Article

Does Food Shopping Behaviour Determine Food Waste Vulnerability in Private Households? Quantitative Analysis on Case Studies from Germany

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Abstract: The discussion about food waste is conducted from many different scientific perspectives. Studies from the perspective of retail geography have hardly been part of this so far. Within the framework of own empirical studies 2020–2022 for case studies from Germany, postal and online surveys were conducted in urban and rural areas in order to correlate psychographic attitudes according to self-assessment about food and shopping with practical shopping and disposal behaviour. Four different clusters can be distinguished, demonstrating that food waste realities are associated with characteristic attitude sets of groups of people as either unconscious wasters or conscious savers. Waste baskets are visualised via relational networks, which help to capture the complexity and completeness of sources of food waste in private households. This approach makes it possible to expand the causes of food waste not only in private households themselves, but also from upstream purchasing practices and the retail geographical characteristics of individual business formats. This study shows that the differences between groups and their receptiveness to the issue of food waste do not diverge systematically, but that niche-like variations in attitudes or purchasing behaviour can make a big difference.

Keywords: food waste; shopping behaviour; retail formats; food waste related lifestyle; quantitative analysis; network analysis

1. Introduction

The scientific interest in food and food disposal has increased rapidly in recent years and is one of many topics in the so-called sustainability discussion [1–5]. The growing attention to resource conservation and recycling potential also includes food waste, which for a long time was considered unmeasurable or accepted as a natural output in a saturated society. Only a more detailed calibration makes it clear that the loss of originally still edible food waste not only means economic–financial damage for individual actors, be it private households, producers, retailers or gastronomy, but it also causes costs for society as a whole due to misused and underused resources of labour, land/nature and capital [6–8]. In the meta-discourse on climate protection measures, efforts to reduce food waste are therefore gaining importance and are prominently defined by the United Nations as a sustainability goal [9].

This study focuses on private households, which still produce the most food waste compared with other actors [10]. Not only does the question arise as to why such waste is produced and how households deal with it [11,12], but also where the original sources—usually outside the household itself—of this food lie. On the basis of quantitative studies in the federal state of Schleswig-Holstein, Germany, it is questioned whether various shopping formats have an influence on the extent of "food waste" in private households and whether, in addition to the disposal motives in the household, structures internalised in shopping formats such as packaging sizes or best-before dates also influence disposal behaviour. The complexity of how relevant indicators are connected to each other is achieved through the representation of relational networks.

2. State of Research

2.1. Food Waste—Definition and Quantification

The scientific discussion about food waste is multidisciplinary. Scientific and technical approaches, psychological, sociological and economic marketing perspectives capture the phenomenon of food waste, whose extent, composition, causes, consequences, potential for intervention and groups of actors are differentiated at global, national and micro levels [13,14]. While some approaches focus causally on the product group "food", its production, its energy yield, its technical processing and refinement [15–17], other perspectives aim to analyse groups of actors in the form of chains or cycles from primary production to marketing, consumption and disposal [18,19]. In this way, food waste generation and avoidance potentials are to be understood as a complex system of different objectives, attitudes and practices that are highly anonymous and atomistic. Accordingly, it is difficult not only to record food waste quantitatively, even approximately correctly [9,20], but also to understand its causes and processes, e.g., in the privacy of households, in order to derive effective (not only legal) interventions and guidelines against food waste generation [21,22].

The initial problem in recording and understanding food waste is the definition of the term food waste. Various authors have taken up this concept, distinguishing between so-called avoidable and unavoidable segments [5], [11] (p. 41) and [23]. It is obvious that this distinction cannot be subject to (natural) scientific exactness. This is because the concept of avoidability hides regional and cultural eating habits, preparation and storage possibilities, biographical characteristics of cooking interests and cooking expertise as well as motivations, moral–ethical standards and individual efforts [24,25]. Against this background, food in its avoidable waste is subject to temporal and biographical fluidity via personal assessments of appearance, taste, "better" alternatives to one's own leftovers in the household or health concerns. The latter contributes to the fact that one "no longer likes" food even in the short term, has "overeaten" a product, is no longer "convinced" of a product [26] or has also passed it on to third parties. Existential crises such as hunger and war can also contribute to the fact that "unavoidable" food waste such as peelings or bone residues is tapped for human utilisation [27]. In order to make surveys comparable, a set of rules was established for the example of the member states of the European Union in order to control the necessary extent and the chosen methods for the quantitative recording of food disposal across borders and via surveys repeated over time [28].

If we concentrate on private households in the further course of this paper, another problem arises in addition to the definition of food waste, that is, the allocation of food waste to the sociological unit "household". In private households with several family members, there may be no knowledge of whether and who disposes of how much in the household or who is even a household member in cross-cultural comparison [29], so that the head of the household does not have a complete overview of food waste in their own household. This circumstance is relevant because surveys usually reach only selected persons such as the head of the household or the person with a special interest in the topic. This problem also explicitly affects our own subsequent surveys. Last but not least, the recording of food waste in private households is incomplete if the disposal of individual household members at work, school, during leisure time or other outings outside the private home is quantitatively outsourced [29], because it is neither manually factually conducted at home in the household, nor can it be detected in a waste garbage can assigned to the household. There are other quantitative sources for this [30], such as canteens, cruise ships, restaurants, hospitals or army stocks, but these are only attributed to private households if consumption also takes place at home [31] (p. 2890). Additionally, the recording of any beverages, nevertheless excluding the most important food "water", poses a special problem in quantitative recording [32] (p. 635), because beverages are usually not disposed of in a garbage can, are not detectable in garbage can analyses and are displaced in disposal behaviour much faster than "solid" foods [33] (p. 156). Diary techniques as in [34] should also capture this waste fraction as best as possible (excluding water), albeit based on self-assessments by participating individuals [34] (p. 3) and at the risk [31] (p. 2886) of

questioning one's waste behaviour in the course of diary keeping and not fully disclosing it. The avoidability or unavoidability of food waste is thus (also) a social construct, which means that the quantitative determination of food waste can only result in approximate values. However, because the socio-economic–societal context is constantly changing, as is the potential for learning which foods and their "leftovers" are edible [26], there is not only the problem of a systematic ad hoc recording of food waste, but also its comparability with future surveys in order to be able to record the quantitative development of food waste.

Accordingly, previous estimates of food waste at the global or selected national levels are incomplete, conveying an image of scientific accuracy for public discussion that does not exist [7]. UNEP [9] (p. 60ff), in particular, makes it clear that a large part of national data allocations to food waste are made through estimates without empirical findings or on the basis of small samples. Systematic and comprehensive surveys on the quantity of food waste on a global level across all actor groups do not exist, nor do related studies on motivations for disposal, sources of disposed goods and consequences beyond selected case regions and food waste sectors [35,36]. For example, the estimated quantities of food waste for the 2010s from different sources, survey methods and discourse targets for Germany vary between 10.9 and 18 million tonnes per year, including or excluding so-called food loss, which is to be stated as food losses during the harvest, during and as a result of inappropriate storage or during transport even before the actual production and consumption [37]. Although various large-scale surveys on the topic of food waste are available specifically for Germany [10,38,39], the sufficiently incompatible data in an example such as Germany, which tends to be well documented, show how uncertain the data on global or specific national food waste cited in the literature are calculated. Detailed diary-based and large sample surveys [34] based on comparable and repeatable methods have recently contributed to consolidating knowledge on the quantitative extent of food waste, at least for member states of the European Union.

2.2. Private Households and Food Shopping Habits

In contrast to quantitative technical surveys at the waste garbage bin, which are subject to major hurdles both in terms of the feasibility of waste collection and waste disaggregation, empirical studies on private households or other food waste actors are much more prominently represented in previous science in terms of their variation in samples or variety of methods [40,41]. Generally, these are case studies that seek to explore attitudes, experiences, processes in private homes or other institutions, motivations and causes of food waste on a quantitative or qualitative (ethnographic) basis [42,43] in order to develop potential interventions against food waste behaviour. The literature base to date is constantly expanding and has been summarized in various review articles [44–47]. It can be observed that, recently, more and more examples from the Global South are approaching the topic of food waste [48].

The procedure for deriving results differs significantly according to the breadth and depth of the questionnaires and data sets used. On the one hand, simple correlations are formed in order to establish statistical correlations of demographic and content-related references and to recognise the conspicuousness of age, gender, household size, education or income in relation to food waste susceptibility, frequency and quantity [49,50]. On the other hand, one tries to bundle factors and subjects as types and groups via a form of question battery, which is usually subject to Likert scaling and only opens up the application of quantitative statistical procedures. The latter can thereby lie completely inconsistent with simple correlations of demographics and behaviour, because as psychographic profiles, segmented groups or lifestyle types they reflect complex patterns of behaviour, practices and demographic background [51]. This approach has become increasingly established in psychology and retail research since the 1970s [52–54] and opens up the possibility of identifying target groups for manageable marketing or educational measures (also with regard to food waste).

The Aarhus School [55–57] developed the construct of the food-related lifestyle (FRL), which reveals group-specific conspicuousness in a questionable set of attitudes, behaviours, level of knowledge, individual meaning and routines on questions of food, food preparation, shopping behaviour, handling of food, etc. These conspicuous features are neither determinant nor unchangeable, but are nevertheless mentally and in practical actions "long-term" and with striking statistical probability. They are "routinised" and mentally stored as "food choice scripts" in order to recognise "comfort and predictability" [58] (p. 9) not only for one's own household, but also for the outside observer. Recent work by Aschemann-Witzel et al. [56] showed that the lifestyle module "food" also opens up perspectives on food waste behaviour and practices. The range of criteria used varies across different publications, which not only set their own priorities, but also make it difficult to compare results.

What they have in common, however, is that the sources of food in private households and ultimately food waste have so far only been recorded to a limited extent. The latter are not recorded as open questions but as closed items (e.g., "I shopped at . . . in the past 30 days" [51] (p. 4) or "I buy almost all my food in a main shop" in [59] (p. 205). In the "puzzle of consumer food waste" [11], the recording of shopping routines as "situational predictors of food waste" [60] (p. 67) has so far played a minor role [61] (p. 377), [58] (p. 12). Work from retail research [62,63] already shows from a non-food-waste oriented perspective that shopping behaviour for groceries and the selection of operational formats can reflect the life attitudes and life satisfaction of their customers. This is the starting point of our own study, which aims to explain the food waste behaviour of private households (also) with the sources of food. In an elaborate survey in the form of open questions, purchasing networks are identified, which are combined with attitudes and perceived waste behaviour. Via network analysis, these relationships can be visualized in their totality of answer sets, so that originally "invisible" or "unimportant" relationships are given a new weighting.

3. Goals and Hypotheses

This study therefore aims to focus more profoundly and systematically on the sources of food and food waste,

1. to understand food waste vulnerabilities in private households not only as practices in the households themselves, but also as the result of upstream purchasing processes and loyalties to specific purchasing formats. These vulnerabilities are captured below in the form of self-assessments of how frequently food waste is generated in private households.
2. whether different purchasing formats also trigger different waste vulnerabilities of their products for private households via their prices, quality, freshness or packaging sizes.
3. to place food waste vulnerability not only in a factual, personal or temporal context, but also in a (geographically) spatially variable context. This spatial context may include, for example, different settlement patterns (rural versus urban), the temporal-spatial effort required for food purchases and different forms of transport mobility.
4. to mirror the results for private households with best-case responses on food waste avoidance offers in retail and primary production. The latter are derived from expert interviews.

These questions are explained using the so-called food related lifestyle (FRL-) model [54]. This model captures the relevant criteria that control the food waste behaviour of private households both inside and outside the households (in the probabilistic sense). This concerns demographic characteristics such as age, gender, household size and income, attitudinal questions about food and interest in food or features of the home such as size of the home or kitchen equipment (micro-space). However, this also relates to shopping behaviour, the choice of operational formats and the accessibility of operational formats for everyday food shopping (meso-space). Figure 1 assumes that not only the behaviour within the own household can explain food waste, but that already in upstream areas of the food chain marketing

and information practices in primary production or in the retail trade affect the food waste vulnerability of private households (macro space).
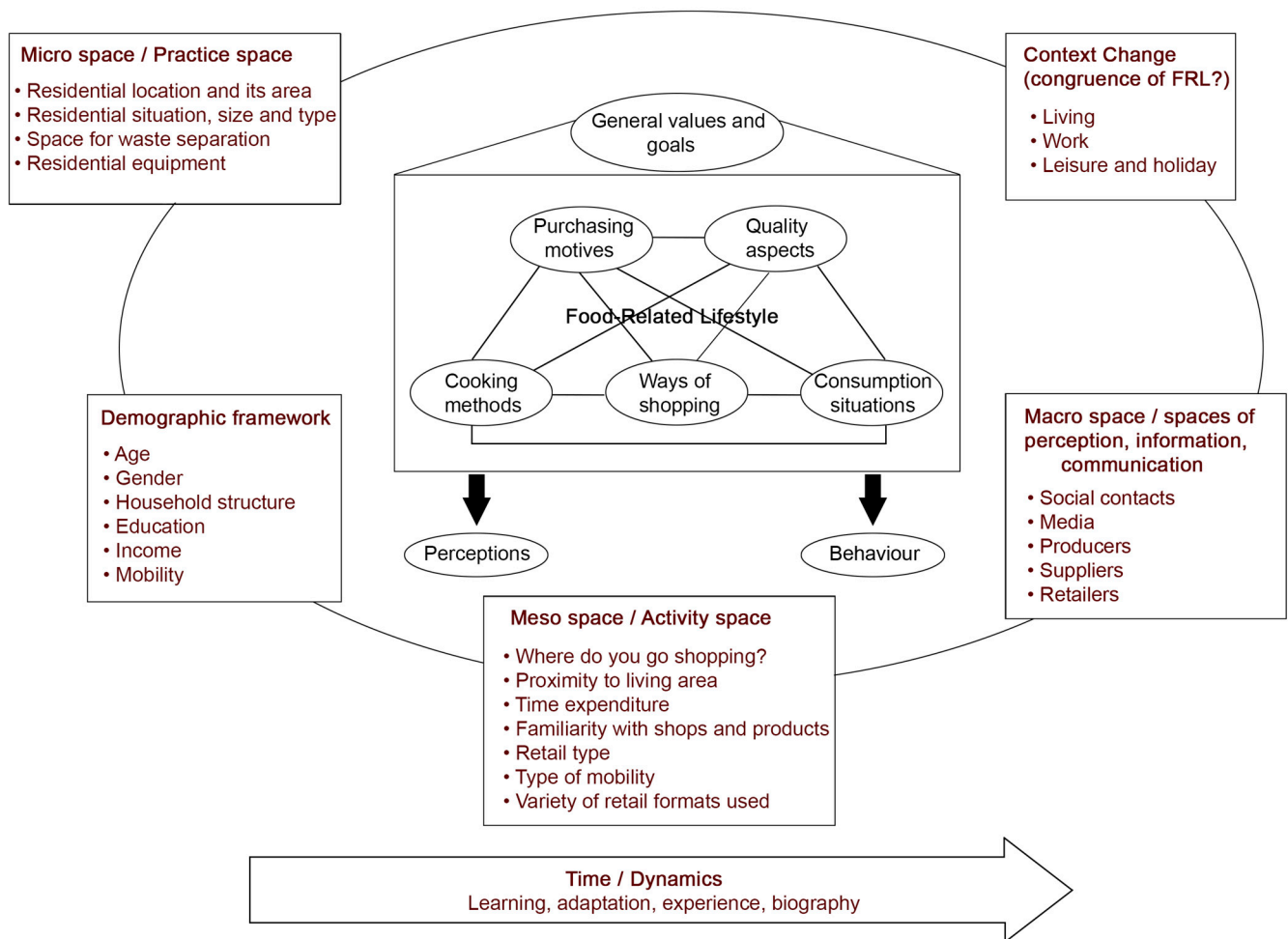

Figure 1. Food (waste) related lifestyle concept [64] (p. 34), supplemented and modified according to [57] (p. 17), [65] (Figure 1).

The original core of the FRL model (here in black and white) is explicitly extended by spatial, temporal and contextual references (here in red) in Figure 1 compared with [57] (p. 17). This accounts for the complexity of the FRL model and addresses the challenge that food waste discourse and solutions are also subject to spatiotemporal features.

4. Methodology

4.1. Case Study and Sample

In the years 2020–2022, own surveys on the topic of food waste were conducted in Schleswig-Holstein, a federal state in the northernmost part of Germany. In its economic-functional and settlement-structural pattern, the federal state is characterised by a broad mix of rural (and agricultural) and urban areas with a corresponding variation in population densities and infrastructural development, e.g., within the framework and diversity of stationary food formats, housing conditions (owner-occupied versus multi-family dwellings) or the possibilities for growing one's own food. Only three towns have a population of more than 100,000. A network of medium-sized and small towns bears the burden of central provision for the rural areas in their planning function as medium-sized centres, sub-centres and rural central places. The latter are usually equipped with one or more branches of the food chains dominating the discount or supermarket segment in Germany. In addition, there are village shops and farm shops as well as direct marketers in rural areas, which not

only expand the range of food business formats locally, but also market goods of regional provenance with the claim of high product transparency. This mixture of offers and the assumed inherent proximity to concepts such as nature, origin, locality or freshness to and of food make it likely that subjects with very different attitudes, practices and experiences in dealing with food and food waste can be mapped across the study region.

The selection of case studies was conducted as a mix of rural communities, small and big city structures and consenting support measures in the distribution and return of questionnaires by local stakeholders (Table 1). This procedure required extensive coordination, which also took half a year due to restrictive COVID measures in Germany. Out of the potential number of 100 case communities, 12 case studies remained.

Table 1. Size and scope of data collection in case municipalities (Source: Author's surveys 2021).

Community	Population Size	Number of Households	Number of Participating Households	Response in %
Achterwehr	1042	450	91	20.2
Bokel	600	250	38	15.2
Brodersby	672	281	86	30.6
Bünsdorf	610	300	49	16.3
Dannau	597	290	37	12.8
Gettorf	7602	3400	320	9.4
Mettenhof	19,897	596	40	6.7
Neuwittenbek	1113	500	114	22.8
Osdorf	2500	1160	117	10.1
Schinkel	1015	450	101	22.4
Todenbüttel	1027	475	66	13.9
Warder	698	200	42	21.0
Online	n.a.	n.a.	357	n.a.

n.a. = no data available.

With the help of a standardised questionnaire and in the form of postal delivery to all households in 11 municipalities and one district of the city of Kiel, all private households were given the opportunity to participate in the survey Appendix A. The questionnaires were returned via collection points in the form of private shops and post boxes of public law institutions. The procedure therefore does not correspond to a random sample, but to the claim of a complete survey. The return of 1101 evaluable questionnaires, or 13.2% of 8352 distributed questionnaires, shows that this could not be realised.

The response corridor usually covered two weeks and was basically coordinated with local stakeholders in the implementation of the surveys. In two cases, financial incentives were offered in the form of lottery tickets for participation in the survey. The questionnaire was 65 questions long and was designed to capture the following concepts: (a) attitudinal questions on food, mobility and shopping; (b) attitudes, practical experience and handling of food waste in one's own household; (c) food purchasing behaviour to identify potential sources of food waste; and (d) socio-demographic and socio-economic structures in private households as statistical filtering instruments. There was explicitly no quantification of food waste according to the self-assessment of private households, which is sometimes not only dramatically underestimated but also suppressed. The surveys focused on relative weightings and relational references of answer sets. Forty attitude questions were recorded within the framework of a Likert scale between 1 (strongly disagree) and 5 (strongly agree). With few exceptions of metric scaling, the questions captured nominally and ordinally scaled data in both closed and open-ended questions, sometimes with the possibility of multiple responses.

The aim was to identify complex patterns of attitudes and invisible groups, which cannot only be assigned to gender, age or income categories, and to recognise their range of action structures. However, this is also connected with the basic problem of mapping representativeness, as it is performed in many other studies in quota samples constructed according to socio-demographic indicators, from which no rejection rates are recognisable. In fact, the analysis is based on group membership, which in its attitude sets is completely detached from age or gender and cannot be put into perspective by official statistics

because comparative data are not available. However, where demographic indicators from original data are used to measure the quality of one's own data rather than out of sheer necessity, they expressly represent only a vague framework to document conspicuousness and deviations from the norm. Here, too, this established approach was taken, although it was questioned self-critically. What is striking is the above-average proportion of female test persons in all regional examples and the over-ageing of participants over 64 years of age. In order to compensate for this shortcoming, an online survey with an identical questionnaire was distributed digitally via the limesurvey software and advertised via Twitter, Instagram, Facebook and stakeholder websites. A basic population from which a participation rate could be read is not available for the digital survey. This was intended to open up the possibility of including more online-savvy and younger population groups in the sample and to strengthen the diversity of the data response. Table 2 shows that this requirement was met in terms of age composition. Among the participants of the online sample, only 7.2% were 65 years and older. The high femininity of the respondents did not change in the online sample and even reached a peak value of 84.2%.

Table 2. Response to questionnaires and significance based on selected population indicators (Source: Author's surveys 2021) [62] (p. 39).

Community	Proportion Female in Basic Population	Proportion Female in Sample	Share 65plus in Basic Population	Share 65plus in Sample
Achterwehr	49.7	67.4	19.4	32.6
Bokel	49.1	68.4	20.4	24.3
Brodersby	53.0	72.3	36.0	41.5
Bünsdorf	49.5	71.7	19.0	40.8
Dannau	50.0	75.7	18.4	27.0
Gettorf	51.2	73.5	22.6	42.5
Mettenhof	51.1	66.7	18.7	48.7
Neuwittenbek	51.4	78.8	24.3	42.1
Osdorf	50.4	75.0	19.2	33.6
Schinkel	50.7	71.9	21.4	40.4
Todenbüttel	49.4	61.5	19.0	33.3
Warder	50.4	69.0	30.1	26.8
Online	n.a.	84.2	n.a.	7.2

n.a. = no data available.

The interview was self-administered and anonymous, and this procedure was also necessary due to the life restrictions of various COVID-19 waves in 2020 and 2021. This eliminated the need for cross-checks and comprehension questions, as would have been possible in the context of face-to-face contact between interviewer and respondent.

4.2. Data Preparation

In order to be able to filter and segment statements, 1458 evaluable cases were clustered into four coherent attitude groups via data compression. On the one hand, compression was carried out by merging 40 attitude criteria in the form of a principal component analysis (varimax-rotation, pairwise; KMO = 0.759; Bartlett = 0.000). Thirty-two criteria were suitable for this analysis due to their communalities.

On the other hand, the resulting factor loadings were used for a cluster analysis (KMEANS pairwise via SPSS26) in order to group cases according to a four-cluster set (Figure 2). In total, 1166 cases were sufficiently complete in their response sets to be usable for cluster analysis. The quality of this classification was measured with the help of a discriminant analysis (96.7% correctly classified). Using the nonparametric test according to Kruskal and Wallis, the groups differed significantly in their mean values across all 32 criteria. The four clusters can be characterised in terms of content from the mean values of the 32 usable criteria and the factor loadings. A detailed description of the procedure can be found in [64]. Appendix B shows the criteria surveyed and their significance in the self-perception of the private households surveyed with regard to food and food waste in the context of their food-related lifestyle. In the nature of things, it is a compromise as

to which and how many criteria can be retrieved from the respondents in a postal survey. Particular focus was placed on criteria such as attitudes to various retail formats and mobility, which would allow us to expect geographic–spatial variations in actual actions.
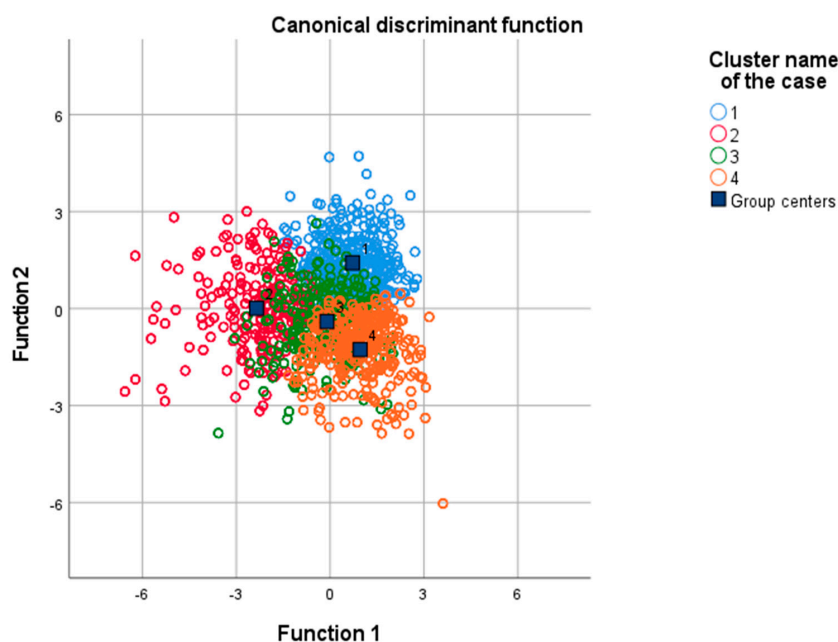

Figure 2. Designated cluster groups (Source: Author's surveys 2021; SPSS26).

The four groups were characterised as Smart (N = 352), Spontaneous (N = 218), Comfortable (N = 296) and Sustainable (N = 300), the characteristics of which can be derived from Appendix B. The Smart group was characterised by the fact that it saw itself as highly organised in its shopping behaviour and food processing, and combined high demands with variety and price consciousness. The Spontaneous group was clearly less organised in its shopping behaviour. Keeping a shopping list was just as little in the foreground as a greater interest in alternative sources of origin. The Comfortable group was mainly car-oriented and related its convenience more to one-stop shopping and proximity to the home. What is striking is a comparatively high degree of forgetfulness about food in one's own household. The Sustainable group was characterised not only by organised shopping, where criteria such as "spontaneous" or "last minute" have little place, but also where appearance or best-before dates are of little importance in food consumption.

4.3. Network

Network analysis helps to combine criteria also in the food waste context and to visualise them in further development of originally only theoretical and mathematical work [66,67], which cannot be represented in original cartography or diagramming techniques. The aim of this networking strategy is to connect content-related origin and destination points, which do not have to have any spatial references, with each other via lines or edges in the frequency of their double-sided mentions. Striking combinations of nodes and edges make it possible to distinguish coloured clusters from each other with the help of algorithms (e.g., a modularity module in the software Gephi094). Using three criteria (colour and size of nodes, colour and width of edges), it is thus possible to visualise, for example, the diversity of answers (represented by the combination of nodes), the dominance of answers, the centrality of particular answers, the niche-like importance or homogeneity of answers in a cluster comparison, conspicuousness in comparison with other networks or even the conspicuous absence of answers [68]. Individual response sets can thus be made visible in their completeness and mutual interconnectedness, from which questions and hypotheses can be derived. In the discussion about food (waste), this methodological graphical tool has rarely been used [69,70].

4.4. Expert Discussions

In early 2022, expert interviews were conducted with representatives from food marketing, food craft and primary production, representing all fresh produce categories and particularly food waste-prone assortments in the food sector. The experts were recruited in the catchment area of the case communities presented in Table 1. From this, no individualizable reference of disposed products of the interviewed private households to these sources of origin can be derived. The expert interviews nevertheless represent types of businesses, cooperative enterprises and locally known food brands that have a decisive influence on the regional discourse on the origin of food and the handling of food. Interview duration ranged from 45 to 90 min. All interviewees were either owners or managers of their companies, so sufficient and long-term competence in merchandise handling and customer marketing can be assumed. With only one exception, the interviews were conducted digitally and recorded in writing as a result of the COVID-19 pandemic. The interviews were conducted using guidelines, but were nevertheless open-ended and dialog-like with the possibility of as yet unknown follow-up questions, in order to also reflect the contextual characteristics of the individual companies. The aim was to find out which solutions for minimizing food waste are already being implemented in the companies themselves and how this knowledge is passed on to their customers. This concerns both information on the handling of food and marketing forms in order to better control the production volume at the expected time of sale and thus prevent surpluses. These examples serve to demonstrate best-practice solutions from the supplier side for the prevention of food waste in private households.

5. Results

5.1. Private Households

The following results are based on the objectives (Section 3) and the methodological segmentation (Section 4) in order to establish the relationship of disposed goods to the sources of origin of these products and their structural characteristics.

The data collected in tables are basically nominally scaled. Accordingly, the range of applicable statistical tests is limited. Do the attitude groups differ in their actual disposal and shopping behaviour? The disposal basket hardly differs in structure across all setting groups (Table 3), with larger variations only observed for bread and dairy items. Analogous to other studies, so-called fresh products dominate food waste [37,71]. Particularly valuable products such as meat or long-life products such as ready meals play only a minor role in the memories of disposed psroducts. In contrast to other studies, the disposal of beverages is consistently underestimated in this survey [33].

Table 3. Last food disposed according to setting groups that households can remember (multiple answers in %) (Source: Author's surveys 2021) [1].

Food Category	Smart	Spontaneous	Comfortable	Sustainable
Baked goods	2.9	1.8	2.6	3.7
Bread	25.8	28.0	26.1	19.9
Dairy products	9.7	13.5	12.9	15.2
Drinks	2.4	2.5	1.8	2.4
Fruit	21.3	22.2	19.9	21.5
Meat	0.8	2.9	1.2	1.0
Ready-made products	2.9	0.4	2.1	1.7
Sausage	8.2	8.4	7.0	6.4
Vegetables	20.3	16.4	19.9	23.2
Others	5.8	4.0	6.5	5.1
N-answers	380	275	341	297

[1] Pearson chi-square (3 cells or 7.5% with expected frequency less than 5) = 0.348 (value 29,258, df 27).

There are statistically significant differences in the reasons why food is disposed of in private households. The Sustainable group in particular is characterised by using the product until the last consequence of spoilage (in the sense of mouldy, sour or rotten) before it has to be disposed of. The interest in buying fresh products minimises the problem of having to deal with official best-before dates (see Table 4: shelf life). Reasons for disposal are based more on the "five senses" than on external guidelines. Demanding thinking about fresh products, especially with regard to bread products, is more widespread in places where additional purchases are made quickly out of convenience or imprudent shopping behaviour (Table 3; Appendix B; referring to group Spontaneous). The categories in Table 4 are not free of overlaps in content. Therefore, the question was designed with the possibility of multiple answers in order to give the respondents the best possible assignment.

Table 4. Reasons for last food disposed of by setting group (multiple answers in %) (Source: Author's surveys 2021) [1].

Reason for Disposal	Smart	Spontaneous	Comfortable	Sustainable
Forgotten	11.7	10.9	11.0	7.8
Mispurchase	1.8	0.8	0.6	0.6
Optics	3.4	3.5	2.5	1.9
Packaging size	2.3	1.2	2.0	1.3
Shelf life	7.8	10.9	8.5	5.2
Spoiled	57.0	58.6	56.5	70.6
Taste	3.4	1.6	3.4	2.3
Too hard	7.0	10.9	11.9	6.5
Others	5.7	1.6	3.7	3.9
N-answers	386	256	354	309

[1] Pearson chi-square (5 cells or 13.9% with expected frequency less than 5) = 0.018 (value 40,787, df 24).

Where do the last products disposed of in private households come from, and how does the "real" shopping world correlate with this? The survey asked about the product groups disposed of and where they were originally bought from memory (e.g., discounters) or originated from (e.g., homemade cake from own production). The network of food shopping sources was recorded as a double naming of retail format and location. Same retail formats at different locations for a private household were counted several times. Tables 5 and 6 show significant differences between the groups. However, quantitative variables of disposal and purchasing shares are not explicitly recorded here. The main sources of disposed products are discounters and supermarkets, which is not surprising because they are the most frequently mentioned sources of purchase across all groups. However, the split between disposal and purchasing sources in the categories "alternatives" and "specialised shops" is striking (Tables 5 and 6). For the Sustainable group, the mention of disposal from alternative sources such as village shops, farm shops or weekly markets is three times lower than their mention as a shopping source, which reflects the special appreciation of these products in terms of freshness, individual advice or small-scale loose purchases. There is no comparable result for the other groups. On the other hand, the disposal mentions from supermarkets, which are similar for all groups, are clearly excessive.

Table 5. Source of last disposed food in private households according to setting groups (multiple answers in %) (Source: Author's surveys 2021) [1].

Source of Origin	Smart	Spontaneous	Comfortable	Sustainable
Alternatives	13.1	14.2	13.2	8.6
Hereunder village shop	3.2	5.4	6.3	1.3
Hereunder farm shop	4.0	2.5	3.3	2.3
Hereunder weekly market	5.9	6.3	3.6	5.0
Discounter	23.4	28.7	22.1	21.1
Own product	5.1	2.5	4.3	4.0
Specialty shops/others	10.5	8.3	9.6	15.5

Table 5. *Cont.*

Source of Origin	Smart	Spontaneous	Comfortable	Sustainable
Supermarket	47.8	46.3	50.8	50.8
N-answers	372	240	303	303

[1] Pearson chi-square (0 cells or 0% with expected frequency less than 5) = 0.033 (value 30,442, df 18).

Table 6. Main sources of food purchases in private households by setting group (multiple answers in %) (Source: Author's surveys 2021) [1].

Source of Origin	Smart	Spontaneous	Comfortable	Sustainable
Alternatives	19.6	11.2	18.4	24.5
Discounter	26.2	34.1	24.8	25.4
Specialty shops	16.3	15.0	15.9	12.0
Supermarket	36.4	37.5	39.5	35.8
Others	1.4	2.2	1.4	2.3
N-answers	1274	722	985	989

[1] All mentions of the same operator at different locations were recorded; Alternatives = village shop, farm shop, organic shop, vegan shop, weekly market; Others = shopping centre, other; Pearson chi-square (0 cells or 0% with expected frequency less than 5) < 0.001 (value 69,569, df 12).

If the reasons for disposal are combined with the sources of origin (Table 7), various conspicuous features can be identified. Depending on the breadth, depth and degree of freshness of the different product worlds of individual business formats, the criterion of shelf life is far above average at discounters. Incorrect purchasing, problems with packaging size and "overstocking" (criterion "forgotten"), as small as the values are, are further typical challenges that arise with purchases from discounters and supermarkets (Table 4). The criterion "too hard" (usually bread products, but also sausages) is a dominant disposal criterion from alternative shopping sources and specialised shops (Table 7). Despite premium prices, this does not prevent these products from being disposed of out of convenience or lack of storage knowledge. At the centre of all criteria is the variant "spoiled" [37] (p. 25), which, according to self-assessment, refers primarily, but not only, to originally fresh products, as is obvious from sources such as weekly market or farm shop (Table 7).

Table 7. Reasons for the disposal of last discarded food by source of origin related to all setting groups (multiple answers in %) (Source: Author's surveys 2021).

Disposal Category	Discounter	Village Shop	Own Product	Farm Shop	Super-Market	Weekly Market	Other (Specialty Shops)
Forgotten	10.7	8.7	20.9	9.7	6.6	3.7	3.6
Mispurchase	1.1	0	0	0	0.8	1.9	0
Optics	1.1	2.2	0	0	2.8	7.4	2.2
Packaging size	2.2	0	0	0	2.6	1.9	0.7
Shelf life	11.4	2.2	0	6.5	6.6	3.7	1.4
Spoiled	64.6	58.7	41.9	74.2	71.4	63.0	57.6
Taste	2.6	0	7.0	0	2.0	5.6	2.9
Too hard	3.7	23.9	18.6	6.5	4.9	11.1	20.9
Other	2.6	4.3	11.6	3.2	2.3	1.9	10.8
N-answers = 1.193	271	46	43	31	609	54	139
N-answers in %	22.7	3.9	3.6	2.6	51.0	4.5	11.7

Contingency coefficient 0.351 (sign < 0.001); Pearson chi-square not usable due to underpopulated cells.

For two selected and diametrically different groups (Spontaneous versus Sustainable), the combined queried statements of disposed products and their sources of origin were visualized as a network using the software Gephi094. The representation was conducted from two perspectives. On the one hand, the products disposed of were represented dominantly via the criterion "degree of origin". On the other hand, the sources of origin of disposed products were visually dominated via the criterion "degree of input" [67].

The representation took place via three variants: nodes (points), edges (lines) and colours. The nodes were weighted differently according to their nominations (as starting

points). Edge sizes resulted from equal node pair nominations. Colours resulted from the similarity or dissimilarity of networks of nodes among each other. A relational network was generated which, in contrast to conventional diagrams or maps, did not require a legend because the understanding of the representation aimed to (a) fully represent the diversity of references in all their complexity, (b) distinguish the dominance and centrality of nodes and statements from peripheral or niche nodes and statements and (c) derive from this conspicuousness new questions that remain hidden in conventional diagrams or tables.

Figures 3 and 4 show the most conspicuous disposal goods for the spontaneous group, which—unsurprisingly—are characterised by original fresh products [37] (p. 23). Because the product worlds of alternative operating formats are primarily aimed at offering fresh products, they are also dominated by relatively high proportions of fresh product disposals (represented by the colour green). Supermarkets and discounters nevertheless account for the most mentions, which—integrated into much broader shopping baskets—resulted in a second disposal/origin cluster (represented by the colour red). Only in comparison with another group (Sustainable group) do similarities or special features of disposal and sources of origin become clear. Figure 5 shows a very similar pattern of disposed products (Table 3), but in front of a much more complex network of connections that open up four colour clusters. Fresh products, and thus also goods susceptible to disposal, were sourced from a much wider range of origins than those of spontaneous consumers, reflecting a more conscious and widespread pattern of retail types in demand, range of food origins and interest in different sources of food.
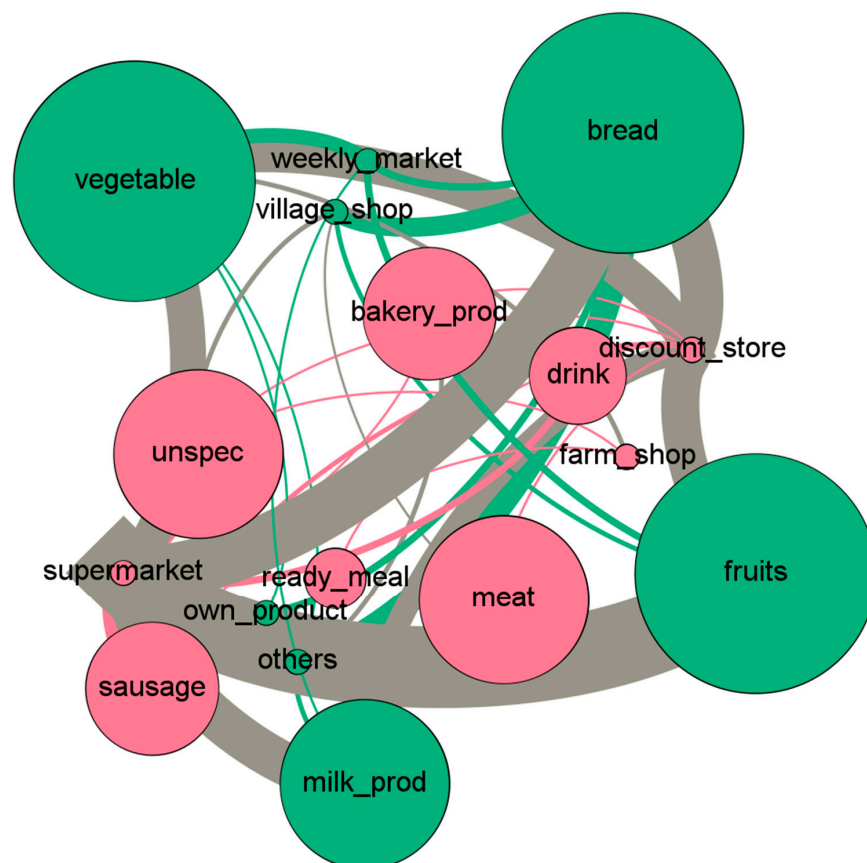

Figure 3. Networking of disposed food groups with their purchasing sources for the group Spontaneous (representation with the help of the software Gephi094; Spontaneous: number of nodes 17; number of edges 231; modularity = 0.167; layout: circular layout, noverlap; edge ranking by weight; node ranking by initial degree (minimum size 5; maximum size 50); node partition by modularity class (2 classes; red 52.94%; green 47.06%)); Source: Author's surveys 2021.
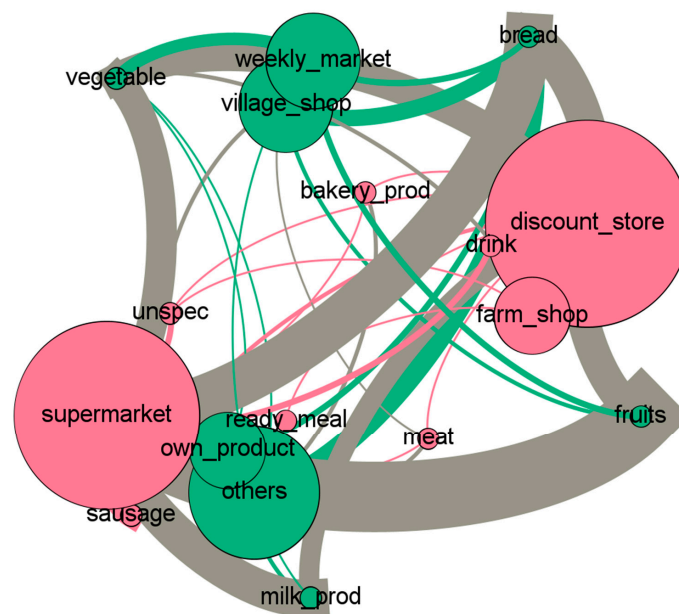
Figure 4. Networking of shopping sources with disposed food groups for the group Spontaneous (representation with the help of the software Gephi094; Spontaneous: number of nodes 17; number of edges 231; modularity = 0.167; layout: circular layout, noverlap; edge ranking according to weight; node ranking according to input degree (minimum size 5; maximum size 50); node partition according to modularity class (2 classes; red 52.94%; green 47.06%)); Source: Author's surveys 2021.
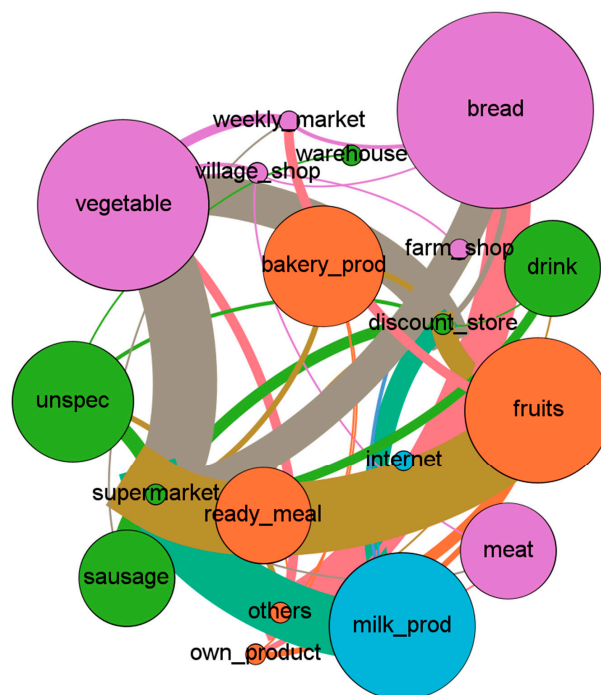

Figure 5. Interlinking of disposed food groups with their purchasing sources for the Sustainable group (representation with the help of the software Gephi094; Sustainable: number of nodes 19; number of edges 282; modularity = 0.169; layout: circular layout, noverlap; edge ranking by weight; node ranking by initial degree (minimum size 5; maximum size 50); node partition by modularity class (4 classes; purple 31.58%; green 31.58%; orange 26.32%; blue 10.53%)); Source: Author's surveys 2021.

This presentation does not indicate how much or how often disposal takes place. Therefore, Table 8 records the self-assessment of how often food disposal occurs in the private households surveyed. The differences are highly significant and strongly support

the thesis that the admitted susceptibility to disposal is subject to a complex pattern of perceptions and purchasing behaviour. Not only is there a specific group of households that denies per se that there is food waste in the home, but disinterest in food preparation and planned shopping on the one hand or idealized attitudes according to origin and quality of food on the other hand lead to the existence of a clear gap of disposal susceptibilities between the groups (see Table 8; Appendix B).

Table 8. Frequencies for food disposal in private households according to self-assessment for the setting groups (in %) (Source: Author's surveys 2021).

Frequency of Disposal	Smart	Spontaneous	Comfortable	Sustainable
Daily	9.5	7.0	11.3	6.1
Up to weekly	21.0	34.8	35.4	22.3
Several times a month	16.4	15.8	19.9	19.9
Monthly	11.0	14.0	12.7	19.3
More seldom	33.4	25.6	18.9	30.4
Never	8.6	2.8	1.7	2.0
N-answers	347	215	291	296

Pearson chi-square (0 cells or 0% with expected frequency less than 5) < 0.001 (value 456,494, df 18).

Figures 3 and 4, as well as Figures 5 and 6, can thus be weighted by the frequency of disposal practices. For example, the group Spontaneous versus Sustainable varied in the frequency of disposal "up to weekly" between 41.8 and 28.4% (daily and up to weekly combined) and "monthly and less frequently" between 39.6 and 49.7%. There was no recording according to self-assessed weight. An analysis shows that even here there can be an underestimation in a ratio of 1 to 10 [20].
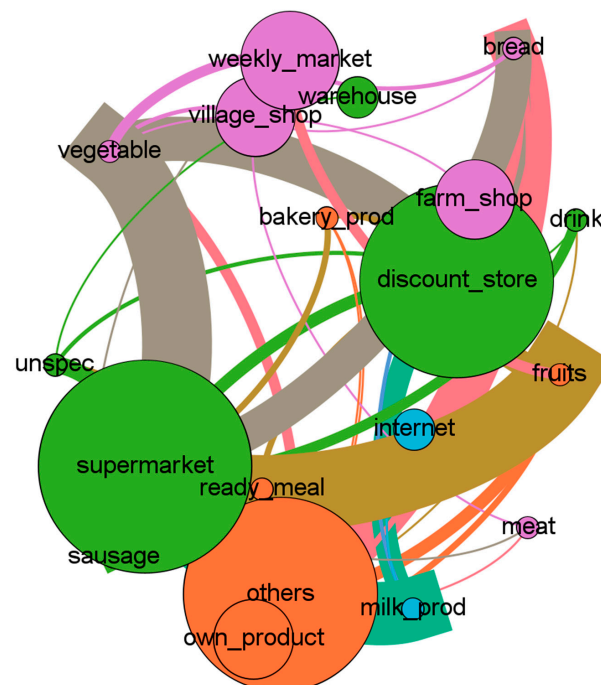

Figure 6. Networking of shopping sources with disposed food groups for the group Sustainable (representation with the help of the software Gephi094; Sustainable: number of nodes 19; number of edges 282; modularity = 0.169; layout: circular layout, noverlap; edge ranking by weight; node ranking by input degree (minimum size 5; maximum size 50); node partition by modularity class (4 classes; purple 31.58%; green 31.58; orange 26.32%; blue 10.53%)); Source: Author's surveys 2021.

If we focus even further on the spatial aspect of grocery shopping and the associated effort in the form of mobility and proximity, systematic differences between the groups can be detected. For example, the Comfortable group uses the car excessively often, while the Sustainable group uses the options "on foot" or bicycle significantly more often (Table 9). A not inconsiderable proportion of the households surveyed in the Sustainable group do not own a car at all (Table 9). The interest in sustainable food use is thus also reflected in other food procurement practices. A more holistic picture of sustainability opens up how procurement and the handling of food are also reflected in different forms of mobility.

Table 9. Structural data on mobility and shopping behaviour (in %; N = 1145) (Source: Author's surveys 2021).

Structural Data	Smart	Spontaneous	Comfortable	Sustainable	N-Answers	Kruskal–Wallis Test [2]
No car in the household	4.3	6.1	1.0	16.3	79	<0.001 [1]
Shopping by bike	22.1	15.6	12.2	25.9	286	<0.001
Shopping on foot	180	20.9	13.4	26.1	287	<0.001
Shopping by car	59.3	62.1	74.1	47.2	887	<0.001
Daily shopping	2.3	3.7	3.1	2.0	31	<0.001
Shopping three to four times a week	17.7	30.6	18.8	15.2	128	<0.001
Shopping twice a week	53.4	45.8	45.7	49.5	567	<0.001
Shopping once a week	23.1	16.2	28.3	32.3	295	<0.001

[1] Contingency coefficient; [2] nonparametric Kruskal–Wallis test determined over all variants of mobility and shopping frequencies.

Nevertheless, contradictions emerge that are not to be expected. For example, the thesis that the Sustainable group places particular emphasis on alternative shopping sources (village store, farm store, weekly market) is not confirmed. Analogous to Table 5, the understanding of sustainable shopping is more likely to be sought in specialty stores, but is also made in supermarkets with growing fresh and organic offerings. Spontaneous (mis)shopping (Table 8) is, rather, supported by shopping proximity, as the group Spontaneous shows: the sources of supply of the group Spontaneous were in the distance of up to 5 min accessibility at 52.6%, significantly higher than that of all other groups (38.9% versus 21.1% versus 42.1%).

The correlation between rural and urban areas is ambiguous: There was no significant difference between the settlement types on the reasons for food waste (chi-square 0.349), whereas the frequency of food waste showed clear differences (rural: monthly or less often 38.9%; urban: 47.8%; chi-square: <0.001) (in contrast to [46] (p. 5)), because the urban sample reflected a group that was overly open to ecological issues. The rural sample recorded here was much more socialised in its shopping outlets and food waste outlets with supermarkets and discounters than the urban sample.

5.2. Original Producers and Marketers—Feedback for Households

Various studies have documented the range of different instruments for preventing food waste [12,72,73]. Educational measures against food waste or information on food recycling should also be used as a communicative instrument between end consumers or waste disposal companies on the one hand and production and retail on the other. Own interviews with primary producers and direct marketers in the study area (see Appendix D of interview partners) show answer sets and the possibilities of using direct market dialogue not only to familiarize customers with production processes and the sources of origin of foodstuffs in order to increase the value of these goods through this transparency, but also to provide assistance with storage, processing or refinement. Welch et al. [74] point out that suppliers can thus establish themselves as "trusted lifestyle authorities" and provide "solutions to customers' everyday problems" [74] (p. 16). Above all, the realization that fresh products are in short supply and can sometimes no longer be offered or are not always homogeneous in terms of quality and composition opens up ways of dealing with food in one's own household in a more targeted and conscious manner. In addition, fresh products

elude standardized customer perceptions. Eating traditions will be revived, and parts originally defined as leftovers, e.g., meat, can trigger new value creation and revitalization of traditional processing methods.

This goes hand in hand with the realization that products are not constantly available and merchandise clearance must become an accepted system. So-called show breads, which are kept ready until the store closes in order to constantly document the full range of products, would no longer be necessary. This would be accompanied by more planned shopping by customers and a reduction in food waste in the stores themselves. However, where food waste occurred, leftovers would be recycled into new products, e.g., as long-life pastries, so that old breads are reprocessed with value added and returned to the merchandise cycle [75]. The fact that these are still premium artisan products is underscored by the fact that the goods are not subject to a price offer. The consolidation or streamlining of the product range, the provision of recipe suggestions for self-recycling, e.g., for jam or juices, and advance orders in the form of subscriber systems are instruments not only for retaining customers in the long term, but also for limiting overproduction in the factories and overstocking in households. The elaboration of unique selling propositions for fresh products in the form of applied traditional techniques, transparency between supplier and clientele via weekly info, email-letters and so-called storytelling to learn more about the personality of the supplier and their products are further possibilities to consolidate customer loyalties. Further solutions are shown by [76] (p. 177), who also considered discounting products, changing packaging sizes or a more generous interpretation of expiration dates, or [22] (p. 160), who considered awareness campaigns to be useful if they are "tailored to different target groups".

6. Discussion and Implications

6.1. Approach

In contrast to other studies [33,40,56], the present work was conducted as a full survey on site. All households had the option of voluntary participation. Participation was not limited or pre-set to demographic quotas. The author's own site visits were carried out in order to be able to identify residential characteristics or generalizations of the case communities and supply infrastructure of food. The socio-political discussion on the topic of food waste was not reflected in the participation numbers in the survey. Nevertheless, the absolute number of cases (N = 1458) was sufficiently large to trace trends and developments. Combining respondent returns with sweepstakes in two cases did not result in increased returns. The survey was not explicitly announced as a survey on food waste, but as a survey with a neutral wording on "food handling" [31] (p. 2887), [71] (p. 21). Although questions about food disposal were asked (Appendix A), they were integrated into a broader context of statements and questions about food and shopping. Deterrent terminology such as "waste" and associated normative desirable and required standards to "non-waste" were excluded. The above-average proportion of female subjects or those who took the lead in completing the questionnaire in their household is also confirmed in other publications ([61] (p. 376): 86% female) or ([51] (p. 6): 61.9% female).

The focus of this study was not to conduct a quantitative food waste survey, for which questionnaires seem less suitable than the diary technique [31] (p. 2894), but rather a customer or user psychological survey based on attitudes, self-perceptions and demand structures. The collection of appropriate results over the questionnaire technique also turned out in other investigations to be a proven instrument [56,57], in order to correlate complex perceptions with perceived or actual action patterns, and from this to compute probabilities for the expectability of these patterns. This approach follows the theory of planned behaviour (TPB) [77] and its adaptation to food and food waste-related attitude patterns (food-related lifestyle FRL) [55].

The time burden on subjects is also much shorter with a questionnaire than with the diary technique, but generally captures memories (from the past) as opposed to ad hoc decisions (from the present) that can be documented in a diary in a timely manner. To

address this problem of asking for memories of food-waste experiences in a blanket way in a questionnaire, our own survey asked for the last time the product or procedure was used, thereby capturing the best possible memory of the last known food-waste practice. This approach did not explicitly capture quantities of food waste in volume or weight. The aim was not only to identify conspicuous groups of goods during disposal, but also to further qualify them by asking about the reasons for disposal and the source of origin. Neither the approach nor the question wording can therefore be readily compared with other surveys [37,41,56], so data can only be compared with due caution.

6.2. Integration into the State of Research

Additionally, in our own survey, so-called fresh products such as fruits, vegetables, bread products and dairy products were at the top of perceived food disposed of (Table 3) [78] (p. 6); [32] (p. 630). In contrast to [34] (p. 6) and its systematic diary technique, the disposal of beverages was clearly underestimated in our own survey. In other studies [31] (p. 2890), beverages were even completely omitted from food waste recording.

Reasons for disposal lay mainly in the self-assessed condition of the products, which were either sour, mouldy, unsightly or spoiled. Shelf life in the sense of adherence to a best-before date, usually for packaged products, played a lesser role in disposal than the public discussion would lead one to expect (Table 4). This tendency was also confirmed by the surveys of [34], which also show that the use of larger (and cheaper?) packages does not have a significant influence on disposal behaviour. This general statement changes, but the susceptibility varies when the reasons for disposal are differentiated according to the sources of origin and the different retail formats, as was performed here. Table 7, for example, shows that the best-before date becomes significantly more relevant in the context of a basket of goods from discounters, which is more dominated by packaged goods, than that of the baskets of other sources of supply, which are dominated by fresh products. Through the differentiation of operational formats, a variation of disposal reasons and disposal risks can be demonstrated. However, where references to purchasing sources are made in the literature [59], a detailed differentiation according to operating formats and their food waste vulnerability has not been sufficiently documented so far. In our own study, this data were formulated as an open question, so that it was possible to map "complete" networks of supply sources and the associated food waste susceptibilities of private households according to self-assessment.

The data collected here were then bundled into lifestyle groups. This approach finds various analogies in other publications. Chen and House [51] (p. 2) came to the conclusion that "lifestyle segmentation outperforms demographic segmentation by reflecting consumer psychological profiles". Demographic characteristics are only derived from lifestyle segmentation [79] (p. 124). Di Talia et al. [80] (N = 213; three groups), Thøgersen [57] (N = 335, five groups), Richter [81] (N = 1023; three groups) and Aschemann-Witzel et al. [76] (N = 826; four groups) exemplify this approach. Although their items differed in wording, number and survey methodology (postal, face-to-face, online), they were able to identify groups of people who are similar in their lifestyles. Typically, it was possible to identify groups that were differently open to the topics of food, cooking interests, price orientation and shopping optimization. This makes them much more suitable for a target group-specific approach to food waste solutions, even if they are much more difficult to characterize than monocausal demographic indicators. In the lifestyle analysis, the demographic assignments were only at the end of the study [63] (p. 14) and not at the beginning. Despite different cluster designations, our own study is also able to show the split between open-minded and planning shoppers versus convenient and spontaneous shoppers.

The Spontaneous group in particular (see Appendix B), which consequently also admitted to food waste practices most frequently in its self-assessment, was particularly at risk of disposing of food in its short-term food purchases, often without a shopping list and without meal planning. Other works already refer to the importance of organized and reflective shopping for food waste minimization [82] (p. 18), [80] (p. 169). This applies in

particular to the group of so-called sustainable consumers who, as green consumers, orient their approach to organized shopping planning and pay attention to selected quality, the use of alternative shopping sources and the consumption of leftovers. Appendix C makes it clear that income was not a disqualifying factor for pursuing sustainable living concepts. Both the lowest and highest income brackets were disproportionately represented in the Sustainable group in our own survey.

Thus, while on the one hand food is idealized and perceived as "worth protecting" (against food waste susceptibility), other groups, such as the spontaneous or the comfortable, recognize in it consumer and repurchasable goods whose aging processes in the kitchen and household are completely "normal" and also include food waste losses. Not a single group presented here was immune to food waste occurrences in their own households. The experience that a not insignificant number of subjects completely deny food waste occurrence in their household (see Table 8; especially in the Smart group) was also confirmed by other studies [34] (p. 4), [83] (p. 2527).

Although the literature base on food waste has continued to grow in recent years, the perspective proposed here of examining the food waste behaviour of private households also from the complexity of a wide variety of retail sources is not reflected in the reviews, handbooks and mainstream articles to date [4,44,46]. Chen [84] explicitly pointed out the need to take "situational factors" seriously as an explanatory factor of food waste behaviour. These situational criteria, which food offers are available and accessible within a reasonable distance, which food offers are accepted by the market according to price, freshness, origin, etc., whether different forms of food retailing are also accepted as offer alternatives by private households in order to generate different food waste, have so far remained unknown to the established waste sciences.

7. Conclusions

The data collected here combine three data worlds from the perspective of private households, that of attitude sets, purchasing behaviour and disposal behaviour. They show a high degree of congruence in terms of content. In particular, the recording of shopping behaviour goes far beyond analogue work in its differentiation across individual operating formats and associated mobility expenditures [55]. In no known work has this recording been carried out so extensively and systematically so far.

As structurally similar as the disposal baskets of the cluster groups were, their origins and reasons for disposal were significantly different. The simplicity that diverse groups avoid shopping sources or are immune to food waste does not exist. The groups were characterized by breadth and an interest in diversifying food sourcing as well as awareness, from which different disposal susceptibilities emerged. The merchandise world of discounters and supermarkets produces significantly broader reasons for disposal for private households than dominant fresh food sellers due to their structural characteristics (of finished products).

The thesis of the multi-dimensional and causally invisible food-related lifestyle is extended to the food(waste)-related lifestyle and ties in with the work of Aschemann-Witzel et al. [56]. There is no homogeneous population that can be attributed to exclusive patterns of supply or disposal. The effort of trying to recognise these patterns is nevertheless great. One-dimensional relationships of selected demographic structures to disposal behaviour are not the focus of this work.

In order to prevent food waste in private households, informational and dialog-like support is required from upstream and downstream actors in the supply/disposal chain. These are producers and different retail formats on the one hand and waste management companies on the other. As an example, a small qualitative sample in the form of expert interviews was used to provide this outlook according to best practice information for private households.

This results in points for future research, which are also located in the interest of a (retail) trade geographic perspective and expand the discussion about the attitudes and

spatially differentiating practices of private households. What level of knowledge do retail actors have about the food waste attitudes and behaviours of their clientele? What "solutions" and communicative channels do retail actors or primary producers offer their customers to minimize the food waste vulnerability of specific product groups? What is the interest and level of knowledge of households to engage in these assistance measures, information channels and "savior actions"? These investigations can be carried out at the meso- and micro-levels (not on a nation state level) in order to do justice to the situational diversity of grocery goods, retail formats and food waste. In scientific geography, these spatial references to food have recently also been thematized as food(waste?)scapes [85]. If spatial references are available, this content can be presented using digital–visual methods and data intersection such as network methodology and Geographical Information Systems, e.g., in order to scrutinize smaller-scale differences in food waste behaviour.

8. Limitations

In the following, all relevant limitations for the informative value of our own investigations are listed. Some of these limitations are not explicitly new, and are also named in other investigations.

The data are not subject to any (natural) scientific precision. Rather, they reflect assessments, memories and relevancies as set by the respondents themselves in partly open-ended questions [61] (p. 380), [76] (p. 179), [83] (p. 2528). The data reflect the answer set of the respondent and thus not necessarily the assessments or practices of other members in the same household [29]. Questionnaire selection and length are subject to multiple trade-offs according to time and financial constraints, as well as acceptability among subjects and local stakeholders. Various COVID-19 waves in 2020 and 2021 contributed to the fact that two site communities dropped out during the survey or subjects decided not to participate. The differentiation by groups was subject to statistical procedures that required specifications by the author in order to bundle both cases and variables in the "best possible" way. Thus, the chosen procedures could have been different [86] (p. 10) The evaluated questionnaires were not always completely filled out. This resulted in the problem that correlating data were missing in the case of data bundling, and thus n-values can fluctuate.

The focus of the study was explicitly not to map the representativeness of data beyond the case region for an entire country such as Germany, but rather the methodological feasibility to derive task sets from this at the meso-level to be transferred to other case regions. In contrast to samples from other studies, our own case regions were full surveys whose validity depends on response rates (Table 1) (in other studies data collection was by market research companies [56] (p. 2), [57] (p. 18). The literature base is much broader than the sources presented here. The latter are necessarily subject to the compromise of basic sources and more recent sources in their selection in order to best reflect the discourse on food waste.

The data collection took place during the COVID-19 pandemic, so that anomalies and deviations in purchasing and waste behaviour or their assessments of this compared with pre-COVID-19 times cannot be ruled out [87]. Whether conspicuousness actually existed for the case study and in this time window can only be shown by follow-up studies in a comparative static analysis. However, new crisis conditions such as inflation, energy shortages and globally disrupted supply chains as a result of the Ukraine crisis do not lead us to expect that the post-COVID-19 phase will seamlessly resume the conditions prevailing before the COVID-19 crisis.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not applicable.

Appendix A

Table A1. Questions in the Survey.

I go shopping in discounters (Aldi, Lidl, Penny).
I go shopping in supermarkets (Edeka, Sky Rewe).
I usually think about what I want to buy before I go shopping.
I make a shopping list before I buy food.
I plan my meals for a few days in advance, so I can shop in a more targeted way.
I like to cook and buy my groceries for this purpose.
I always buy all my groceries from one shop of my choice.
I go to the shop closest to my home.
I go to the shop closest to my place of work.
I want to be able to reach the shop easily by car.
I want to be able to reach the shop easily on foot.
I want to be able to reach the shop easily by bicycle.
When shopping for groceries, the price is most important to me.
Fresh products are important to me.
Organic products are important to me.
I sometimes forget something in the fridge.
I like to buy food spontaneously.
Shopping for food is simply a MUST for me.
What I (we) eat at home I is often a last-minute decision.
I like to eat with other people.
I use advertising leaflets from supermarkets and discounters to select special offers.
Especially since COVID-19, I have stockpiled more food in the form of jars and canned goods.
I like to eat in Restaurants.
If there are any leftovers, I have them packed up in the restaurant to take away.
I like always having plenty of food at home.
In my home everything is always eaten up.
I have a guilty conscience when I have to throw food away.
The appearance of fruit and vegetables is important for my purchase decision.
When I go shopping, I choose food products with a long best-before date.
I dispose of suitable food waste in the organic waste bin and/or in the compost.
If food is left over, I also eat it later.
I freeze food to preserve it.
I buy products that come from the 'region'.
In my childhood, food waste was an important topic in the family.
I need variety in my food.
I am good at estimating how much food I need in the household.
I also use other shopping alternatives like online grocery shopping on my PC.
I also use other shopping alternatives like a village/farm shop.
I also use other shopping alternatives like a weekly market.
I follow media reports on the topic food.
1 = not at all true; 2 = seldom true; 3 = sometimes true; 4 = often true; 5 = totally true; very often true
How many rooms do you have in your apartment besides kitchen and bathroom?
How many cars do you have in your household?
How do you dispose of organic waste at home? (residual waste bin; organic waste bin; compost; sink; toilet; animal food; another option)
What was the last food you threw away at home and what do you remember? (fruit, vegetable, bread, drink, other baked goods, sausage, meat, dairy product, ready meal, other item)
Why did you throw this food away? (too large a package, rotten/mouldy, do not like the taste(anymore), best before date exceeded, too hard, mispurchase, forgotten in the cupboard, appearance no longer good, another option=
Where did you get this food from? (supermarket, discounter, village shop, farm shop, weekly market, hypermarket, on the internet, own production e.g., from garden, another option)
How often does food waste (no peel or bone residues) occur in your household? (never, daily, several times a week, weekly, several times a month, monthly, less often)
Who produces food waste in your household? (yourself, partner, children in the household, guests in the household, others)
Fruit and vegetables are sometimes thrown away in my house.
Dairy products such as yoghurt or cheese are sometimes thrown away.
Bread is sometimes thrown away.
Packaged food is sometimes thrown away.
1 = not at all true; 2 = seldom true; 3 = sometimes true; 4 = often true; 5 = totally true; very often true

Table A1. *Cont.*

On average, how often do you buy food for your household? (daily, three to four times a week, twice a week, once a week, fortnightly, less often)
Where do you mainly buy food for your household?
How much time do you usually need to get to the nearest food supplier of your choice? (Indicate in minutes for a single route)
What means of transport do you normally use for this? (on doot, by bicycle, by car, by bus/public transport, by taxi, motorbike, other way)

How old are you?
What is your gender? (male, female, diverse)
How many people live with you in your household in total?
How many children under 13 live with you in your household?
What is the name of your municipality or the postal code of your place of residence?
How many years have you lived in the current community?
What is your current occupation? (housewife/husband, student, retired, self-employed, employed, civil servant, not employed)
What is the current total net income of all your household members per month (in euros)? (0–500, 501–1000; 1001–1500, 1501–2000, 2001–2500, 2501–3500, 3501–5000, greater than 5000, not specified)

Appendix B

Table A2. Cluster Structure (Means Values: 1 not at All True; 5 Totally True/Very often True); Source: [63] (p. 45).

Factor	Item	Smart	Spontaneous	Comfortable	Sustainable	Kruskal–Wallis Test
1	Shopping list	4.7	**3.1**	4.6	4.5	<0.001
1	Plan meals	4.2	**2.8**	3.5	4.1	<0.001
1	Think before shopping	4.8	3.8	4.8	4.8	<0.001
1	Spontaneous shopping	2.2	**3.1**	2.6	2.3	<0.001
1	Last-minute food	2.4	**3.3**	3.2	2.3	<0.001
2	Village shop	2.9	2.7	2.9	2.7	<0.001
2	Regional food	**4.2**	3.6	3.9	3.9	<0.001
2	Weekly market	**3.6**	2.9	2.7	2.9	<0.001
2	Organic products	3.6	2.9	3.5	**3.8**	<0.001
3	Eat up everything	4.1	3.7	3.6	4.1	<0.001
3	Forgotten in fridge	2.1	2.3	**2.7**	2.1	<0.001
3	Good estimates	4.5	**3.8**	4.0	4.3	<0.001
3	Eat later	4.6	4.2	4.6	**4.8**	<0.001
4	Easily on foot	3.2	2.7	2.5	**3.3**	<0.001
4	Easily by bicycle	3.4	2.5	2.7	**3.6**	<0.001
4	Easily by car	3.7	3.6	**4.3**	2.9	<0.001
5	Appearance fruit	4.3	3.9	4.0	3.1	<0.001
5	Long best-before-date	**4.2**	3.5	3.7	2.7	<0.001
6	Only in one shop	2.3	2.2	2.9	2.7	<0.001
6	In discounters	3.5	3.6	3.3	3.1	<0.001
6	Advertising leaflets	**3.5**	2.9	2.6	**2.5**	<0.001
7	Like to cook	4.8	3.9	4.4	4.8	<0.001
7	Fresh products	4.8	4.0	4.6	4.5	<0.001
8	Stockpiling COVID-19	2.6	2.3	**1.9**	2.1	<0.001
8	Plenty at home	**3.7**	3.3	3.3	3.3	<0.001
9	Like restaurants	3.1	3.4	3.1	3.2	<0.001
9	Eating in company	4.0	3.7	3.6	**4.1**	<0.001
9	Variety	**4.4**	3.9	3.5	3.8	<0.001
10	Close to work	1.8	2.3	2.2	2.3	<0.001
10	Close to home	3.2	3.0	3.3	3.2	<0.001
11	Take leftovers home	2.6	2.8	2.9	**3.6**	<0.001
11	Eat later	4.6	4.2	4.6	**4.8**	<0.001

Appendix C

	Smart	Spontaneous	Comfortable	Sustainable
Female ⌀ 74.9	78.3	61.7	76.2	79.2
Male ⌀ 25.1	21.7	38.3	23.8	20.8
Age -40 ⌀ 21.8	11.5	18.1	23.7	46.1
41-64 ⌀ 47.2	48.4	54.9	58.1	42.4
65+ ⌀ 31	40.1	27	18.2	11.4
Children under 13 ⌀ 15.7	12.5	12.8	24.7	21.4
Single person household ⌀ 26.2	23.1	28	21.4	27.5
Retired ⌀ 33.1	43.6	28	21	13.5
Employee ⌀ 38	31.5	40.7	46.7	47.3
Pupils and students ⌀ 5.6	2	2.8	3.1	17.2
Income up to 1500 euros ⌀ 12.5	9.4	13	9.1	16.7
1501-2500 euros ⌀ 24.2	23.8	22.8	19	24.4
2501-5000 euros ⌀ 50.4	56	53.3	55.6	41.9
5001 euros+ ⌀ 12.9	10.8	10.9	16.3	17
Urban ⌀ 42.6	43.2	39.8	34.8	58.9
No car ⌀ 6.9	4.3	6.1	1	16.3

Figure A1. Group Structure (in %) (Source: Author's surveys 20021). Notes: The colouring is determined by the mean absolute deviation. If the deviation from the mean value is smaller than the mean absolute deviation, it counts as a moderate deviation and, accordingly, has a light green or yellow colouring. If the deviation is higher than the mean absolute deviation, it counts as an above-average deviation and then has a dark green or red colouring.

Appendix D

Table A3. Interview Partners.

Food Sector	Company	Interview Partner	Time
Bakery products	Kornkraft Schinkel	Production manager	7 December 2021
Bakery products	Backhaus Passade	Production manager	6 January 2022
Dairy products	Riecken Milch	Owner	5 January 2022
Dairy products	Rzehak Biohof	Owner	12 January 2022
Dairy products	Geestfrisch	Owner	14 January 2022
Dairy products	Hof Berg Dannau	Production manager	20 January 2022
Meat	Ahrens Fleisch	Owner	12 January 2022
Meat	Slowfood Kiel	Main speaker	17 January 2022
Fruits and vegetable	Biokiste Loubier	Owner	13 January 2022
Fruits and vegetable	Obstquelle Schuster	Owner	20 January 2022
Marketing	Kubitzberg Altenhof	Sales manager	22 March 2022
Fresh food	Hamfelder Hof	Production manager	3 May 2022
Foodsharing	Foodsharing Kiel	Main speaker	21 June 2022

References

1. Feedback EU. *No Time to Waste: Why the EU Needs to Adopt Ambitious Legally Binding Food Waste Reduction Targets*; Feedback EU: Rijswijk, The Netherlands, 2022; Available online: https://feedbackglobal.org/wp-content/uploads/2022/09/Feedback-EU-2022-No-Time-To-Waste-report-1.pdf (accessed on 19 December 2022).
2. Kneafsey, M.; Maye, D.; Holloway, L.; Goodman, M. *Geographies of Food*; Bloomsbury Academic: London, UK, 2021.
3. Oliveira, M.; Lago, A.; Magro, G. Food loss and waste in the context of the circular economy: A systematic review. *J. Clean. Prod.* **2021**, *294*, 126284. [CrossRef]
4. Reynolds, C.; Soma, T.; Spring, C.; Lazell, J. *Routledge Handbook of Food Waste*; Routledge: London, UK, 2020.
5. Blakeney, M. *Food Loss and Food Waste—Causes and Solutions*; Edward Elgar Publishing: Cheltenham, UK, 2019.
6. Coudard, A.; Corbin, E.; de Koning, J.; Tukker, A.; Mogollón, J. Global water and energy losses from consumer avoidable food waste. *J. Clean. Prod.* **2021**, *326*, 129342. [CrossRef]
7. Dou, Z.; Toth, J. Global primary data on consumer food waste: Rate and characteristics: A review. *Resour. Conserv. Recycl.* **2021**, *168*, 105332. [CrossRef]
8. Chen, C.; Chaudhary, A.; Mathys, A. Nutritional and environmental losses embedded in global food waste. *Resour. Conserv. Recycl.* **2020**, *160*, 104912. [CrossRef]
9. UNEP (United Nations Environment Programme). *Food Waste Index Report 2021*; UNEP: Nairobi, Kenya, 2021; Available online: https://www.unep.org/resources/report/unepfood-waste-index-report-2021 (accessed on 7 December 2022).
10. Schmidt, T.; Schneider, F.; Leverenz, D.; Hafner, G. *Lebensmittelabfälle in Deutschland—Baseline 2015*; Thünen Report 71; Thünen Institute: Braunschweig, Germany, 2019; Available online: https://www.thuenen.de/media/publikationen/thuenen-report/Thuenen_Report_71.pdf (accessed on 19 December 2022).
11. Roodhuyzen, D.; Luning, P.; Fogliano, V.; Steenbekkers, L. Putting together the puzzle of consumer food waste: Towards an integral perspective. *Trends Food Sci. Technol.* **2017**, *68*, 37–50. [CrossRef]
12. Schanes, K.; Dobernig, K.; Gözet, B. Food waste matters—A systematic review of household food waste practices and their policy implications. *J. Clean. Prod.* **2018**, *182*, 978–991. [CrossRef]
13. Boulet, M.; Hoek, A.; Raven, R. Towards a multi-level framework of household food waste and consumer behaviour: Untangling spaghetti soup. *Appetite* **2021**, *156*, 104856. [CrossRef]
14. Okayama, T.; Watanabe, K.; Yamakawa, H. Sorting analysis of household food waste–Development of a methodology compatible with the aims of SDG12.3. *Sustainability* **2021**, *13*, 8576. [CrossRef]
15. Jeswani, H.; Figueroa-Torres, G.; Azapagic, A. The extent of food waste generation in the UK and its environmental impacts. *Sustain. Prod. Consum.* **2021**, *26*, 532–547. [CrossRef]
16. Galanakis, C. (Ed.) *Food Waste Recovery—Processing Technologies and Industrial Techniques*; Elsevier: Amsterdam, The Netherlands, 2015.
17. Zhang, M.; Gao, M.; Yue, S.; Zheng, T.; Ma, X.; Wang, Q. Global trends and future prospects of food waste research: A bibliometric analysis. *Environ. Sci. Pollut. Res.* **2018**, *25*, 24600–24610. [CrossRef]
18. Caldeira, C.; Laurentiis, V.; Corrado, S.; Holsteijn, F.; Sala, S. Quantification of food waste per product group along the food supply chain in the European Union: A mass flow analysis. *Resour. Conserv. Recycl.* **2019**, *149*, 479–488. [CrossRef]
19. Canali, M.; Amani, P.; Aramyan, L.; Gheoldus, M.; Moates, G.; Östergren, K.; Silvennoinen, K.; Waldron, K.; Vittuari, M. Food waste drivers in Europe, from identification to possible interventions. *Sustainability* **2017**, *9*, 37. [CrossRef]
20. Delley, M.; Brunner, T. Household food waste quantification: Comparison of two methods. *Br. Food J.* **2018**, *120*, 1504–1515. [CrossRef]

21. Bovay, J.; Zhang, W. A century of profligacy? The measurement and evolution of food waste. *Agric. Resour. Econ. Rev.* **2019**, *49*, 375–409. [CrossRef]

22. Priefer, C.; Jörissen, J.; Bräutigam, K. Food waste prevention in Europe—A cause-driven approach to identify the most relevant leverage points for action. *Resour. Conserv. Recycl.* **2016**, *109*, 155–165. [CrossRef]

23. Huang, I.; Manning, L.; James, K.; Grigoriadis, V.; Millington, A.; Wood, V.; Ward, S. Food waste management: A review of retailers' business practices and their implications for sustainable value. *J. Clean. Prod.* **2021**, *285*, 125484. [CrossRef]

24. Principato, L. *Food Waste at Consumer Level—A Comprehensive Literature Review*; Springer: Cham, Switzerland, 2018.

25. Sahakian, M.; Shenoy, M.; Soma, T.; Warabe, A.; Yagasa, R.; Premakumara, D.; Liu, C.; Favis, A.; Saloma, C. Apprehending food waste in Asia—Policies, practices and promisung trends. In *Routledge Handbook of Food Waste*; Reynolds, C., Soma, T., Spring, C., Lazell, J., Eds.; Routledge: London, UK, 2020; pp. 187–206.

26. Bemmel, A.; Parizeau, K. Is it food or is it waste? The materiality and relational agency of food waste across the value chain. *J. Cult. Econ.* **2020**, *13*, 207–220. [CrossRef]

27. Smith, A. The perfect storm—A history of food waste. In *Routledge Handbook of Food Waste*; Reynolds, C., Soma, T., Spring, C., Lazell, J., Eds.; Routledge: London, UK, 2020; pp. 37–54.

28. European Union. Commission delegated decision (EU) 2019/1597 of 3 May 2019 supplementing Directive 2008/98/EC of the European Parliament and of the Council as regards a common methodology and minimum quality requirements for the uniform measurement of levels of food waste. *Off. J. Eur. Union* **2019**, *62*, L248/77–L248/85. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D1597&from=EN (accessed on 12 February 2023).

29. Parizeau, K. Household food waste. In *Routledge Handbook of Food Waste*; Reynolds, C., Soma, T., Spring, C., Lazell, J., Eds.; Routledge: London, UK, 2020; pp. 129–143.

30. Liu, C.; Chen, J. Takeaway food, waste, and their geographies in workplace. *Geogr. Res.* **2019**, *58*, 265–274. [CrossRef]

31. Giordano, C.; Piras, S.; Boschini, M.; Falasconi, L. Are questionnaires a reliable method to measure food waste? A pilot study on Italian households. *Br. Food J.* **2018**, *120*, 2885–2897. [CrossRef]

32. Szabó-Bódi, B.; Kasza, G.; Szakos, D. Assessment of household food waste in Hungary. *Br. Food J.* **2018**, *120*, 625–638. [CrossRef]

33. Dooren, C.; Janmaat, O.; Snoek, J.; Schrijnen, M. Measuring food waste in Dutch households: A synthesis of three studies. *Waste Manag.* **2019**, *94*, 153–164. [CrossRef] [PubMed]

34. Herzberg, R.; Schmidt, T.; Schneider, F. Characteristics and determinants of domestic food waste: A representative diary study across Germany. *Sustainability* **2020**, *12*, 4702. [CrossRef]

35. Corrado, S.; Sala, S. Food waste accounting along global and European food supply chains: State of the art and outlook. *Waste Manag.* **2018**, *79*, 120–131. [CrossRef]

36. WWF. *Das große Wegschmeißen—Vom Acker bis zum Verbraucher*; WWF: Berlin, Germany, 2015; Available online: https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF_Studie_Das_grosse_Wegschmeissen.pdf (accessed on 19 December 2022).

37. GfK. *Systematische Erfassung des Lebensmittelabfalls der Privaten Haushalte in Deutschland—Schlussbericht 2020*; GfK: Nuremburg, Germany, 2021; Available online: https://www.bmel.de/SharedDocs/Downloads/DE/_Ernaehrung/Lebensmittelverschwendung/GfK-Analyse-2020.pdf?__blob=publicationFile&v=4 (accessed on 19 December 2022).

38. Bundesministerium für Ernährung. *Ermittlung der Weggeworfenen Lebensmittelmengen und Vorschläge zur Verminderung der Wegwerfrate bei Lebensmitteln in Deutschland*; Institut für Siedlungswasserbau, Wassergüte- und Abfallwirtschaft: Stuttgart, Germany, 2012; Available online: https://www.bmel.de/SharedDocs/Downloads/DE/_Ernaehrung/Lebensmittelverschwendung/Studie_Lebensmittelabfaelle_Langfassung.pdf?__blob=publicationFile&v=3 (accessed on 19 December 2022).

39. Schmidt, T.; Schneider, F.; Claupein, E. *Food Waste in Private Households in Germany*; Thünen Working Paper 92a; Thünen Institute: Braunschweig, Germany, 2019; Available online: https://literatur.thuenen.de/digbib_extern/dn061022.pdf (accessed on 19 December 2022).

40. Stancu, V.; Lähteenmäki, L. Consumer-related antecedents of food provisioning behaviors that promote food waste. *Food Policy* **2022**, *108*, 102236. [CrossRef]

41. Annunziata, A.; Agovino, M.; Ferraro, A.; Mariani, A. Household food waste: A case study in southern Italy. *Sustainability* **2020**, *12*, 1495. [CrossRef]

42. Parizeau, K.; Massow, M.; Martin, R. Household-level dynamics of food waste production and related beliefs, attitudes, and behaviours in Guelph, Ontario. *Waste Manag.* **2015**, *35*, 207–217. [CrossRef]

43. Evans, D. Beyond the throwaway society: Ordinary domestic practice and a sociological approach to household food waste. *Sociology* **2012**, *46*, 41–56. [CrossRef]

44. Santos, J.; Silveira, D.; Costa, M.; Duarte, R. Consumer behaviour in relation to food waste: A systematic literature review. *Br. Food J.* **2022**, *124*, 4420–4439. [CrossRef]

45. Harvey, J.; Nica-Avram, G.; Smith, M.; Hibbert, S.; Muthuri, J. Mapping the landscape of consumer food waste. *Appetite* **2022**, *168*, 105702. [CrossRef]

46. Principato, L.; Mattia, G.; Leo, A.; Pratesi, C. The household wasteful behaviour framework: A systematic review of consumer food waste. *Ind. Mark. Manag.* **2020**, *93*, 641–649. [CrossRef]

47. Moraes, N.; Lermen, F.; Echeveste, M. A systematic literature review on food waste/loss prevention and minimization methods. *J. Environ. Manag.* **2021**, *286*, 112268. [CrossRef]

48. Sunday, C.; Sowunmi, F.; Obayelu, O.; Awoyemi, A.; Omotayo, A.; Ogunniyi, A. Disentangling drivers of food waste in households: Evidence from Nigeria. *Foods* **2022**, *11*, 1103. [CrossRef] [PubMed]

49. Koivupuru, H.; Hartikainen, H.; Silvennoinen, K.; Katajajuuri, J.; Heikintalo, N.; Reinikainen, A.; Jalkanen, L. Influence of socio-demographical, behavioural and attitudinal factors on the amount of avoidable food waste generated in Finnish households. *Int. J. Consum. Stud.* **2012**, *36*, 183–191. [CrossRef]

50. González-Santana, R.; Blesa, J.; Frígola, A.; Esteve, M. Dimensions of household food waste focused on family and consumers. *Crit. Rev. Food Sci. Nutr.* **2020**, *62*, 2342–2354. [CrossRef] [PubMed]

51. Chen, L.; House, L. Food lifestyle patterns among contemporary food shoppers. *Int. J. Consum. Stud.* **2021**, *46*, 944–963. [CrossRef]

52. Wells, W. Psychographics: A critical review. *J. Mark. Res.* **1975**, *12*, 196–213. [CrossRef]

53. Darden, W.; Ashton, D. Psychographic profiles of patronage preference groups. *J. Retail.* **1974**, *50*, 99–112.

54. Oates, B.; Shufeldt, L.; Vaught, B. A psychographic study of the elderly and retail store attributes. *J. Consum. Mark.* **1996**, *13*, 14–27. [CrossRef]

55. Grunert, K.; Brunsø, K.; Bisp, S. *Food-Related Lifestyle*; MAPP Working Paper No. 12; University of Aarhus: Aarhus, Denmark, 1993; Available online: https://pure.au.dk/portal/files/88/wp12.pdf (accessed on 21 December 2022).

56. Aschemann-Witzel, J.; de Hooge, I.; Almli, V. My style, my food, my waste! Consumer food waste-related lifestyle segments. *J. Retail. Consum. Serv.* **2021**, *59*, 102353. [CrossRef]

57. Thøgersen, J. Sustainable food consumption in the nexus between national context and private lifestyle: A multi-level study. *Food Qual. Prefer.* **2017**, *55*, 16–25. [CrossRef]

58. Stancu, V.; Haugaard, P.; Lähteenmäki, L. Determinants of consumer food waste behaviour: Two routes to food waste. *Appetite* **2016**, *96*, 7–17. [CrossRef]

59. Giordano, C.; Alboni, F.; Cicatiello, C.; Falasconi, L. Do discounted food products end up in a bin? An investigation into the link between deal-prone shopping behaviour and quantities of household food waste. *Int. J. Consum. Stud.* **2019**, *43*, 199–209. [CrossRef]

60. Visschers, V.; Wickli, N.; Siegrist, M. Sorting out food waste behaviour: A survey on the motivators and barriers of self-reported amounts of food waste in households. *J. Environ. Psychol.* **2016**, *45*, 66–78. [CrossRef]

61. Stefan, V.; van Herpen, E.; Tudoran, A.; Lähteenmäki, L. Avoiding food waste by Romanian consumers: The importance of planning and shopping routines. *Food Qual. Prefer.* **2013**, *28*, 375–381. [CrossRef]

62. Grzeskowiak, S.; Sirgy, M.; Foscht, T.; Swoboda, B. Linking retailing experiences with life satisfaction: The concept of storey-type congruity with shopper's identity. *Int. J. Retail. Distrib. Manag.* **2016**, *44*, 124–138. [CrossRef]

63. Nilsson, E.; Gärling, T.; Marell, A.; Nordvall, A. Who shops groceries where and how?—The relationship between choice of store format and type of grocery shopping. *Int. Rev.Retail. Distrib. Consum. Res.* **2015**, *25*, 1–19. [CrossRef]

64. Jürgens, U. Food waste and shopping behaviour—Quantitative household investigations based on local case studies from Germany. *Die Erde* **2022**, *153*, 28–59. [CrossRef]

65. Aschemann-Witzel, J.; Hooge, I.; Amani, P.; Bech-Larsen, T.; Oostindjer, M. Consumer-related food waste: Causes and potential for action. *Sustainability* **2015**, *7*, 6457–6477. [CrossRef]

66. World Resources Institute. *Mapping Social Landscapes*; WIR: Washington, DC, USA, 2018; Available online: https://www.wri.org/research/mapping-social-landscapes-guide-identifying-networks-priorities-and-values-restoration (accessed on 19 December 2022).

67. Cherven, K. *Mastering Gephi Network Visualization*; Packt Publ.: Birmingham, UK, 2015.

68. Holzer, B.; Stegbauer, C. (Eds.) *Schlüsselwerke der Netzwerkforschung*; Springer: Wiesbaden, Germany, 2019.

69. Maggioni, I. What drives customer loyalty in grocery retail? Exploring shoppers' perceptions through associative networks. *J. Retail. Consum. Serv.* **2016**, *33*, 120–126. [CrossRef]

70. Brinkley, C. Visualizing the social and geographical embeddedness of local food systems. *J. Rural. Stud.* **2017**, *54*, 314–325. [CrossRef]

71. Hanssen, O.; Syversen, F.; Stø, E. Edible food waste from Norwegian households-detailed food waste composition analysis among households in two different regions in Norway. *Resour. Conserv. Recycl.* **2016**, *109*, 146–154. [CrossRef]

72. Aschemann-Witzel, J. Helping you to waste less? Consumer acceptance of food marketing offers targeted to food-related lifestyle segments of consumers. *J. Food Prod. Mark.* **2018**, *24*, 522–538. [CrossRef]

73. Young, C.; Russell, S.; Robinson, C.; Chintakayala, P. Sustainable retailing—Influencing consumer behaviour on food waste. *Bus. Strategy Environ.* **2018**, *27*, 1–15. [CrossRef]

74. Welch, D.; Swaffield, J.; Evans, D. Who's responsible for food waste? Consumers, retailers and the food waste discourse coalition in the United Kingdom. *J. Consum. Cult.* **2021**, *21*, 236–256. [CrossRef]

75. Augustin, M.; Sanguansri, L.; Fox, E.; Cobiac, L.; Cole, M. Recovery of wasted fruit and vegetables for improving sustainable diets. *Trends Food Sci. Technol.* **2020**, *95*, 75–85. [CrossRef]

76. Aschemann-Witzel, J.; de Hooge, I.; Almli, V.; Oostindjer, M. Fine-tuning the fight against food waste. *J. Macromarketing* **2018**, *38*, 168–184. [CrossRef]

77. Ajzen, I. The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* **1991**, *50*, 179–211. [CrossRef]

78. Falasconi, L.; Cicatiello, C.; Franco, S.; Segrè, A.; Setti, M.; Vittuari, M. Such a shame! A study on self-perception of household food waste. *Sustainability* **2019**, *11*, 270. [CrossRef]

79. Verain, M.; Bartels, J.; Dagevos, H.; Sijtsema, S.; Onwezen, M.; Antonides, G. Segments of sustainable food consumers: A literature review. *Int. J. Consum. Stud.* **2012**, *36*, 123–132. [CrossRef]

80. Di Talia, E.; Simeone, M.; Scarpato, D. Consumer behaviour types in household food waste. *J. Clean. Prod.* **2019**, *214*, 166–172. [CrossRef]

81. Richter, B. Knowledge and perception of food waste among German consumers. *J. Clean. Prod.* **2017**, *166*, 641–648. [CrossRef]

82. Graham-Rowe, E.; Jessop, D.; Sparks, P. Identifying motivations and barriers to minimising household food waste. *Resour. Conserv. Recycl.* **2014**, *84*, 15–23. [CrossRef]

83. McCarthy, B.; Liu, H. Waste not, want not—Exploring green consumers' attitudes towards wasting edible food and actions to tackle food waste. *Br. Food J.* **2017**, *119*, 2519–2531. [CrossRef]

84. Chen, M. Integrating the extended theory of planned behavior model and the food-related routines to explain food waste behavior. *Br. Food J.* **2023**, *125*, 645–661. [CrossRef]

85. Vonthron, S.; Perrin, C.; Soulard, C. Foodscape: A scoping review and a research agenda for food security-related studies. *PLoS ONE* **2020**, *15*, e0233218. [CrossRef]

86. Amicarelli, V.; Tricase, C.; Spada, A.; Bux, C. Households' food waste behavior at local scale: A cluster analysis after the COVID-19 lockdown. *Sustainability* **2021**, *13*, 3283. [CrossRef]

87. Iranmanesh, M.; Ghobakhloo, M.; Nilashi, M.; Tseng, M.; Senali, M.; Abbasi, G. Impacts of the COVID-19 pandemic on household food waste behaviour: A systematic review. *Appetite* **2022**, *176*, 106127. [CrossRef] [PubMed]