# Suboptimal food? Food waste at the consumer–retailer interface

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*Jessica Aschemann-Witzel*[1], *Ilona E. de Hooge*[2] *and Valérie L. Almli*[3]
[1]MAPP Centre, Department of Management, Aarhus School of Business and Social Sciences, Aarhus University, Aarhus, Denmark, [2]Marketing and Consumer Behaviour group, Wageningen University, Wageningen, The Netherlands, [3]Sensory and Consumer Science Department, Nofima, Ås, Norway

**Chapter Outline**



## 12.1 Why a lot of food waste is due to suboptimal food

Food waste is commonly defined as food for human consumption but due to some reason lost or wasted and potentially used for other purposes at some point in the supply chain (FAO, 2011; Fusions, 2015). When food waste occurs closer to the consumption stage, the waste more often concerns items that are ready to be eaten or used by consumers. In reports or in literature, it might quite often be mentioned that the wasted food had been "perfectly edible." However, for food supply chain actors and consumers it does not make sense to waste "perfect food." Therefore, the occurrence of food waste can be mostly attributed to a situation or food not being as optimal as desired, and/or procedures not going according to plan.

In the early stages of the supply chain and in particular in emerging or developing countries, it is primarily the procedures that are not optimal, due to shortcomings of and inefficiencies in harvesting, storage, and transportation (Parfitt et al., 2010). A share of the harvest can be lost in the field because machinery is not efficient, foods can spoil due to shortcomings in storage conditions, or can be lost during transport because the roads are in a bad state or the transport distances are too long. Examples of these are fruits that perish in the field due to being exposed to too much sunlight, or damaged during transportation in the truck (Henz, 2017).

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In developed countries, the technology is more optimized, but then the food itself is not optimal enough compared with the standards and requirements of the processing facilities and the esthetic expectations of retailers and customers. In addition, it can be the case that the item would be too costly to be changed into a product worth selling, given that there is sufficient alternative raw material in a better state, and given the low prices of commodities. For example, potatoes can be too small to be processed, or vegetables can have such deviating shapes that they do not meet storage and transport standards or the expectations of consumers (Stuart, 2009), such as the famous bent cucumber.

In the later stages of the supply chain, it is more likely that the procedures are not optimal, with a lack of optimal storage conditions in stores or consumer households. Also, packages get mislabeled by the processor or dented in wholesale (Raak et al., 2017), retailers order more units than required (Eriksson et al., 2017), and consumers buy items that are subsequently incorrectly treated or not used as planned. Consequently, the product that was perfectly edible at purchase has become not so perfect over time. Or, it is perfectly edible but there is an even better item: it is not as optimal in some way or other as a competing item of the same price in store, or as the item of the same type that awaits use in a household's fridge or cupboard.

## 12.2 Definition of suboptimal food and the consumer–retailer interface

Food being in essence perfectly edible but not as optimal as other available food or not regarded as optimal as desired by a member of the supply chain and in particular by the end-consumer is a major reason why food is wasted. Accordingly, such imperfect or *suboptimal food* can be defined as foods that "deviate from normal or optimal products" in a number of ways, without food safety or the item's intrinsic quality being affected (De Hooge et al., 2017, p. 81). This suboptimality can in particular but not exclusively be in terms of (1) appearance in for example, shape, size, or weight; in terms of (2) the time frame in which the food can still be used, determined by, for example, its state of ripeness or the current date being close to or beyond the indicated date label; or in terms of (3) the status of its packaging being, for example, mislabeled, torn, or dented.

A large share of food waste in developed countries is caused by households (EC, 2010; FAO, 2013). These countries are in a state of economic prosperity and most households show high affluence levels. There is no scarcity of food supply and there is a great diversity of foods offered. The majority of consumer households can not only secure sufficient food with their available income, but also the share of income they use for food is about a tenth of their budget only. Thus, for the occurrence of food waste it is not so crucial whether the food is actually edible or not, but rather in which status of optimality or suboptimality the food is. Given that the greater share of food waste is caused by consumer households, the decision of using or discarding a food regarded as suboptimal is to a great extent taken by consumers. However, consumer choices in terms of food waste are influenced by

actions and choices of the food supply chain, and actions in the food supply chain concerning suboptimal food are influenced by consumer choices, or at least by what the supply chain anticipates the consumer would do. The place where both parts "meet" and interact is typically the retailer, that is, the supermarkets where the consumers purchase foods. This crucial interaction determining food waste up and down the supply chain is therefore the so-called *consumer–retailer interface*.

Examples of interactions between retailers and consumers are consumers selecting the fruits and vegetables with the best appearance from the piles offered in store, and retailers are consequently demanding high esthetic standards from their suppliers. The uniform and "perfect" appearance of the items offered, in turn, also shapes consumer's expectations over time, determining what consumers assume is the adequate and normal appearance of a fruit or a vegetable. Retailers offer lower prices for purchases of larger quantities and of unit sizes with a variety of pricing strategies. This leads consumers to potentially buy more than they need, resulting in food being wasted due to having passed the optimal usage stage in terms of ripeness or date. Consumers, in turn, are often price-sensitive and deal prone, and many consumers favor price-oriented shopping formats, discount-level private labels, and price promotions during shopping. These consumer behaviors motivate retailers to use such approaches. However, producers, processors, and retailers are via their decisions also setting the boundaries for what consumers can decide about in their food choices. For example, the fact that certain misshapen vegetables that the farmers grow do not reach the store in the first place, inhibits any consumer who would actually buy suboptimal foods. The decision of food processors on which date label to print on a package of, for example, pasta—6 months, or maybe 12 months?—might be decisive for the situation much later in time when a consumer checks the cupboards and throws anything past the date in the bin. Only when mislabeled packages or foods in torn or dented packages are nevertheless sold in some way or other—whether in the original store or in some alternative format—can consumers buy and use such suboptimal foods.

## 12.3 Types of suboptimal food and respective decisions on optimality

It follows from the definition of suboptimal food and from the occurrence of food waste as caused by consumers that there are two crucial moments where consumers make a decision on the optimality or suboptimality of food. The first is before *purchase* and in-store, when consumers make a choice on which items to purchase. The second moment is after purchase and at home, when consumers make a choice on whether and which items to use, thus on *consumption*. In the first case, any item not chosen by any consumer might end up being discarded, and the food waste is accounted for as being caused by the retailer. In the second case, any item not chosen by the consumers in the household might end up being discarded, and the burden of food waste is accounted for as consumer household food waste. The suboptimality of the food might be of any type, but the most often described and

cited categories are suboptimality in terms of the *date label*, thus a textual description of the optimality, and the sensory perception of the status of the actual food in *appearance* or any other sensory perception, or in terms of the status of the *packaging* of the food (see Fig. 12.1 for an overview).

This distinction underlines that consumer−related food waste—defined as food that is wasted because of the consumer—is linked to firstly, the purchase decision, and secondly, to the consumption decision. In addition, it underlines that primarily consumer perceptions of and decisions based on date label, appearance, and packaging lead to waste of food otherwise perfectly edible.

The definition of suboptimal food assumes that food safety is not affected or that the item's intrinsic quality is not reduced to any great extent. However, consumers assess certain suboptimal foods to be unsafe even if they are not, or they somehow fear or are uncertain about the safety, and therefore rather not purchase the item or discard it. A lot of research shows that consumers have difficulties understanding and handling date labels and assessing whether foods are still edible (Van Boxstael et al., 2014). Foods that are in fact unsafe to eat are not suboptimal anymore, but have likely been at a stage previously where they were only suboptimal. An example of this is fish past the use-by date, which should not be eaten due to food safety reasons, but which had been perfectly edible before it got to that stage. A food's intrinsic quality refers to the characteristics inherent to the food, such as taste or healthiness (Grunert, 2007). Food quality is understood to be composed of a range of dimensions (Grunert, 2005; Oude Ophuis and van Trijp, 1995), and the degree of quality is assessed on a continuum.

The categories of food suboptimality and the distinction of the purchase versus the consumption situation underline an important observation: a considerable share of suboptimal food is food that has become suboptimal after it was optimal, due to choices and circumstances in the supply chain. Consumer research shows that consumers at times find themselves in the situation where they move food from a stage of suboptimality to inedibility, and then discard the food. An example of this is a banana with a spot, which might remain in the fruit bowl until it has become so intensely brown or black that it is necessary to discard it.

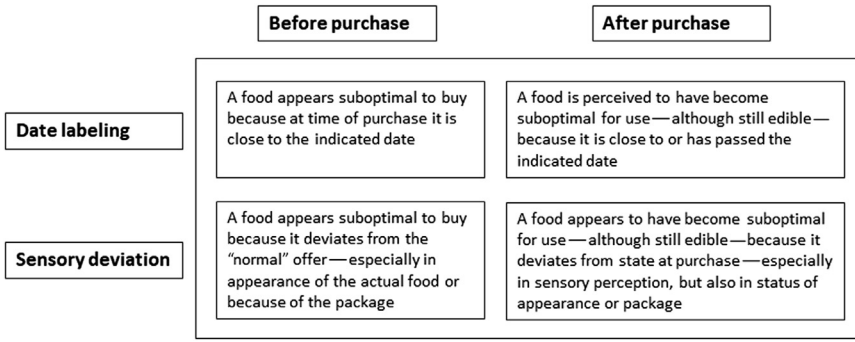


**Figure 12.1** Decisions on optimal versus suboptimal food by consumers.
Source: Own.

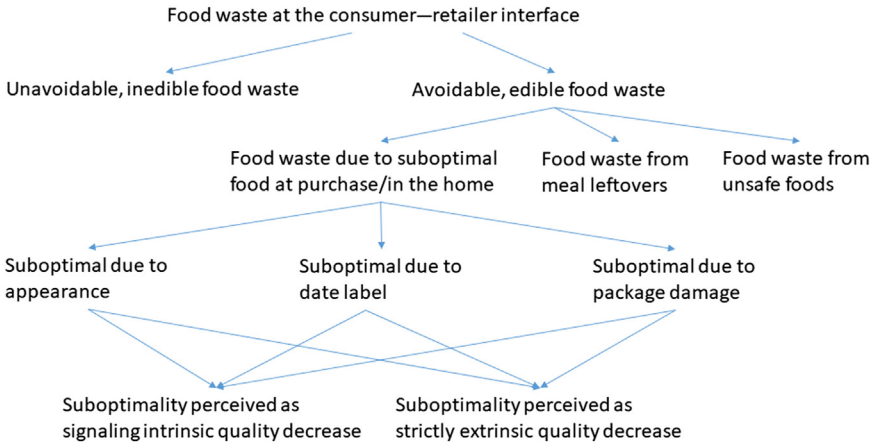


**Figure 12.2** Suboptimal food definition and its major categories within the broader context of food waste.
Source: Own. Adapted from Aschemann-Witzel, J., Giménez, A., Ares, G., 2018b. Consumer in-store choice of suboptimal food to avoid food waste: the role of food category, communication and perception of quality dimensions. Food Qual. Preference, 68, 29–39. Available from: https://doi.org/10.1016/j.foodqual.2018.01.020.

The definition of suboptimal food only concerns foods that are not used or cooked yet, and it does not concern leftovers from prepared food and meals. The reason is that optimality refers to whether the food is optimal enough to be used, and use of the food is the consumption in terms of eating it or using it for preparing a meal. For leftovers, the definition does not apply, although leftovers can of course be in more or less good status for being reused. The process of becoming inedible over time happens for leftovers as well, though, as consumers might store leftovers in the fridge or freezer, until it can be discarded more easily, that is, with less bad consciousness (Evans, 2014), as it is not perfectly edible anymore.

Fig. 12.2 sets the definition of suboptimal food into context, showing the most typical categories and the process of becoming suboptimal through the decisions that consumers make. The figure also shows that even though the food is fine and fit for purchase or consumption, both intrinsic and extrinsic quality dimensions might be assumed to be or perceived to be affected. This happens along a continuum between optimality and suboptimality.

## 12.4 Types of interactions at the consumer–retailer interface

In principal, the interaction between consumers and retailers consists of the retailers offering food physically in the store, and of the retailer communicating about the food and assortment offered. Consumers react to this communication and offer of

food by visiting the store, selecting or deselecting food for purchase, and returning for repurchase. Consumers might also communicate—back to the retailer as well as to other consumers—about their experience with the store and about the assortment. In this interaction in the interface between consumers and retailers, a number of relations are suspected to cause food waste.

With regard to the causes of food waste that relates to the consumer−retailer interface, it is useful to first consider the general factors causing food waste at the consumer level. Extensive research on consumers and food waste and a number of reviews have identified and categorized these factors (Aschemann-Witzel et al., 2015; Hebrok and Boks, 2017; Priefer et al., 2016; Quested et al., 2013). The multitude of factors causing food waste at the consumer level can be boiled down to six clusters of factors, of which the first three are tied to the consumer side, and the last three are tied to the context (Aschemann-Witzel et al., 2015). The first consumer side cluster is about consumer *motivation* to avoid food waste. This cluster concerns consumers being aware and knowledgeable about the food waste issue and about its consequences, the extent to which they hold underlying values, beliefs and attitudes such as environmental concern, perception of social unfairness of food wastage, or a dislike of wasting own monetary resources, which all can play a role in shaping a motivation to avoid food waste in one or the other form. The second consumer side cluster is about the existence of goal conflicts between various consumer motives to buy food related to what the food is used for and the role that it plays in a consumer's life. These conflicts lead to potentially necessary *trade-offs* between the goal of not wasting food and other goals, such as food safety, convenience, sensory experience, or health. As a third consumer side cluster, consumers can possess the knowhow, skills, and *capabilities* to purchase, store, handle, and use food in a way that aims to solve the conflicts and trade-offs between different consumer goals. Yet, oftentimes consumers lack such capabilities, resulting in consumer-related food waste.

The first context-side cluster of factors relates to issues that have to do with the consumer's *social influence* and background, such as upbringing, the family, friends, and neighbors, or the further social surrounding of the consumer in question. Consumers want to fulfill the needs of their loved ones, show affection via the food and meals they provide, or signal acknowledgment, respect, or status to guests with the food that they offer on social occasions. At the same time, consumers might also feel embarrassed by not being able to offer sufficient food for guests, but also when rummaging through and purchasing "shabby" suboptimal food, or if observed wasting food. The second cluster of factors encompasses the concrete *purchase situation*, which is heavily determined by how supermarkets or other stores design their offer, organize the store management, or the market practices enacted in the store. The layout of the store, the type of foods offered, the pricing mechanism applied as well as the packaging all influence consumers food choices for optimal or suboptimal food, or the likelihood that they at some point waste some of the food they have purchased (e.g., if no single-size packages are available, or the food did not have the expected shelf-life, etc.). Third and finally, the consumer's context is shaped by the *macroenvironment*, which means that the political

directions, the legal requirements, the societal trends, the technological possibilities, environmental issues, and economic prosperity impact the context in which the consumer and the retailer act. As various reviews on the causes of food waste underline (Aschemann-Witzel et al., 2015; Hebrok and Boks, 2017; Priefer et al., 2016; Quested et al., 2013), these factors are interrelated and thus do not exert an influence on consumer level food waste separately of the other factors. Fig. 12.3 visualizes the three consumer-side and the three context-side cluster of factors, and underlines that these are interrelated.

With these clusters of causes of food waste as background knowledge, a number of interactions at the consumer−retailer interface can be pointed out. They are basically based on the idea that the point of purchase of food is a place where *foods, money, and information* are exchanged between consumers and retailers.

With regard to the first interaction, the foods, it is the types of foods, the assortment, and the functionalities of the food products offered that determine which foods consumers can buy, what they can do with the foods, and what they expect to find in the assortment the next time they come back to the store. The producer or processor decision of the date label to be printed on the food (a longer or shorter one?) is tied to the food item, as is the package chosen and the functionalities that the package has (does the package protect the content well, can it be separated into units, easily closed again, stored, completely emptied?), or the appearance and sensory aspects of the food product (does the food have an abnormal shape or color, of which size is it, does it have a long shelf-life?). Consumer purchase responses contribute to how retailers determine which foods are offered. For example, when a product package innovation that can easily be fully emptied is not purchased sufficiently for a longer period of time, the retailer will not reserve further shelf space for the product. Also, if consumers do not buy single-household sizes of foods, then it is not a worthwhile investment for producers. As another example, retailers adapt their esthetic standards required from the supplier based, among others, on their observation of which fruits and vegetables are deselected. Consumer motivation can lead consumers to accept abnormal shapes of fruits, trade-offs with convenience


**Figure 12.3** Clusters of factors causing consumer-related food waste.
Source: Own. Adapted from Aschemann-Witzel, J., De Hooge, I.E., Amani, P., Bech-Larsen, T., Oostindjer, M., 2015. Consumer−related food waste: causes and potential for action. Sustainability 7 (6), 6457−6477.

might stop consumers from taking the time and hassle to fully empty the package, and consumer capabilities can determine whether consumers discard items after the date label has passed or determine whether they trust their own judgment of edibility. Social relations can influence consumers' motivation, preferences, and the trade-offs they perceive in food purchase, and the foods offered in the purchase situation comply to current legal requirements on, for example, date labeling, or change with technological possibilities.

With regard to the second interaction, the money exchange, this is an area repeatedly mentioned as a major cause of food waste (Stuart, 2009). It has been discussed that the cost of food makes up only a small share of the household budget in affluent societies as well as that the price levels are rather low for food, often so low it is difficult to imagine the resource input and processing costs in the supply chain are covered at all. The low price is then said to contribute to consumers not perceiving the value of a food item, in particular when the underlying idea is that the traditionally scarce or religiously sacred food should not be wasted or treated disrespectfully (Gjerres and Gaiani, 2013). In addition, pricing mechanisms designed to increase purchase volume are said to potentially cause waste in that consumers tend to buy more than they actually need. Price gradients with lower unit costs for larger packages and multiitem offers such as "buy one get one free" are frequently used strategies in supermarkets. Consumer demand and price-oriented behaviors impact the success of store formats and of marketing strategies in retail. Retailers apply similar demands upstream in the supply chain, where they exert considerable power in the relations to the suppliers. Consumers' psychographic profiles determine their motivation to, for example, be deal prone and seek price promotions or not, and their capabilities might be limited depending on their budget constraints. Economic prosperity, in turn, influences consumers budgets, and social trends have an impact on the importance given to be a "smart shopper."

Coming to the point of information, the third interaction, one has to be aware that not only information in terms of facts and recommendations is exchanged in the consumer–retailer interface, but also that consumers infer something from the foods, the assortment, presentation, and state. Communication is known to function via language and action. For example, retailers offering fruits and vegetables homogeneous in appearance can shape consumers' impressions of what is normal, and placing eggs in or outside the fridge can shape consumers' assumption of how they should store eggs at home. Single households might feel disrespected when they encounter difficulties in finding appropriately small package units, and consumers can feel frustrated and misunderstood when a new package functionality is simply not as easy as the processor conveys. Selling per weight or per unit of, for example, celery heads communicates something about how consumers are expected to select food. Of course, the point of sale is used by retailers to convey a lot of information in text and visuals, with information about the food's characteristics and value on packages, and with in-store promotions or customer brochures. These communication channels are used to provide suggestions on best storage conditions, meal suggestions, as well as the retailer's brand values and corporate social responsibility (CSR) actions, including what

retailers do against food waste and for social and environmental sustainability. Consumers' motivation and the priorities when deciding on trade-offs are influenced, as well as their capabilities to deal with food, by whether they received helpful information from packages and in-store communication, and by their perceptions of social norms and societal trends around food based on what they are told and see in the store. Consumers' reactions in terms of purchase, loyalty, and word of mouth determine the directions that retailers take with regard to the presentation of and communicational context of their offer.

## 12.5 Consumer perception of suboptimal food

When considering how consumers perceive suboptimal food, it is important to underline that optimality and suboptimality are in no way fixed distinctions. Suboptimality is not only relative to the assessment of the *characteristics* of the food (e.g., is it an abnormal shape, or is it not? Is the product "as such" affected, or the appearance and package?) but also relative to the *purpose of use* (e.g., is the shape in any way affecting what I wanted to use it for? Does the date hinder me to store it for later use?). The clusters of factors in Fig. 12.3 can all exert an influence here, but in particular capabilities come into play. A consumer who has the capability to safely assess edibility and who can use a food item in various ways might not perceive a suboptimality as a hindrance to use the product in the same way as a consumer who lacks such capabilities. An apple with a spot might then simply be an item best suited for apple cake, as a possible alternative to being eaten right away.

Furthermore, there is another important influence on the perception of suboptimality, and that is the relative *value perception* of the item. As Fig. 12.3 shows, the cluster of factors called motivation is important, and it encompasses being aware of the issue and impact of food waste, holding values and beliefs that motivate the desire to avoid it, such as benevolence or environmental concern. Such factors can alter consumers' beliefs about suboptimality and can influence consumers' perceptions of a benefit of suboptimal food, as for example when irregularly shaped fruit and vegetables become an instrument for actively taking care of the environment by selecting these on purpose. As value perceptions are linked to the exchange—for example, what do you get in return for what you give—it is also relevant for suboptimal food perceptions which price one has to pay for the item. A package of milk might be optimal when it has the longest date instead of being close to the date. However, when the item closest to the expiry date suddenly is offered at half the price, it becomes more desirable to choose, and in these circumstances it might not be perceived as suboptimal as it was before, given the change in price–value relation.

The role of the price that a consumer has to pay can logically lead to a difference in consumer behavior in the situation before purchase versus the situation at time of potential consumption. In the first case, the consumer can still make a choice about

whether or not to pay for the product, if the value received in return is regarded as sufficient enough. In the second case, the product has already been paid for, and the value invested is fixed. What can matter, however, is how much has been paid at time of purchase, as this determines how much value is perceived to be lost, should the item be discarded instead of used. This is the thought underlining the critique of pricing strategies triggering food waste, because one reason might be that an item bought on promotion does not appear as valuable to be saved from the bin as an item for which the full price had been paid. Fig. 12.4 visualizes how characteristics, purposes and value perceptions are interrelated crucial elements of consumer perceptions of suboptimal food.

Some examples of results from research studies can underline and exemplify how consumers perceive suboptimal food. For example, a quantitative experimental survey study in five European countries (De Hooge et al., 2017) showed that there is a clear difference between whether or not a suboptimal food choice situation takes place in the supermarket or the home setting. On average, two out of six choices between optimal and suboptimal products fell on using the suboptimal item first when the choice took place within the household and the consumer already possessed the item in question. On the other hand, only for 0.5 of the 6 choices was a suboptimal item selected when the choice concerned a purchase decision in the supermarket. A clearly external suboptimality such as in the case of the bent cucumber was relatively most often accepted from among the six examples of suboptimality. This might indicate that value perception is hardly affected by the abnormal shape. The contrary case is the example of an apple with a spot, which is hardly chosen in the supermarket situation. Interestingly, it is also least likely chosen to be consumed first within households. This observation might indicate the role of both trade-offs and capabilities—when the primary purpose of use is affected, many consumers might not want to engage in the effort of an alternative use, or simply cannot readily see what they could do instead. Related to that, it was also found that consumers who were more likely to accept the suboptimal items were characterized by greater

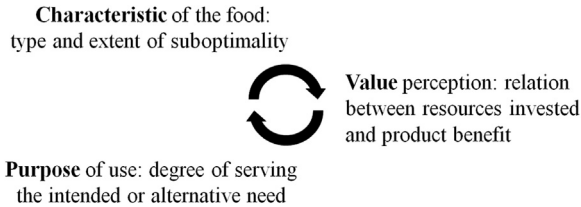


**Figure 12.4** Consumer perception of suboptimal food—interactive factors during purchase. Source: Own. Adapted from Aschemann-Witzel, J., Giménez, A., Ares, G., 2018b. Consumer in-store choice of suboptimal food to avoid food waste: the role of food category, communication and perception of quality dimensions. Food Qual. Preference, 68, 29–39. Available from: https://doi.org/10.1016/j.foodqual.2018.01.020; Aschemann-Witzel, J., Jensen, J.H., Jensen, M.H., Kulikovskaja, V., 2017. Consumer behaviour towards price-reduced suboptimal foods in the supermarket and the relation to food waste in households. Appetite 116, 246–258. Available from: https://doi.org/10.1016/j.appet.2017.05.013.

environmental orientation, and by engaging more regularly in shopping and cooking tasks. Overall, the role of different types of suboptimality, product category differences, and consumers product associations underline that consumers give particular attention to the food characteristics that are perceived to signal food safety, risk, and intrinsic quality of the food when making purchase and consumption decisions.

Another research study qualitatively explored consumer consideration when met with suboptimal food in the store (Aschemann-Witzel et al., 2017). In 16 accompanied shopping interviews in a Danish supermarket, consumers continuously voiced their current stream of thought while doing their normal shopping tour in the presence of a student interviewer. Findings show how consumers go back and forth between food characteristics on the one hand and purpose of use at home on the other hand: consumers consider product quality in various dimensions, package unit size, and the current date label of the item, as well as their storage capacity at home, their household's needs, and the plans for meals on that day when making purchase decisions about foods with a price reduction. As the quantitative survey study also showed, consumers appeared willing to choose suboptimal products under certain price reductions, depending on the product category and on the extent of price reduction. Here again, value perception is shown to play a particular role. Due to precisely that reason, it is a common practice of multiple supermarkets to reduce prices of food for example when nearing the date label (Theotokis et al., 2012), an idea that has been taken up in the wake of the societal interest in food waste at the consumer–retailer interface.

In the home situation, consumers have to consider whether or not they want to consume the item now or at a later point, and whether they want to consume the item the way it is, or in any way altered or prepared form, depending on what is among the range of possibilities of use for the individual and item in question. Motivations, trade-offs, and capabilities have a particular role here. A qualitative research study used focus groups in the same five European countries as the quantitative study mentioned before and using a range of techniques to elicit consumers' considerations and perceptions about suboptimal food and food waste in their home. In this study, consumers ($n = 83$ in total) were asked to bring a photo showing a food item they recently had to discard, and to elaborate on the reasons for waste in their home. Interestingly, many of the pictured items did not belong to the main categories often discussed in the literature—that is, fruits, vegetables, bread, dairy products, and meal leftovers—but consisted of packaged foods with a long shelf life such as canned food, snacks, dressings and sauces, or herbs. The most frequent reason mentioned for discarding these items was that they had been lying for a long time in the fridge or in the kitchen closet (sometimes several years), that they had lost all attractiveness for the respondent and that the likelihood of still using them was nil. This observation underlines that food waste in the home is also about foods that were optimal at a point of time in the past, and that may even still be optimal from nutritional and organoleptic perspectives, but that have become suboptimal due to inadequately long storage and loss of attractiveness.

The qualitative research mentioned above also entailed that consumers were given a range of suboptimal foods of different types to discuss jointly, and a task

where they had to sort fruit and vegetable images in different stages of suboptimality, to elicit the underlying dimensions that consumers use in perceiving such foods. These foods included among other dairy products of varied best-before dates (milk and yoghurt), vegetables of varied freshness and calibers (carrots, potatoes, apples), and bread of varied freshness. It appeared clearly across the different countries that consumers have much stricter thresholds for determining that a product is acceptable in the store than at home. When purchasing dairy products, respondents are especially observant of the date labeling and tend to systematically purchase the freshest milk (longest date). Milk with a best-before date similar to the purchase date would not be purchased unless a significant price reduction was offered. This was expressed by statements such as "It cannot be that milk with best-before date today is sold at full price" (51-year-old female, Germany). Few would select milk expiring on the day of purchase even at reduced price, but some would if they had a concrete plan, such as to cook porridge on the same day. Similarly, yoghurt would not be purchased past the best-before date at full price.

In a home setting, though, respondents strongly differed with regard to consuming yoghurt past the best-before date. Some would discard the product automatically, some would rely on their senses of sight, smell and taste to test it first, and some would have no hesitation at all for consumption. Several consumers also exposed strategies for usage, such as including yoghurt in baking. Further, consumers displayed very diverse strategies for avoiding waste of bread as, for example, adapting purchase frequency, or ideas for bread storage, including using containers (wooden box, plastic bag), and freezing (whole loaves, in portions or sliced). Many bread-saving recipes were evoked through the different discussions, the most frequently mentioned one being toasting. Respondents also discussed odd-shaped vegetables and fruits of different freshness levels. Reasons for potentially rejecting vegetables were in particular lack of appeal due to poor freshness, apparent decay, and fear of getting sick. Interestingly, in all countries odd-shaped vegetables triggered associations to naturalness, organic production, and higher taste expectations in the consumer's mind. Yet, most would not have picked these in the supermarket due to their difficulty to peel, and because a large share of the item may be thrown away.

Admittedly, consumers stated that discounts on such products would influence purchase decision a lot. In summary, this research provided rich insights on consumers' motivations and practices with regard to food rejection of suboptimal foods. Consumers' perception of suboptimal foods varies across product categories and across situations, and knowledge for evaluating food safety as well as skills for alternative usage of nonstandard products are crucial in the fight against food waste. Important questions remain to understand the deeper roots of why some people better accept suboptimal foods than others—how did they learn these attitudes and how can we make others learn from them? Through upbringing, through school, through the media? "There is a relationship between taste experience and visual experience," declared one of our participants (50-year-old male, Norway). Visually suboptimal foods face the challenge of convincing the consumer to get past their visuals and to give them the chance they deserve to prove their palatability.

## 12.6 Retailer actions against food waste

Given the role that the consumer–retailer interface plays for food waste, there has been a lot of discussion about the responsibility of supply chain stakeholders for the food waste observed in developed societies (Bloom, 2010; Juul, 2016; Stuart, 2009). Following the core idea of CSR, it is demanded that the businesses in the food sector assume responsibility for issues beyond their profit goal and beyond legal requirements (Carroll, 1999). The EU defines such CSR as "integrating social, environmental, ethical, consumer, and human rights concerns into their business strategy and operations" (EC, 2015, p. 1). A number of issues of particular relevance have been identified for the food sector, such as safety and healthiness, environmental impact, animal welfare, labor rights, and the prosperity of the local community (Forsman-Hugg et al., 2013). Newer conceptualizations of CSR and related concepts have shifted the focus to the idea that CSR might as well be designed and used strategically as well as enacted proactively. This allows aligning profit goals with favorable societal outcomes, and thus creating "shared value" (Porter and Kramer, 2011) and a "business case for sustainability" (Carroll and Shabana, 2010; Schaltegger et al., 2012).

Interestingly, the societal focus on food waste has made it relatively easier than before for retailers to align their commercial goals with actions against food waste in the supply chain. The more society pays attention to the food waste issue and acknowledges the effort, the more can such effort pay off in terms of a favorable attitude towards the company, higher levels of trust, a higher degree of loyalty and ultimately greater sales. Such a relation between CSR activities and commercial success has been repeatedly underlined as a favorable effect that might motivate the business to engage in CSR (Dixon-Fowler et al., 2013; Grewatsch and Kleindienst, 2016). Thus, just as CSR research suggests, there can be a range of advantages when retailers engage in food waste avoidance (Aschemann-Witzel et al., 2017), as listed below:

1. Decreasing food waste reduces cost of disposal
2. Food waste avoidance improves environmental and social sustainability
3. Company image improves where customers and stakeholders appreciate efforts
4. Better employees are attracted, and current employees are more satisfied

Research on the key success factors of commercial as well as noncommercial initiatives against food waste (Aschemann-Witzel et al., 2017) has shown that both "timing" and "business opportunity" are among the key success factors mentioned by actors and experts. This might indicate that the societal focus has gained a momentum that has helped in the starting phase and development of various anti-food waste initiatives. Overall, the food waste initiatives within the supply chain can be categorized into three types of initiatives. First, information and capacity building initiatives that target consumer awareness, knowledge, preferences, and skills. Such initiatives can help to increase consumer acceptance of suboptimal food and their capabilities to use suboptimal foods. Examples of these types of initiatives are information and awareness raising campaigns conducted by nongovernmental

organizations (NGOs) or supply chain stakeholder platforms. Secondly, initiatives that redistribute suboptimal food into alternative channels of sale, such as the food banks that have been founded across Europe in the past decade, which allow consumers with lower income to make use of food donated by processors or retailers and otherwise potentially wasted. Thirdly, there are initiatives that work on changing the current status and functioning of the supply chain and of the retail environment. Examples of this are social entrepreneurs who innovate new products based on suboptimal food, as for example "fruit paper" snacks made from fruits otherwise wasted due to suboptimalities, or soups from misshapen vegetables.

Retailers can play a role in all three of these types of initiatives. For example, retailers can support the information and capacity building actions of NGOs or platforms, donate food to food banks, and provide shelf space for new products with the benefit of a good cause towards avoiding food waste in the supply chain. Retailers have in the past years, however, also become active themselves in a number of ways. Examples that have received a lot of media attention are the Danish branch of Norwegian retail chain Rema1000, who had already abolished multiitem offers ("buy one, get one free") in their stores in 2008. They had been in contact with the NGO Stop Wasting Food and this collaboration had triggered the action. However, the marketing manager also explains that he himself had experienced annoyance about the appeal of price promotions, which then led him into wasting some of the food bought. Rema1000 received very positive customer feedback and observed an improvement of their brand perception in the market, and they have also been awarded acknowledged industry prices for their engagement. Even more international coverage was dedicated to the French supermarket Intermarché when they very famously introduced and heavily marketed "inglorious" fruits and vegetables in abnormal shapes in their stores, and the action was very successful in terms of the sales of these items—which they claimed quickly sold out (Aschemann-Witzel et al., 2016).

A mapping study conducted on the types of actions that retailers engage in to avoid food waste provides some more insights into the type of actions that retailers engage in. The study was done in Denmark, a country where food waste at the time of study had been particularly high on the agenda in the media, and where most retailers had already begun to take a standpoint and to introduce actions (Kulikovskaja and Aschemann-Witzel, 2017). The website and CSR report information on the actions against food waste, as well the actions observed in-store were considered. All major retail chains were explored and 18 stores were visited. These visits included some mystery shopping interviews, where a researcher acting as a regular, interested food shopper asked store personnel about their activities. Six different types of actions were found:

1. Price or pricing
2. Product
3. Unit
4. Communication
5. Collaboration
6. In-store management

Price actions (the first type) were particularly prominent and used across all retail chains and store formats to lesser or greater extent. They took the form of price reductions of suboptimal food, changes in price strategies such avoiding multiitem offers, or prolonging the offer in that the second item can be fetched from the store at some other point in time. A second type of action is connected to the product, and consists of changes in the packaging (e.g., shelf-life, ease of emptying) or of offering foods that deviate from optimality. The third is linked to unit sizes. This concerns changing the package sizes (e.g., single-household units) or the possibility to partition the food in serving units, as well as shifting the price from per item to per weight for fruit and vegetables. Furthermore, in the category of communication actions, stores were found to communicate about the pricing actions, about suboptimality and about the potential to avoid food waste by the choice of an item on stickers attached to the suboptimal foods, in in-store posters, or on the website. As a fifth, the collaboration with other actors in the supply chain was identified. For example, retailers might collaborate with food banks or other noncommercial organizations by donating suboptimal foods or by supporting the organizations efforts. Sixth and finally, retailers can also engage in refinement or alteration of their in-store management, improvement of processes and inefficiencies, as well as giving greater focus to the avoidance of food waste. This can be in the form of improved technology or management software or procedures, changing the placing of suboptimal food within the store assortment, or increasing the frequency of personnel checking the status of suboptimality so that items can quickly be donated or offered at a reduced price.

An action that has become particular widespread not only in Denmark but also in retailers in other countries—as already the example of Intermarché shows—is selling suboptimal food at a reduced price alongside the "normal" food items. This increases favorable consumer perceptions of the relation between the resources invested in the production of, the price of, and the value received in return for the suboptimal food. On a day-to-day basis, the most common product examples might be those nearing the date, but fruits and vegetables that have become somewhat unappealing or overripe as well as slightly damaged packages are also among those items. The mapping study revealed that store personnel observed approximately 9 out of 10 items of suboptimal food reduced in price to be sold by the end of the day. Given the increased interest in the topic of food waste in society, many retailers highlight this action now as a contribution to food waste avoidance. Thus, it is an example of an action that belongs to CSR activities, which has gained a strategic importance in positioning the company as being responsible, and which can improve image among customers and stakeholders.

Yet, there are a number of challenges when retailers offer otherwise wasted foods for reduced prices (Aschemann-Witzel et al., 2017; De Hooge et al., 2018). The actions add cost, in particular if the retailer would not have to pay for the wasted food, as contractual agreements might lay the burden of it on suppliers (Eriksson et al., 2017). Another challenge is that low prices encountered in store might affect quality perceptions of the store. Moreover, store management becomes

more complicated and tedious if date and appearance of items have to be checked by store personnel. And then, the company might fear that the suboptimal food sales "cannibalize" the sales of the "normal" foods (De Hooge et al., 2018). An example of this encountered in the mapping study mentioned earlier (Kulikovskaja and Aschemann-Witzel, 2017) is that one store was selling bake-off bread at 50% off from 7 p.m. onwards, but moved the time to 8 p.m. once the store manager noticed consumers queuing up to wait for the price reduction to happen.

The type of suboptimality that appears to hold particular potential to be changed by altering consumer perceptions is the shape and color deviations of fruits and vegetables. The claim that suboptimal products are otherwise perfectly edible can be said to hold most apparently when it concerns products with simply a strange shape or abnormal color. Originally, the European Union formalized the norms, or so-called cosmetic specifications, concerning the shape, size, color, skin, and weight for fruits and vegetables (European Union, 2007). After realizing that such specifications might generate food waste across the food supply chain, the European Union abolished cosmetic specifications for 26 of the 36 fruits and vegetables in 2009 (European Union, 2008). Yet, despite this abolishment, suboptimal fruits and vegetables are rarely found in stores, making it impossible for consumers to purchase such suboptimal products. To explore in greater detail how producers, producer organizations, and retailers deal with such suboptimal fruits and vegetables, an interview study was conducted (De Hooge et al., 2018). In this study, 33 German and Dutch producers, producer organizations, and retailers were interviewed to discuss how they dealt with cosmetic specifications and with fruits and vegetables not fulfilling these specifications, and the possibilities and challenges of changing these business practices.

The findings demonstrate that not only the European Union, but also producers, producer organizations, and retailers set standards concerning the appearance of fruits and vegetables (De Hooge et al., 2018). The supply chain actors tend to use such standards to signal being a company that delivers only high-quality products. The consequences of setting such cosmetic specifications for fruits and vegetables are clearly visible across the supply chain. The amount of foods that do not fulfill these specifications differ depending on the type of supply chain actor, varying from about 1% for greenhouse producers and Dutch retailers to 40% for open field producers. In all cases, supply chain actors try to find alternatives for these products before wasting them. Yet, most actors are limited in the alternatives available for suboptimal fruits and vegetables. For example, producers try to export suboptimal fruits and vegetables to alternative market channels abroad or to food processing markets, but otherwise they are limited to options that are already defined as food waste by the literature (e.g., transforming the product to biogas, cattle feed, or manure). Retailers are limited to donating suboptimal foods to charity, but can only do so if the food fulfills the safety food requirements of the national and European laws. Consequently, the majority of suboptimal fruits and vegetables are wasted.

In the interview study it was also examined to which extent there appears to be a business potential in selling suboptimal fruits and vegetables. It appeared that

supply chain actors have mixed feelings about producing and marketing suboptimal products. Societal motivations, company image, and CSR motivations may provide reasons for supply chain actors to produce and market suboptimal products, but actors also perceive the current market mechanism and pricing strategies to be problematic. With limited shelf space being available in stores and no increase in consumer demand, the introduction of suboptimal products would actually harm the market for all products. Also, producing and marketing suboptimal products would, in the actors' views, not provide a sustainable solution, as oddly shaped food products actually increase the burden on transportation and logistics. Finally, and perhaps most important of all, all types of actors perceive the consumer to be the underlying barrier for the marketing of suboptimal products: consumers are believed to be the ones who determine what is being sold, and as consumers' first impressions and food purchase decisions are based on product appearances, consumers are thought to be unwilling to purchase suboptimal products.

## 12.7 Consumer response to retailer actions

Ultimately, consumers need to favorably respond to the retailers efforts, so that these stores continue being engaged in food waste avoidance actions. When consumers do not support or even dislike these actions, the actions will ultimately fail. When consumer responses are more favorable, these responses can either have more direct consequences, such as cost saving, inefficiencies being removed, and higher profit margins, or have more indirect consequences, such as activities being more positively received within society and by stakeholders.

In a case study exploring food waste avoidance initiatives across the supply chain, examples of all three cases (failure, indirect success, direct success) of market and consumer responses were found (Aschemann-Witzel et al., 2017). In the case of a failed attempt, a bakery had observed that they were always discarding quite a large share of the assortment at the end of the day, and decided to deliver only the average sold amount to each subsidiary for a while. However, consumers complained heavily about the reduced assortment and about multiple items being frequently sold out. The interesting observation was that consumers responded as if being personally offended by the bakery's behavior, commenting on whether or not the bakery cared about satisfying their customers. This affected both business and employee satisfaction. Therefore, the bakery returned to the original approach. In the case of Rema1000 in Denmark, the marketing manager admitted that after abolishing the multiitem offers, sales volumes for some products declined. However, the positive feedback from consumers supported the management belief that the action would be worthwhile in the longer run (Aschemann-Witzel et al., 2016), and indeed, the supermarket has gained a very favorable reputation since then. It is difficult to assess how the initiative to remove the multiitem offer is related to the improved image and brand position, given it is an indirect effect, but the retailer appears to be convinced of it being a worthwhile decision. Finally, the case study

identified an example in which an idea to avoid food waste at the same time developed into a business success: An ICA (ICA is the name of ta Swedish he supermarket chain) store located in a supermarket in Lund installed an in-store kitchen preparing lunch and dinners from suboptimal food previously wasted. This allowed the supermarket to sell the food that otherwise would have been discarded, and to attract new consumers with relatively low-cost meal options. It also gave the store the opportunity to engage in more risk-taking strategies such as opening a fish and meat counter and broadening their assortment, because they had a "second opportunity" to use the food in the kitchen (Aschemann-Witzel et al., 2016). Thus, it is possible to develop actions of avoiding food waste into a win−win situation where commercial goals are also supported.

It is frequently mentioned that the occurrence of food waste is a multifaceted issue with a diverse set of interactive underlying factors (Hebrok and Boks, 2017; Quested et al., 2013). Therefore, food waste does not only depend on consumers, and consumer responses to supply chain actions are not equal across consumers. Indeed, sociodemographic and psychographic individual factors, as well as social and contextual factors, have been found to relate to food waste. Therefore, it seems logical to take into account consumers' distinct lifestyles (Ganglmair-Wooliscroft and Lawson, 2010) when considering how they would respond to retailer actions.

In a survey across five European countries, a food-related lifestyle measurement was used in combination with statements specific to the topic of food waste (for the findings for Denmark, see Aschemann-Witzel et al., 2018). Through factor and cluster analysis, dimensions of interaction with and preferences for food attributes in day-to-day life were identified, as well as the consumer segments that differed in these dimension. The consumer groups differed in their food involvement, as expressed in the dimension of cooking enjoyment, in food planning, social relationships via meals, food safety concerns, and price orientation. From what these consumers reported about food wastage in their home, their attitude towards the food waste issue, and their experimentally derived choices for optimal versus suboptimal foods, recommendations of which actions likely fit best to which segment can be derived. For example, the consumer segment characterized by a high involvement with food but a spontaneous approach to meal planning might make use of ready-made meals based on suboptimal food from the store, and might use apps suggesting how to creatively use leftovers. A consumer segment already good in planning food purchase and meals can be taken a step further in food waste avoidance with more advanced storage tips. Consumers characterized by a low interest in cooking but quite a price orientation, in turn, are most likely attracted by price reductions of suboptimal food, or by food banks selling donated items.

Price-reduction of suboptimal food is one of the actions that has become rather widespread among retailers. This holds in particular in Denmark, where the mapping study found that it has become rather an industry standard to do so for at least certain food categories, and quite often with colored stickers indicating this to be a food waste avoidance action (Aschemann-Witzel and Kulikovskaja, 2016). An experimental survey (Aschemann-Witzel, 2018) explored in greater depth which factors explain consumer reactions to the foods offered at reduced price. It also

tested varying approaches to communicate the benefit of the price reduction, that is, highlighting either the economic savings or the food waste avoidance. Both arguments take different routes, appealing to opposing motivations and value orientations, but both work towards changing the relative value perception of the suboptimal food. The study mimicked the yellow stickers actually used in-store by a range of four supermarkets, but varied the text. Results showed that rather than the actual communicational argument, a decisive factor for consumers was whether or not they were familiar with the supermarket and with the sticker. A gender effect was found, such that men were less likely to react favorably to the food waste messages compared with women. The findings also confirmed the crucial importance of the characteristic of the food in terms of perceived quality, as well as use in terms of likelihood of being consumed entirely. Interestingly, a similarly designed experimental survey study conducted in a very different context, namely the country of Uruguay in which food waste has not yet been discussed to a great extent, showed that offering the price-reduced suboptimal food with communication did indeed have an effect. Suboptimal food communicated with the food waste avoidance argument was more favorably received among respondents of low or of high socioeconomic status. Overall, consumers of low socioeconomic status and men were more likely willing to buy the suboptimal items. The food category in question was crucial for quality perception, and depending on the food and its suboptimality, different dimensions of quality were affected (Aschemann-Witzel et al., 2018a,b).

## 12.8 Conclusions

The research examples discussed here explore how consumers perceive and choose suboptimal food, which can contribute to food waste avoidance at the consumer–retailer interface. Consumer acceptance of suboptimality is clearly higher in the home versus the supermarket, and greatly differs by product category and type of suboptimality. Consumers individual characteristics also play a role. During either in-store choice or when considering at home usage, consumers negotiate the specific suboptimal food item's characteristic in relation to the household needs and usage context, underlining that consumers indeed assess benefits versus costs. Safety, quality, and potential usage options are of particular importance. Retailers can and already are acting against food waste at the consumer–retailer interface, and six types of actions by supermarkets have been identified, for which price-reduction of suboptimal food is most widespread. Retailers, however, see quite a number of barriers to also selling fruits and vegetables currently not meeting cosmetic standards and wasted in the supply chain early on, and point to a need in consumer expectations. Furthering sales of suboptimal food with accompanying communication is found to increase choice likelihood, but it depends on the context, as for example, consumer group and market. What remains yet underresearched is the relative effectiveness of various approaches to reduce food waste in the consumer–retailer interface, in particular in carefully designed interventions or with actual food waste measures in-store or at within the household.

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