Transition pathways towards a more sustainable food system considering dietary consumer archetypes

Abstract

Global consumption of animal-based foods has risen significantly in recent decades, and demand is expected to continue to rise. This trend poses major environmental, health, and ethical concerns, including deforestation, biodiversity loss, greenhouse gas emissions, and animal welfare issues. Despite growing awareness, dietary changes remain slow, influenced by cultural, social, and economic factors.

This study explores consumer dietary patterns and their links to psychological and socio-demographic characteristics to identify leverage points for promoting sustainable food choices. Based on a survey conducted in five European countries (Germany, France, Italy, Sweden, and Romania) with 2,551 respondents, we identified four consumer archetypes: Dairy, Starch, Protein, and Fibres, each with distinct sustainability motivations. The "Fibres" group demonstrated the highest engagement with sustainability, while the "Starch" group showed the lowest. Policy acceptance varies across archetypes, with financial incentives preferred over restrictive measures. Emphasizing animal welfare could enhance public engagement with sustainability policies. The overall findings highlight the complexity of consumer behaviour related to sustainable consumption and the need for tailored strategies to support dietary shifts.

Keywords: Consumer archetypes; Dietary patterns; Alphabet theory; Sustainable food choices; Policy interventions

1. Introduction

Global consumption of animal-based foods has increased significantly in recent decades. This trend and the intensification of livestock production is expected to continue, with an estimated 62-144% 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, as 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, 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). 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 and 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.

The literature suggests that changes in dietary behaviour can be slow. However, it shows that social norms can and do change and that this process can be facilitated by the coordinated efforts of civil society, health organizations 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 (Clark et al., 2016; Hoek et al., 2021; Lin and Niu, 2018; Righi et al., 2023).

The aim of the study presented in this paper 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 by taking into account the nature of different consumer archetypes. The research focuses on dietary patterns and their links to psychological factors and socio-demographic characteristics, aiming to bridge the gap between consumer behavior analysis and practical policy making, offering insight into how interventions and policies can address specific archetypes to enhance the sustainability of the food system.

This paper is structured as follows: after this introduction, section two provides the background of this study on dietary patterns, the consumer characteristics and a brief explanation of possible policy

interventions and future opportunities. The next section presents the theoretical framework used, followed by the methodological section, which starts with the data and sampling chosen and the methods used in the study. The final section provides a discussion of the results and conclusions.

2. Background

Food consumption depends to a large extent on the achievement (deliberate or automatic) of consumption goals related to consumers' characteristics and their values and beliefs (Lin and Niu, 2018; Righi et al., 2023).

2.1. Dietary patterns

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. Dietary choices are influenced by cultural, social, and economic factors (Drewnowski and Kawachi, 2015). Consumers can be categorized into three main dietary groups: meat eaters, meat avoiders, and meat reducers (Dagevos and Voordouw, 2013). Meat eaters include omnivores, who consume a variety of animal and plant-based foods, as well as those following stricter diets like ketogenic and paleo. These diets are stricter, as they are often related to health-concerned consumers (Cambeses-Franco et al., 2021; Joshi et al., 2019). Meat avoiders include vegetarians and vegans, who avoid some or all animal products, often for ethical, environmental, or health reasons (Rosi et al., 2017). Meat reducers, such as flexitarians (Derbyshire, 2017), aim to decrease meat consumption while maintaining a balanced diet. This approach aligns with global health goals promoting increased consumption of plant-based foods and reduced intake of red meat and sugar.

2.2. Consumer characteristics

Consumer characteristics play a key role in sustainable food choice. This particularly involves psyhological factors such as motivations (Brunin et al., 2022; de Boer et al., 2014), personal values, awareness, knowledge (Lin and Niu, 2018; Migliavada et al., 2022; Schwartz, 2012), attitudes (Aertsens et al., 2009; Clonan et al., 2015; Gazdecki et al., 2021), and behaviors (Hoek et al., 2021; M. Ross and Kapitan, 2018; Verain et al., 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 and Vranken, 2013). However, the significance of sustainability attributes varies across product types and purchasing scenarios, and consumers prioritize conventional attributes, such as price, brand, taste, or functionality over sustainability (Raghunathan et al., 2006). In addition, marketing and purchasing factors also influence consumer decision-making (Herbes et al., 2018; Van

Herpen et al., 2012). Segmenting consumers based on socio-demographic or psychological variables could provide insights into potential consumer groups interested in sustainable products (Aertsens et al., 2009; Clark et al., 2016; Gerini et al., 2016; Panzone et al., 2016; Righi et al., 2023; Verain et al., 2017).

2.3. Policy Implications and Future Possibilities

The research highlights the need for dietary shifts and consumer acceptance of selected sustainability policies and interventions to keep the food system within planetary boundaries (Blair et al., 2024; van Dam and van Trijp, 2016). 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). One major obstacle for a shift towards more sustainable food systems is the attitude-behavior gap, as identified by Akaichi et al. (2016), that occurs when consumers express concern but do not reflect this in their purchasing decisions. Blair et al. (2024) examine stakeholder perspectives in the livestock sector, revealing a strong preference for small-scale, local, and animal-friendly production by 2035. While some stakeholders favor meat reduction, others support continued meat consumption or artificial meat alternatives. The study underscores the divergence in opinions regarding government intervention in livestock policies, highlighting the need for inclusive and balanced approaches to avoid polarization. Lai et al., (2020) validate the role of Values-Beliefs-Norms (VBN) constructs and social norms in shaping meat consumption. Their findings suggest that interventions should integrate health and environmental concerns, as different consumer groups respond better to tailored messaging. Righi et al. (2023) further confirm that food security concerns, both for personal health and environmental benefits, lead to sustained dietary shifts with lower carbon emissions. Aligning policies with individual values and social norms can enhance their effectiveness (de Boer et al., 2014). Reisch, (2021) argues that people-centric policymaking is essential for systemic behavioral change. Policies should actively engage consumers, address cognitive biases, and integrate human and institutional behavior into food governance. Given the interconnected challenges of climate change, land use, food production, and health, a holistic governance approach is crucial for sustainable food systems (De Schutter et al., 2020).

3. Theoretical framework

This research is based on the Alphabet Theory (Zepeda and Deal, 2009), which describes attitudes as the central psychological construct in determining habits and behaviours. In terms of consumer behaviour, we looked at self-reported eating patterns. Other relevant determinants, i.e socio-

demographic characteristics, were also included in this research. In addition, recognising that certain attitudes do not necessarily translate into behaviour (the attitude-behaviour gap) (El Haffar et al., 2020), the level of motivation was also included in this research as a key determinant of behaviour. To provide a basis for decision-makers in the food system, we also analyse consumer acceptance of selected sustainability policies and interventions, such as the labeling of sustainable products (e.g., traffic light system), the provision of concrete guidelines for sustainable food choices, and the labeling of the benefits of sustainable foods. Additionally, we examine financial incentives for sustainable food choices, the imposition of taxes or monetary compensation on unsustainable products, and the implementation of binding agricultural regulations to promote greater sustainability in the food system.

4. Methodology

In this chapter, data collection and sampling are described as well as the methods used for the analysis in this study.

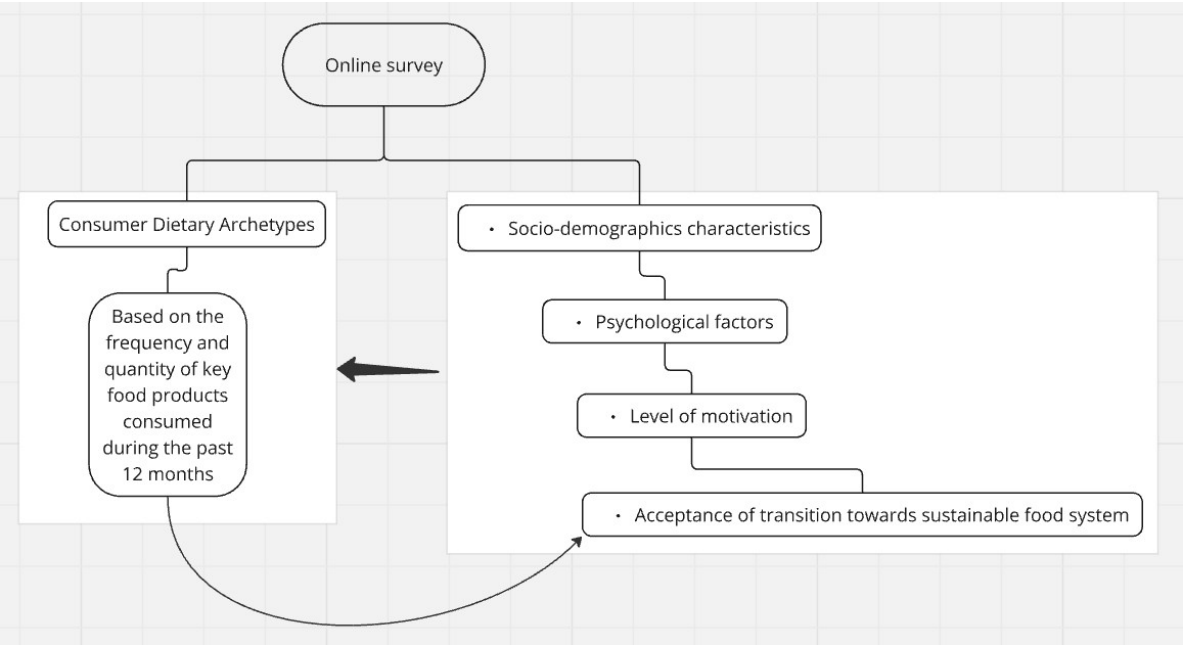
4.1. Data collection and sampling

An online survey was carried out in five study countries, Germany, France, Italy, Sweden and Romania. These countries were chosen to cover different European geographical regions with different cultural backgrounds and eating habits. The data was collected in autumn/winter 2023/2024. Two pilot rounds were carried out in each of the case study countries, and the survey design was improved after each pilot round. In each study country, about 500 respondents participated in the survey, resulting in a valid sample of 2551 respondents. The average time taken to complete the survey was 20 minutes. Quota sampling was used to draw representative samples in each country in terms of age, gender and region with different cultural backgrounds and eating habits. The quota sampling was based on the distribution of age and gender in the total population in the NUTS 1 regions of each country to achieve a high representativeness of the sample (EUROSTAT, 2023).

4.2. Survey concept and structure

The survey addressed different sustainability dimensions in the food system, i.e. environment, climate and animal welfare. It is linked to the Alphabet theory (Zepeda and Deal, 2009) and consists of two main elements: i) the identification of consumer archetypes and, ii) the profiling of these archetypes by various consumer characteristics, such as socio-demographic characteristics, psychological factors, level of motivation of food consumption, and acceptance of transition towards sustainable food systems and possible future sustainability interventions and policies (Figure 1).

Figure 1. Consumer survey concept (own compilation)



The online survey included several sections, of which those in bold are the ones we consider for this analysis[1]:

1. **Introduction**: involving 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**: including questions about age, gender, region.
3. **Dietary patterns:** covering 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** (Brunin et al., 2022; 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** (Aertsens et al., 2009; Clonan et al., 2015; Gazdecki et al., 2021): 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 (Lin and Niu, 2018; Migliavada et al., 2022; Schwartz, 2012): 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.

[1] This research is part of a broader study so not all elements in the survey are part of this specific analysis

7. Preferences and willingness to pay: 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.
8. Role of sustainability labels in daily life: this section included a set of 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.

4.3. Data analysis model

The dietary patterns of the respondents were recorded to create consumer archetypes. Because this information had to be collected through an online survey, a retro-perspective method was employed. This methods collect information about past food intake and include techniques such as the 24-hour recall (where respondents detail everything consumed in the previous 24 hours), Food Frequency Questionnaires (FFQ) (which ask individuals how often they have consumed specific foods over a defined period, such as weeks or months), and Dietary History (a comprehensive assessment of past eating habits obtained via detailed questionnaires and interviews).

In our study, we adopted elements of the Food Frequency method by selecting key product categories and asking consumers to report the frequency of their consumption of these categories on a scale ranging from "several times a day" to "never" over the past 12 months. The 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 improve the quality of the reported portion sizes, we added one or several pictures with real products and portion 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[2].

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 archetypes (Vehkalahti and Everitt, 2018).

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.

To assess the significance and reliability of our data, we then apply statistical methods. We use a non-parametric test, the Kruskall-Wallis, to evaluate whether samples originate from the same distribution and is used to compare two or more independent samples of varying sizes (Field, 2005). Additionally, we assess the reliability of scales measuring motivations for sustainable food consumption using an internal consistency test, the Cronbach alpha. This test examines correlations between individual scale items and the overall score to determine the consistency of the measurement. The reliability assessment is conducted in two steps: first, by evaluating scales formed by multiple items for different dimensions (e.g., environment, climate, and animal welfare) separately; and second, by summarizing these dimensions into a single factor to measure overall motivational levels, testing reliability across different study contexts (Vehkalahti and Everitt, 2018).

[2] In Appendix

5. Results

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). The survey was completed by 2551 participants total. An overview of the relevant socio-demographic characteristics of all five countries is provided in

Table **1**.

Table 1: 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

We assumed no major bias between the national population and the samples in this research.

5.1. Consumer dietary archetypes

In this section, the dietary archetypes are described. Based on the cluster analysis, four general dietary clusters were identified, 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.

Table 2: 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**

5.2. Level of motivation for sustainability of food consumption

The overall level of motivation for more sustainability in food consumption regarding environment, climate and animal welfare was 2.54 which falls in between the statements: “I am maybe motivated” to “I am certainly motivated”. The study reveals regional differences in the average levels of motivation for sustainable food consumption (Tab. 3). Consumers in Italy showed the highest scores, followed by consumers in France and Germany, whereas the scores were lower for consumers in

Sweden and Romania. However, the scores were univocally highest for animal welfare in all countries. In Germany and France, the level of motivation for environmentally friendly food consumption showed the second highest scores after animal welfare.

Table 3: 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 (Tab. 4).

Table 4: 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" archetype have the highest scores for all three scales, consumers in "Protein" archetype the second highest scores (expect for animal welfare), whereas consumers in the "Starch" archetype show the lowest scores (Tab. 5).
Comparing the scores of the single sustainability scales within the single archetypes, consumers belonging to the "Dairy" archetype show higher scores for animal friendly consumption compared with the other motivational scales, whereas consumers belonging to the "Starch" archetype show higher scores for environmentally friendly consumption compared with the other motivational scales. The scores for environmentally friendly and climate friendly food consumption are the same among the "Protein" and "Fibres" archetypes.

Table 5: Motivational level in single dimensions and in total in each dietary archetype (mean values)

	Dietary archetype				
	1	2	3	4	
Scales	**Dairy**	**Starch**	**Protein**	**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

The chi-square tests of the Kruskal-Wallis rank sums revealed that the differences in motivational levels observed between dietary archetypes are significant (Tab. 6).

Table 6: Chi-squares of rank sums of motivational level in single dimensions in each dietary archetype

	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

5.3. Attitudinal profile of dietary archetypes

In table 7, an overview on how different consumer archetypes evaluate statements towards information and support 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. The average attitudes in the other dietary archetypes are lower.

Table 7: Attitudes towards information and support regarding sustainable food (mean values)

	Dietary Type			
Positive attitudes towards food sustainability	**1 Dairy**	**2 Starch**	**3 Protein**	**4 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/cons	3.25	3.41	3.43	**3.70**

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

5.4. 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, and for those that do not require consumers to act themselves. There were only small differences in the ranking of interventions when comparing the different archetypes. 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 archetypes (Table 8).

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 archetypes are significant (Table 9).

Table 8: Acceptance of interventions related to sustainable food consumption single archetypes

	Dietary archetype				
	1 Dairy	**2 Starch**	**3 Protein**	**4 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 9: Chi-squares of rank sums of evaluation of role of different actors in different dietary archetypes

	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

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 (Tab. 10).

Table 10: Acceptance of policies related to sustainable food consumption in different archetypes

	Archetypes			
	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	**3.8**7	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 11: Chi-squares of rank sums of evaluation of role of different actors in different archetypes

	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

6. Discussion and conclusion

The study identified four distinct consumer archetypes (Dairy, Starch, Protein, and Fibres) each characterized by specific dietary patterns, sociodemographic characteristics, and levels of motivation and attitudes for sustainable food consumption. These archetypes provide valuable insights into consumer behavior and their potential responsiveness to sustainability policy interventions.

“Fibres” archetype demonstrated the highest motivation for sustainable food consumption across all three scales, environment, climate, and animal welfare. This group, predominantly represented by women and individuals with higher levels of education and income, also exhibited the strongest inclination toward high nutritional quality. The “Protein” archetype, the most prevalent overall, showed the second-highest motivation for sustainability, except for animal welfare, where its scores were lower. Conversely, the “Starch” archetype, which is particularly prevalent in Romania and characterized by lower education and income levels, displayed the lowest motivation for sustainable food consumption. Consumers in the “Dairy” archetype, while not the least motivated, scored higher on animal-friendly consumption compared to other sustainability dimensions.

The study also revealed significant regional differences in sustainability motivation. Italian consumers exhibited the highest motivation levels, followed by those in France and Germany, while consumers in Sweden and Romania showed lower levels of motivation.

Notably, across all countries, concern for animal welfare consistently received the highest scores, suggesting that interventions highlighting animal welfare benefits may be more effective in driving consumer engagement with sustainable food choices. In Germany and France, environmental sustainability was the second-highest concern, further emphasizing the regional variations in sustainability priorities.

The findings regarding the attitudes towards food sustainability highlight differences. The “Fibres” archetype shows the strongest support, particularly for preserving natural landscapes, while other archetypes exhibit more moderate engagement. These results suggest the need for targeted communication strategies to enhance sustainability awareness, especially among less engaged consumer segments. The strong demand for sustainability information, particularly among “Fibres” consumers, presents an opportunity for food companies to improve transparency and education efforts.

When evaluating consumer acceptance of policy interventions aimed at promoting sustainability in livestock production and consumption, pull mechanisms were generally preferred over push mechanisms. Consumers showed the highest acceptance for financial incentives encouraging sustainable food choices, whereas interventions involving taxation or monetary compensation for

unsustainable products were the least favored. Importantly, consumers in the "Fibres" archetype exhibited the highest overall acceptance of sustainability interventions, aligning with their strong motivation for sustainable food consumption.

The findings highlight the importance of designing targeted interventions that align with consumer archetypes and regional sustainability concerns. Given the strong emphasis on animal welfare across all countries, policies leveraging this concern could be particularly impactful in promoting sustainable consumption. Among the interventions to promote more sustainability in the food system, consumers' acceptance is highest for financial incentives for sustainable food choices recommended, followed by labelling of sustainable products (i.e. traffic light), whereas imposing taxes/monetary compensation for unsustainable products had the lowest level of acceptance in all four consumer archetypes.

As far as livestock policies are concerned, there is strong support for a shift to local, animal-friendly meat production, against livestock intensification, lab-grown meat production or plant-based substitutes. However, "Protein" and "Dairy" consumers show greater acceptance of lab-grown meat, while "Starch" consumers are more inclined toward reducing meat consumption and supporting organic meat production. This suggests a preference for traditional over innovative approaches, though further analysis will refine insights into the potential for innovation and relevant consumer segments.

Overall, the study highlights regional and cultural differences in dietary patterns and sustainability perceptions. It confirms that consumer motivation alone is not sufficient to drive significant changes without accompanying policies and interventions. Financial incentives and nudging strategies appear to be the most promising tools, but incentives should be designed according to the type of consumers, that are not to be considered a homogeneous group. This study underscores the complexity of consumer behavior in relation to sustainable food consumption. By recognizing the diversity of consumer motivations, regional differences, and archetype-specific responses to policy measures, decision-makers can design more effective strategies to promote sustainability in the food system.

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