
3. Price level: 2.05 €

Please choose one of the three cow milk options in each of the following six buying scenarios, namely the one which you would most likely choose in a real buying situation. There are no right or wrong choices.

Buying scenario 1 for one litre of fresh milk.
*
Only answer this question if the following conditions are met:
gleichung.NAOK == 1
Please choose the appropriate response for each item:

	Option 1	Option 2	
	Pasture-based dairy cows with calf rearing **Less water pollution** **Organic** **-** **Locally produced and processed** **1.40 €**	**-** **Biogas production** **Conventional** **Mountain cultural landscape and biodiversity** **Locally produced and processed** **1.40 €**	**The milk that I usually buy**

I choose this option:

Buying scenario 2 for one litre of fresh milk.
*
Only answer this question if the following conditions are met:
gleichung.NAOK == 1
Please choose the appropriate response for each item:

	Option 1	Option 2	
	Pasture-based dairy cows with calf rearing **Biogas production** **Conventional** **Mountain cultural landscape and biodiversity** **Locally produced and processed** **1.40 €**	**Pasture-based dairy cows** **-** **Organic** **-** **Locally produced and processed** **1.40 €**	**The milk that I usually buy**

I choose this option:

Buying scenario 3 for one litre of fresh milk.

*

Only answer this question if the following conditions are met:
gleichung.NAOK == 1
Please choose the appropriate response for each item:

	Option 1	Option 2	
	-	**Pasture-based dairy cows**	
	Biogas production	**-**	
	Conventional	**Organic**	**The milk that I usually buy**
	-	**Mountain cultural landscape and biodiversity**	
	Produced and processed in the EU	**Produced and processed in the EU**	
	1.70 €	**1.10 €**	
I choose this option:			

Buying scenario 4 for one litre of fresh milk.

*

Only answer this question if the following conditions are met:

gleichung.NAOK == 1

Please choose the appropriate response for each item:

	Option 1	Option 2	
	Pasture-based dairy cows	**Pasture-based dairy cows with calf rearing**	
	-	**-**	
	Biogas production	**Conventional**	**The milk that I usually buy**
	Organic	**Mountain cultural landscape and biodiversity**	
	-		
	Produced and processed in the respective country	**Produced and processed in the respective country**	
	1.10 €	**1.70 €**	

I choose this option:

Buying scenario 5 for one litre of fresh milk.

*

Only answer this question if the following conditions are met:

gleichung.NAOK == 1

Please choose the appropriate response for each item:

	Option 1	Option 2	
	Pasture-based dairy cows	Pasture-based dairy cows with calf rearing	
	Biogas production	Less water pollution	
	Conventional	Organic	The milk that I usually buy
	Mountain cultural landscape and biodiversity	-	
	Produced and processed in the EU	Produced and processed in the EU	
	1.70 €	1.10 €	

I choose this option:

Buying scenario 6 for one litre of fresh milk.

*

Only answer this question if the following conditions are met:

gleichung.NAOK == 1

Please choose the appropriate response for each item:

	Option 1	Option 2	
	-	Pasture-based dairy cows with calf rearing	
	Less water pollution	Biogas production	
	Organic	Conventional	The milk that I usually buy
	Mountain cultural landscape and biodiversity	-	
	Produced and processed in the respective country	Produced and processed in the respective country	
	1.70 €	1.10 €	

I choose this option:

The next section is about milk buying scenarios including different milk options with varying product attributes. Firstly, the milk attributes will be explained. Please read them carefully before continuing.

Production system

In the buying scenarios, milk from two different production systems will be included.

1. Milk from conventional production: access to outdoor is not mandatory. Accordingly, some dairy cows are kept in stalls. In addition, on some farms the dairy cows are kept in tethers throughout their lives without the possibility of movement.

2. Milk from organic production: According to the EU Regulation (EU) 2018/848 on organic production and labelling of organic products, organic milks cows need to have access to outdoor or pastures. Tethering or isolating of animals is prohibited aside from individual animals for a limited period of time and only for welfare, safety or veterinary reasons.

Increased animal welfare

In the buying scenarios, different measures to increase the animal welfare in milk production are included that go beyond organic standards.

1. Pasture-based dairy cows: during summer, the milk cows have access to pastures at least 26 days per month, while during winter, they have access to outdoor run at least 13 days per month.

2. Pasture-based dairy cows with calf rearing: On dairy farms, usually the separation between dairy cows and calfs takes place within the first few hours after the birth of a calf. Afterwards, cow and calf are kept permanently separated from each other. The separation is practiced in both conventional and organic milk production. In the pastured-based dairy cow with calf rearing, the calf remains at least four months with cow, resulting in lower milk yields during this stage.

Reduction of climate and environmental impacts

In the buying scenarios, different measures to reduce greenhouse gas (GHG) emissions in milk production are in included

1. Reduction/compensation of GHG emissions through biogas production using manure: The production of cow's milk generates greenhouse gas emissions. These can be reduced/compensated for by various measures. One such measure is the production of biogas with cow dung on the farm. Agricultural biogas plants not only reduce climate-damaging emissions, but also produce renewable energy. Compared to conventional farmyard manure storage, biogas plants reduce considerable parts of the methane emissions that would otherwise be emitted uncontrollably into the atmosphere.

2. Reduction of water pollution through 100 percent of fodder from grassland: the milk cows are solely grass-fed, reducing high nitrogen accumulations in soils and water, resulting from feeding cows with concentrates.

Biodiversity

Pasture-based dairy system from nature conservation mountain area: the milk cows are kept in mountain regions and fed with grass from the area. Grazing of the cows contributes to the conservation of cultural landscape and biodiversity in the mountain area.

Geographical origin

In the buying scenario, the milk options vary regarding the geographical origin of production

1. Produced and processed in the EU outside the country
2. Produced and processed in the country, but ouside the own region of residence
3. Locally produced and processed: produced within the own region of residence

Price

The average price for conventionally produced milk is 1.10 €. In the buying scenario, the milk options vary regarding the milk price per liter.

1. Price level: 1.10 €
2. Price level: 1.40 €
3. Price level: 1.70 €

Please choose one of the three cow milk options in each of the following six buying scenarios, namely the one which you would most likely choose in a real buying situation. There are no right or wrong choices.

Buying scenario 1 for one litre of fresh milk.

*

Only answer this question if the following conditions are met:

gleichung.NAOK == 2

Please choose the appropriate response for each item:

	Option 1	Option 2	
	Pasture-based dairy cows with calf rearing	-	
	Less water pollution	-	
	Conventional	**Organic**	**The milk that I usually buy**
	Mountain cultural landscape and biodiversity	-	
	Produced and processed in the EU	**Produced and processed in the EU**	
	1.10 €	**1.70 €**	
I choose this option:			

Buying scenario 2 for one litre of fresh milk.
*
Only answer this question if the following conditions are met:
gleichung == 2
Please choose the appropriate response for each item:

	Option 1	Option 2	
	-	Pasture-based dairy cows	
	-	Less water pollution	
	Organic	Conventional	The milk that I usually buy
	Mountain cultural landscape and biodiversity	-	
	Produced and processed in the respective country	Produced and processed in the respective country	
	1.10 €	1.70 €	

I choose this option:

Buying scenario 3 for one litre of fresh milk.
*
Only answer this question if the following conditions are met:
gleichung == 2
Please choose the appropriate response for each item:

	Option 1	Option 2	
	Pasture-based dairy cows	Pasture-based dairy cows with calf rearing	
	-	Biogas production	
	Conventional	Organic	The milk that I usually buy
	-	Mountain cultural landscape and biodiversity	
	Produced and processed in the respective country	Produced and processed in the respective country	
	1.10 €	1.70 €	

I choose this option:

Buying scenario 4 for one litre of fresh milk.

*

Only answer this question if the following conditions are met:

gleichung == 2

Please choose the appropriate response for each item:

	Option 1	Option 2	
	Pasture-based dairy cows Less water pollution Organic Mountain cultural landscape and biodiversity Locally produced and processed 1.40 €	- Less water pollution Conventional - Locally produced and processed 1.40 €	The milk that I usually buy
I choose this option:			

Buying scenario 5 for one litre of fresh milk.

*

Only answer this question if the following conditions are met:

gleichung == 2

Please choose the appropriate response for each item:

	Option 1	Option 2	
	Pasture-based dairy cows with calf rearing - Organic - Produced and processed in the EU 1.70 €	- Less water pollution Conventional Mountain cultural landscape and biodiversity Produced and processed in the EU 1.10 €	The milk that I usually buy
I choose this option:			

Buying scenario 6 for one litre of fresh milk.
*
Only answer this question if the following conditions are met:
gleichung == 2
Please choose the appropriate response for each item:

	Option 1	Option 2	
	-	Pasture-based dairy cows	
	-	Biogas production	
	Conventional	Organic	
	-	Mountain cultural landscape and biodiversity	The milk that I usually buy
	Locally produced and processed	Locally produced and processed	
	1.40 €	1.40 €	

I choose this option:

Choice experiment on ham

The following part of the survey consists of buying scenarios including different cooked ham options with varying product attributes. Firstly, the ham attributes included in the buying scenarios will be explained. Please read them carefully before continuing.

Production systems

In the buying scenarios, ham from two different production systems will be included.

1. Ham from conventional production: Among many other aspects, in conventional production, access to outdoor is not mandatory. Accordingly, most pigs are kept in very small stables in groups.
2. Ham from organic production: According to the EU Regulation (EU) 2018/848 on organic production and labelling of organic products (among many other rules), organic pigs need to have access to outdoor or pastures. Isolating of animals is prohibited aside from individual animals for a limited period of time and only for welfare, safety or veterinary reasons. The stables offer more space, they different areas for feeding and resting. Furthermore, they are built with solid (not slatted) floor and include material for rooting and better resting comfort. Pigs have access to outdoor runs.

Improved animal welfare

Usually, pigs are kept indoor in relatively dark stables on concrete floor, where they are not able to perform their natural behaviour including rooting and cooling down their body temperature though getting in contact with water (water wholes or rain). In the buying scenarios, the following measure to increase the animal welfare in pork meat production is included.

1. More space and designed indoor and outdoor areas: allow pigs to perform more natural behaviour by offering a pool/pond and a shower same as rooting area more space and outdoor run.
2. Free range with mobile housing: During summer, the pigs are kept on pastures/fields mobile stables, which allows the pigs to perform more natural behaviour by offering generous space for moving, ponds and rain for cooling down the body temperature and by offering the possibility for rooting in the soil. During winter, the pigs are kept in stables with outdoor run.

Reduction of greenhouse gas emissions: In the buying scenario, different measures to reduce greenhouse gas (GHG) emissions in pork meat production are in included.

1. Reduction/compensation of GHG emissions through biogas production using manure: Manure of the pigs is used to produce biogas. The replacement of fossil fuels through biogas helps to reduce greenhouse gas emission and global warming
2. Reduction/compensation of GHG emission through food waste-based feeding: Usually, pigs are fed with crops/grains that are solely produced for feeding. At the same time, one third of all food that is produced is wasted/cannot be used for human consumption. Feeding by-products from food production and certain (suitable) waste could reduce food waste and thus also greenhouse gas emissions.

Geographical origin

In the buying scenario, the milk options vary regarding the geographical origin of production

1. Produced and processed in the EU outside the country
2. Produced and processed in the country, but ouside the own region of residence
3. Locally produced and processed: produced within the own region of residence

Price

In the buying scenario, the ham options vary regarding the price for 100g of ham.

1. Price level: 2.50 €
2. Price level: 3.25 €
3. Price level: 4.00 €

In the following, please choose one of the two ham options in each of the following six buying scenarios, namely the one which you would most likely choose in a real buying situation. There are no right or wrong choices. If none of the options in a scenario are convenient at all, please choose the "none of these" option.

Buying scenario 1 with 100g of cooked ham.
*
Only answer this question if the following conditions are met:
gleichung.NAOK == 1
Please choose the appropriate response for each item:

	Option 1	Option 2	Option3
	More space and designed indoor and outdoor areas - Organic Produced and processed in the respective country 2.50 €	Free range with mobile stables Biogas production Conventional Produced and processed in the respective country 4.00 €	None of these

I choose this option:

Buying scenario 2 for 100g of cooked ham.
*
Only answer this question if the following conditions are met:
gleichung.NAOK == 1
Please choose the appropriate response for each item:

	Option 1	Option 2	
	Free range with mobile stables - Conventional Produced and processed in the EU 2.50 €	- Food waste/by-products-based feeding Organic Produced and processed in the EU 4.00 €	None of these

I choose this option:

Buying scenario 3 for 100g of cooked ham.
*
Only answer this question if the following conditions are met:
gleichung.NAOK == 1
Please choose the appropriate response for each item:

	Option 1	Option 2	
	Free range with mobile stables **Biogas production** **Organic** **locally produced and processed** **3.25 €**	**More space and designed indoor and outdoor areas** **Food waste/by-products-based feeding** **Conventional** **locally produced and processed** **3.25 €**	**None of these**

I choose this option:

Buying scenario 4 for 100g of cooked ham.
*
Only answer this question if the following conditions are met:
gleichung.NAOK == 1
Please choose the appropriate response for each item:

	Option 1	Option 2	
	More space and designed indoor and outdoor areas **Food waste/by-products-based feeding** **Conventional** **Locally produced and processed** **3.25 €**	**Free range with mobile stables** **-** **Organic** **Locally produced and processed** **3.25 €**	**None of these**

I choose this option:

Buying scenario 5 for 100g of cooked ham.

*

Only answer this question if the following conditions are met:

gleichung.NAOK == 1

Please choose the appropriate response for each item:

	Option 1	Option 2	
	-	More space and designed indoor and outdoor areas	
	Biogas production	-	None of these
	Organic	Conventional	
	Produced and processed in the respective country	Produced and processed in the respective country	
	2.50 €	4.00 €	

I choose this option:

Buying scenario 6 for 100g of cooked ham.

*

Only answer this question if the following conditions are met:

gleichung.NAOK == 1

Please choose the appropriate response for each item:

	Option 1	Option 2	
	-	More space and designed indoor and outdoor areas	
	-	Biogas production	None of these
	Organic	Conventional	
	Locally produced and processed	Locally produced and processed	
	3.25 €	3.25 €	

I choose this option:

The following part of the survey consists of buying scenarios including different cooked ham options with varying product attributes. Firstly, the ham attributes included in the buying scenarios will be explained. Please read them carefully before continuing.

Production systems

In the buying scenarios, ham from two different production systems will be included.

1. Ham from conventional production: Among many other aspects, in conventional production, access to outdoor is not mandatory. Accordingly, most pigs are kept in very small stables in groups.

2. Ham from organic production: According to the EU Regulation (EU) 2018/848 on organic production and labelling of organic products (among many other rules), organic pigs need to have access to outdoor or pastures. Isolating of animals is prohibited aside from individual animals for a limited period of time and only for welfare, safety or veterinary reasons. The stables offer more space, they different areas for feeding and resting. Furthermore, they are built with solid (not slatted) floor and include material for rooting and better resting comfort. Pigs have access to outdoor runs.

Improved animal welfare

Usually, pigs are kept indoor in relatively dark stables on concrete floor, where they are not able to perform their natural behaviour including rooting and cooling down their body temperature though getting in contact with water (water wholes or rain). In the buying scenarios, the following measure to increase the animal welfare in pork meat production is included.

1. More space and designed indoor and outdoor areas: allow pigs to perform more natural behaviour by offering a pool/pond and a shower same as rooting area more space and outdoor run.

2. Free range with mobile housing: During summer, the pigs are kept on pastures/fields mobile stables, which allows the pigs to perform more natural behaviour by offering generous space for moving, ponds and rain for cooling down the body temperature and by offering the possibility for rooting in the soil. During winter, the pigs are kept in stables with outdoor run.

Reduction of greenhouse gas emissions: In the buying scenario, different measures to reduce greenhouse gas (GHG) emissions in pork meat production are in included.

1. Reduction/compensation of GHG emissions through biogas production using manure: Manure of the pigs is used to produce biogas. The replacement of fossil fuels through biogas helps to reduce greenhouse gas emission and global warming

2. Reduction/compensation of GHG emission through food waste-based feeding: Usually, pigs are fed with crops/grains that are solely produced for feeding. At the same time, one third of all food that is produced is wasted/cannot be used for human consumption. Feeding by-products from food production and certain (suitable) waste could reduce food waste and thus also greenhouse gas emissions.

Geographical origin

In the buying scenario, the milk options vary regarding the geographical origin of production

1. Produced and processed in the EU outside the country
2. Produced and processed in the country, but ouside the own region of residence
3. Locally produced and processed: produced within the own region of residence

Price

In the buying scenario, the ham options vary regarding the price for 100g of ham.

1. Price level: 2.50 €
2. Price level: 3.25 €
3. Price level: 4.00 €

In the following, please choose one of the two ham options in each of the following six buying scenarios, namely the one which you would most likely choose in a real buying situation. There are no right or wrong choices. If none of the options in a scenario are convenient at all, please choose the "none of these" option.

Buying scenario 1 with 100g of cooked ham.

*

Only answer this question if the following conditions are met:

gleichung.NAOK == 2

Please choose the appropriate response for each item:

	Option 1	Option 2	
	Free range with mobile stables	-	
	Food waste/by-products-based feeding	-	
	Conventional	**Organic**	**None of these**
	Produced and processed in the EU	**Produced and processed in the EU**	
	2.50 €	**4.00 €**	
I choose this option:			

Buying scenario 2 for 100g of cooked ham.

*

Only answer this question if the following conditions are met:

gleichung.NAOK == 2

Please choose the appropriate response for each item:

	Option 1	Option 2	
I choose this option:	- Food waste/by-products-based feeding Conventional Locally produced and processed 3.25 €	Free range with mobile stables Biogas production Organic Locally produced and processed 3.25 €	None of these

Buying scenario 3 for 100g of cooked ham.

*

Only answer this question if the following conditions are met:

gleichung.NAOK == 2

Please choose the appropriate response for each item:

	Option 1	Option 2	
	More space and designed indoor and outdoor areas Biogas production Organic Produced and processed in the EU 4.00 €	- Food waste/by-products-based feeding Conventional Produced and processed in the EU 2.50 €	None of these

I choose this option:

Buying scenario 4 for 100g of cooked ham.

*

Only answer this question if the following conditions are met:

gleichung.NAOK == 2

Please choose the appropriate response for each item:

	Option 1	Option 2	
	More space and designed indoor and outdoor areas Biogas production Conventional Produced and processed in the EU 4.00 €	Free range with mobile stables - Organic Produced and processed in the EU 2.50 €	None of these

I choose this option:

Buying scenario 5 for 100g of cooked ham.
*
Only answer this question if the following conditions are met:
gleichung.NAOK == 2
Please choose the appropriate response for each item:

	Option 1	Option 2	
	Free range with mobile stables **Food waste/by-products-based feeding** **Organic** **Produced and processed in the respective country** **4.00 €**	**-** **Biogas production** **Conventional** **Produced and processed in the respective country** **2.50 €**	**None of these**

I choose this option:

Buying scenario 6 for 100g of cooked ham.
*
Only answer this question if the following conditions are met:
gleichung.NAOK == 2
Please choose the appropriate response for each item:

	Option 1	Option 2	
	- **-** **Conventional** **Produced and processed in the respective country** **4.00 €**	**More space and designed indoor and outdoor areas** **Food waste/by-products-based feeding** **Organic** **Produced and processed in the respective country** **2.50 €**	**None of these**

I choose this option:

The role of sustainability in food consumption
The following questions are about the role certain food labels play in your food choices.
How often do you choose food with the following labels?

*
Please choose the appropriate response for each item:

	Regularly (several times a week)	Occasionally (several times a month to once a week)	Rarely (once a month or less frequently)	Never	I don't know such product food labels/attributes
Organic labels (Organic refers to a form of agriculture that protects the environment and conserves resources. Farms that produce organic products work according to the principles and specifications of organic farming.)					
Animal welfare labels (Animal welfare refers to the health and well-being of farm animals. Animal welfare includes the aspects of physical health, the ability to perform natural behaviours and the emotional well-being of the animals.)					
Climate friendly production labels (Climate-friendly production is based on reducing, avoiding or offsetting greenhouse gas emissions.)					
Local production labels (A regional product has been produced, processed and marketed within a delimited region, whereby region can					

	Regularly (several times a week)	Occasionally (several times a month to once a week)	Rarely (once a month or less frequently)	Never	I don't know such product food labels/attributes
mean the greater area of the place of residence, for example the district or certain natural areas.)					
Fairtrade labels (Fair trade is the term used to describe controlled trade in which producers receive a minimum price for their products, which is determined by a fair trade organisation. This is intended to provide producers with a higher and more reliable income than in conventional trade, even at lower market prices.)					
Mountain product labels (The origin of the food is a mountain area.)					
Geographical indication labels (A geographical indication (GI) is a distinctive sign used to identify a product whose quality, reputation or other such characteristics relate to its geographical origin.)					

Transition towards sustainable food consumption

When it comes to sustainability (regarding environment, climate and animal welfare) improvements in food systems, who in particular should, according to your opinion, take responsibility? Please rank according to the level of responsibility.

*

Please choose the appropriate response for each item:

	1 = very low level of responsibility	2 = rather low level of responsibility	3 = neither high nor low level of responsibility	4 = rather high level of responsibility	5 = very high level of responsibility
Consumers (e.g. by making responsible food choices and paying higher prices, etc.)					
Retailers/distributors/shop owners					
Farmers					
Policy makers					

In the following, a list of interventions to promote the sustainability (regarding environment, climate and farm animal welfare) in the food system is shown. We would like to ask you how much you are in favour of or against the single interventions to improve the sustainability.
*
Please choose the appropriate response for each item:

	1 = I am completely against the intervention	2 = I am rather against the intervention	3 = I am neither for nor against this intervention	4 = I am rather in favour of this intervention	5 = I am completely in favour of this intervention
Labelling of sustainable products (traffic light)					
Release concrete instructions for sustainable food choices and communicated to the whole population					
Labelling of benefits of sustainable foods					
Financial incentives for sustainable food choices (e.g. VAT reduction for sustainable alternatives).					
Impose taxes/monetary compensation for unsustainable products					
The introduction of binding agricultural regulations to promote greater sustainability in the food system.					

In the following, a list of possible future policies related to meat consumption are shown. We would like to ask you how much you are in favour of or against the single policies.
*
Please choose the appropriate response for each item:

	1 = I am completely against the intervention	2 = I am rather against the intervention	3 = I am neither for nor against this intervention	4 = I am rather in favour of this intervention	5 = I am completely in favour of this intervention
Continued meat (and other animal based products) consumption: Meat consumption patterns cannot and should not be moderated					
More efficient meat (and other animal based products) production through improved husbandry systems and breeding					
More artificial lab-grown meat as an alternative to meat					
More protein-rich foods from plants and algae as an alternative to meat (and other animal based products)					
Shift to consumption of locally produced meat (and other animal based products)					
Significant reduction of meat (and other animal based products) consumption					
Shift to consumption of meat (and other animal based products) from animal friendly husbandry systems					

	1 = I am completely against the intervention	2 = I am rather against the intervention	3 = I am neither for nor against this intervention	4 = I am rather in favour of this intervention	5 = I am completely in favour of this intervention
More meat and other animal based products from organic production.					

Socio-demographic characteristics part 2

Household size: How many people live permanently in your household (including you)? *

Only numbers may be entered in this field.

Please write your answer here:

-

Number of children: How many children (persons younger than 18 years) live permanently in your household? *

Only numbers may be entered in this field.

Please write your answer here:

-

Which age groups are represented by the children living in the household? *

Only answer this question if the following conditions are met:

Answer was greater than '0' at question '73 [Q15]' (Number of children: How many children (persons younger than 18 years) live permanently in your household?)

Check all that apply

Please choose **all** that apply:

- 0 to 2 years old
- 3 to 5 years old
- 6 to 10 years old
- 11 to 17 years old

Level of education: What is the highest educational qualification you have achieved? *
Choose one of the following answers
Please choose **only one** of the following:

- No degree
- Vocational certificate or apprenticeship with certificate of proficiency
- Basic vocational training/vocational baccalaureate
- High school diploma
- Bachelor's degree from a college/university
- Master's degree/diploma or doctorate from a college or university

Income: What is your total monthly gross household income before tax deductions? *
Choose one of the following answers
Please choose **only one** of the following:

- less than 1000 €
- 1000-2999 €
- 3000-4999 €
- 5000-6999 €
- 7000-9999 €
- 10000-12999 €
- 13000 € or more
- no answer

Thank you very much for your participation in this research. We very much appreciate you time and effort to complete the survey!
If you have any questions, please contact Hanna Stolz (hanna.stolz@fibl.org)