Consumer awareness of food waste, best before dates and food appreciation – a model project in the food retailing sector

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Abstract

Purpose – The purpose of this study is to investigate what consumers think about food waste, best before date (BBD) and appreciation of food in the context of a model project in the food-retailing sector. The focus was on the following key questions: How is the issue of food waste itself perceived by consumers? What understanding of the BBD was present in the sample and what do consumers imagine under the term appreciation in the context of food? The study also included an evaluation of the acceptance of the model project by customers. In this project, food no longer suitable for sale was distributed free of charge to visitors of a supermarket via a freely accessible refrigerator.

Design/methodology/approach – The research design was based on a mixed methods approach in an explorative sequential design. First a qualitative survey was conducted via interviews ($n = 8$) with customers, and the results were used for a subsequent quantitative survey ($n = 88$) in the supermarket.

Findings – The majority of those questioned were sensitized to the topics of food waste, BBD and appreciation of food. The results of the interviews and the questionnaires revealed a consistently positive opinion about the model project. These results indicate potential for reducing food losses among consumers and in food retailing and for improving appreciation.

Originality/value – This was the first study conducted as part of a model project in the retail sector in the context of food waste. The study also investigated within in the project what people think about the BBD, food losses and appreciation. At the same time, the acceptance of the project was assessed.

Keywords Food waste, Food losses, Food retail sector, Best before date, Food appreciation, Consumer

Paper type Research paper

1. Introduction

The Food and Agricultural Organisation (FAO) of the United Nations (UN) estimates that 1.3 billion tonnes of food are wasted worldwide every year (United Nations, 2015). This corresponds to about one-third of the food intended for consumption (Gustavsson *et al.*, 2011). In the Europe Union (EU), the amount of food waste is between 88 and 90 million tons of food waste per year, which corresponds to a per capita amount of between 173 and 179 kg per year (Monier, 2010; FUSIONS, 2016). Germany accounts the second largest amount of food waste after Great Britain (Monier, 2010). According to a recent extrapolation by the Johann Heinrich von Thünen Institute, about 12 million tonnes of food waste per year (75 kg per capita) accrues in Germany along the supply chain from agricultural production to the consumer, about half of which can be considered theoretically avoidable (Schmidt *et al.*, 2019).

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Proportionally, the largest amounts are generated at consumer level, whereas the food retail sector's (FRS) share is lowest (Schmidt *et al.*, 2019; Noleppa and Cartsburg, 2015; Alexander *et al.*, 2017). However, the FRS has a great potential to influence consumer behaviour regarding purchase decisions and handling of food at the point of sale (Alexander *et al.*, 2017; Schmidt *et al.*, 2019; Brunner and Schönberger, 2005).

By EU Directive 2018/851/EU, food waste is defined as the loss of discarded food after harvest, transport or processing and production (Federal Ministry of Food and Agriculture, 2019). The literature additionally differentiates between food losses and food waste (Schmidt *et al.*, 2019). Food losses occur in the agricultural production of food for consumption up to marketing in wholesale (Noleppa and von Witzke, 2012). Food waste can be attributed to retail, catering and consumer behaviour (Gustavsson *et al.*, 2011). These definitions can be expanded by including the avoidability of food waste, according to foods that would have been edible at the time of disposal or when consumed in good time. These are classified as avoidable food waste (Hafner *et al.*, 2013). In the present study, all terms describing food losses in any way are used synonymously. The surveys are related to avoidable food waste.

Due to high numbers of food losses and their potential environmental impact, policy and business solutions need to be developed, and private initiatives to avoid food losses need to be encouraged (Waskow, 2018). In Germany, there already are commercial and consumer-level projects that are working on reducing food waste. Some supermarkets already give away food that is no longer suitable for sale (Schobelt, 2018). Non-profit and privately organized initiatives pass on this food to private households. The association Tafel Deutschland e.V. supports people in need with these foods. The initiative "Food sharing" is accessible to everyone (Kienle and Jüstel, 2017; Baur, 2018). None of these initiatives or projects has so far been subject to scientific research in the area of reducing food waste.

The legal framework in Germany allows food that is no longer suitable for sale (e.g. seasonal produce) or whose BBD has expired to be passed on by retailers to people or organisations. In doing so, it must be ensured that the food is safe, continues to be stored correctly and does not pose an avoidable health risk. Food that carries a use-by date may not be further distributed once this date has expired (Federal Ministry of Food and Agriculture, 2021b).

The Dr. Rainer Wild Foundation has initiated a model project in the FRS to investigate the extent to which consumers are sensitized to the topics of food waste, best before date (BBD), food appreciation and the potential of projects with this focus in the FRS. A refrigerator was set up in the entrance area of a supermarket, where food that was no longer suitable for sale was distributed to consumers free of charge. This could be food with an expired best before date, optical defects or leftover special offer goods. Several times a day supermarket employees sorted out such food in the sales room and stored it in the refrigerator. The project was carried out for a period of several weeks from October 2018 to May 2019 in a supermarket of Kaufland Dienstleistungs GmbH & Co. KG in Heidelberg (Germany). It was the only model project including evaluation within the region. The study aimed to investigate what consumers think about food waste, BBD and appreciation of food in the context of this model project. In addition, it was asked how the participants rate this project.

In this context, the focus was on the following key questions: How is the issue of food waste itself perceived by consumers? What understanding of the BBD was present in the sample and what do consumers actually imagine under the term appreciation in the context of food? The study also included an evaluation of the acceptance of the model project by customers.

2. Methods

2.1 Research design

The study was exploratory in character and was based on a mixed methods approach in explorative sequential design according to John Creswell and Plano Clark (2018). For this

design, it is intended to use qualitative and quantitative methods sequentially (Creswell and Plano Clark, 2018; Schoonenboom and Johnson, 2017). The present study was conducted in three phases excluding preparatory and follow-up work over a six-week period from October 2018 to November 2018 (Figure 1).

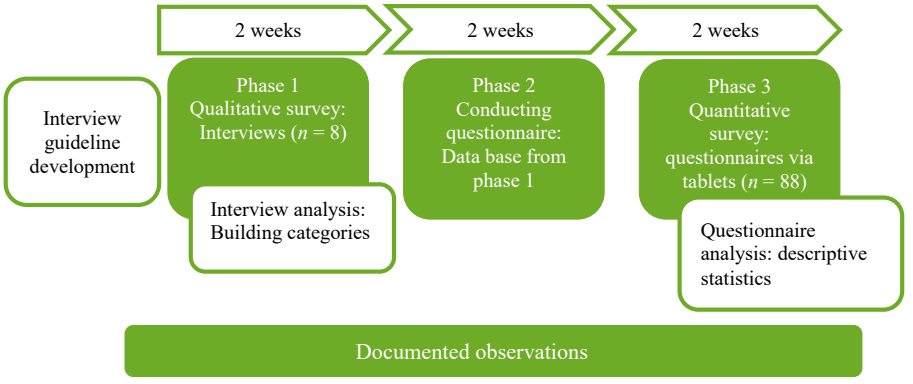
In the present study, first a qualitative survey was conducted, and the results were used for a following quantitative survey. Both surveys were based on the key questions of the study (see introduction). The qualitative survey was conducted through interviews ($n = 8$) in order to gain impressions and opinions of consumers on the project and the issues of BBD, food waste and appreciation. In a subsequent quantitative survey with questionnaires (via tablets), the questions were addressed, and the results of the interviews were tested on a larger sample ($n = 88$).

During the period of the survey, supporting observation protocols and photographic documentation around the project situation were kept. The results of the interviews, the quantitative survey and the observation protocols were finally triangulated in a comparative consideration.

The use of both qualitative and quantitative methods was necessary because the application of only one method seemed insufficient due to the lack of data on such projects. The comprehensive questions concerning the model project required a mixed methods approach.

2.1.1 Selection of the project supermarket. The supermarket was selected by the company itself, which had previously been contacted and agreed to the project. Their criteria were the location in Heidelberg, the space available in the store, the commitment of a store manager and the availability of staff to manage the project. In addition, the store manager of the final project supermarket was very enthusiastic and spoke out in favour of carrying out the project in his branch. All in all, the search for a project market proved to be difficult, as many of the partners who were contacted declined.

2.1.2 Interviews. The criteria for the selection of the interview partners were determined in advance. Guided interviews were only conducted with people who had previously been observed by the author taking food out of the refrigerator ($n = 8$). This procedure was found to make it easier to start a conversation. Since the questions were directly related to the project, it was important that the respondents were already firm with the project. The interview guide aimed to cover the key questions with the issues of BBD, food waste, appreciation of food and acceptance of such a project. The participants were also asked if they already had an idea what they would like to prepare with the food they had taken out of the fridge (Table 1).



Source(s): Own illustration

Figure 1. Study design and applied methods of the evaluation of the model project

The interviews were recorded and transcribed immediately after each one. The analysis of the transcripts was based on the structuring content analysis according to Mayring (2010). Based on the main topics and the corresponding interview questions, four main categories were formed in advance to structure the analysis: BBD, food waste, appreciation, model project. These four categories were used to analyse the interview content. Within these categories, subcategories described by corresponding codes have been created. This approach is a deductive-inductive category formation (Kuckartz, 2014). In addition to the content analysis, short portraits of the different interview partners were created (Table 2).

2.1.3 Survey. The contents of the interviews were used to develop the questions and response options for the questionnaire. The questionnaire was intended to test the results of the interviews from the qualitative phase and the key questions with the issues BBD, food waste, appreciation of food and acceptance of such a project on a larger sample of consumers. The participants were additionally asked about their gender, age, work situation and the

Table 1.
Questions of the interview guideline (own illustration)

Questions of the interview guideline
(1) What do you think about this project?
(2) Do you already have an idea/a plan what you want to do with the products?
(3) What does the best before date mean to you?
(4) Are there food products where the best before date is more or less relevant for you?
(5) In Germany, according to current studies, many foods are thrown away that could still be consumed. What do you think about this problem?
(6) What do you think about the topic of appreciation of food?
(7) Do you see effects on the appreciation of food through such projects?
(8) How would you find it, if this project was available in many supermarkets?

Table 2.
Brief portraits of the interviewed subjects (own illustration, interviews 1–8)

Interview	Sex*	Age	Nationality **	Living situation/ House-hold members	Employment	Withdrawn products
1	f	23	D	Shared apartment with two persons	Employed, part-time studies	Ham, diced feta cheese
2	m	43	D	Household with wife and two children	Employed	Puff pastry
3	m	60	D	Single-person household	Unemployment benefit recipient	Tomato butter
4	m	29	D	Two-person household with girlfriend	Student	Tomato butter
5	m	48	I	Household with wife and three children	Employed	Cake
6	m	70	D	Single-person household	Pensioner	Toast rolls
7	f	About 45	N	Family household with husband and two children (two other children have already moved out)	Employed	Yoghurt
8	m	68	D	Family household with two children	Pensioner	Mozzarella, meat salad, potato salad

Note(s): *f = female; m = male
**D = Germany; I=India; N=Nigeria

number of people living in their household (see Figure 2). The number of minors living in the household was also questioned. The questionnaire contained the following types of questions: multiple choice, five-point rating scale and open questions (social statistics) as well as an open comment field.

The sample population was all supermarket visitors present at the time of the survey. The quantitative survey was conducted in the project supermarket using tablets among randomly selected visitors (n = 88). For this, people in the area of the fridge were asked to fill in a questionnaire about the project. The participants filled out the questionnaire independently and anonymously. The selection of the sample was limited due to the given project duration and willingness to participate. The evaluation of the data was based on descriptive statistics. Thus, the results could be compared with those of the interviews.

2.2 Ethics

An ethics approval was not required for this study. The participants were informed in advance that the data would be collected anonymously and would only be used for the purpose of the study.

3. Results

3.1 Interviews

In a first step, short portraits of the interviewees (n = 8) were created using the interview data. These contained socio-demographic data and a listing of the food taken from the refrigerator by the respective person (Table 2).

sociodemopraphic informations	**sex** (n = 56, in %)	male: 33,9 %
		female: 66,1%
	age (n = 53, in %)	≤ 20 years: 5,7 %
		≤ 30 years: 52,8%
		≤ 40 years: 13,2 %
		≤ 50 years: 9,5 %
		≤ 60 years: 11,3 %
		≥ 60 years: 7,5 %
	work situation (n = 55, in %)	employed: 56 %
		study: 33%
		not employed: 3 %
		seeking work: 2 %
		retirement: 2 %
		in education: 2 %
		other: 2 %
	number of people per household (n = 51, in %)	≤ 2: 68,6 %
		3: 9,8 %
		4: 15,7 %
		5: 2 %
		≥ 6: 3,9 %

Source(s): Own illustration

Figure 2.
Social-statistical information of the participants of the quantitative survey

3.1.1 Best before date. The participants were asked how they deal with the BBD and what it implies for them. They showed an awareness of the precise meaning of the BBD. In this context, statements such as, "[. . .] as the name already says" (Interview 1) and "I think exactly what it means" (Interview 4) were made. In addition, the sensory test of the food, in line with the BBD, was a decision tool for or against consumption for one of the interviewees. "Smell, taste, it's ok or just throw it away" (Interview 2). Some interviewees also mentioned specific food groups in regard to their BBD. "For me it depends on what kind of food it is" (Interview 7). The most frequently mentioned food groups that were named for the question about the BBD were fish and meat. Sausage and yoghurt were also mentioned.

3.1.2 Food waste. The answers to the questions about globally high levels of food loss were largely emotional. This is shown by statements such as, "I think it is quite sad that every year tons of food are thrown away [. . .]" (Interview 1) and "I think it's a real shame" (Interview 5). In addition to these reactions, some respondents also expressed an awareness of the consequences of food waste. One of the interviewees talked about "[. . .] tons of food [. . .]" produced "[. . .] for nothing" (Interview 1). Another interviewee described food waste as a "waste of resources [. . .]" (Interview 4). The context of global nutrition was also frequently mentioned in this context. The participants stated that in Germany food is thrown away, whereas there are regions and people who are not sufficiently supplied with food in the world. Interview partner 6 made an exemplary statement: "There are many people who need it [. . .]" (Interview 6).

3.1.3 Appreciation. Another aspect asked was the respondents' opinion about the appreciation of food. Two interviewees stated that society is living in abundance and that this has a negative effect on the appreciation of food (Interview 2; Interview 3). Other respondents said that there was no or little appreciation for food in Germany. This was expressed by statements such as, "I think the (appreciation) is relatively low in Germany" (Interview 4) and "We have lost that somewhere" (Interview 5). A further interviewee said: "Yes, like many other things, food has become a throw-away product. There is no respect for quality anymore" (Interview 6). Again, one participant made the connection with the situation in other countries: "There is a lack of care, although the deficiency situation is obvious in many regions of the world" (Interview 3).

3.1.4 Model project. In addition to the thematic references, the interviewees were also asked what they think of such a project and whether they believe that projects of this kind could have an impact on the appreciation of food. The opinion on the project was positive. The majority confirmed a possible influence on the appreciation (Table 3).

A frequently mentioned reason for supporting this project was that the project saved food that might otherwise be thrown away (Interview 1; Interview 2). A possible nationwide expansion of this project was endorsed by all eight interviewees (see Table 4).

The respondents considered partial effects on the appreciation of food through such projects possible. On the one hand, there were positive statements such as "I think it will do something to them in their minds" (Interview 1) and "So that could make everyone aware of it" (Interview 4). On the other hand, two participants in the interview were critical of this

Table 3.
Statements reflecting approval of the model project (own illustration, interviews 1–7)

Interview	Statements matching agreement
1	"I think it's a very good thing"
2	"Good. Excellent"
3	"Jo good"
4	"[. . .] but it is super meaningful"
5	"I really think it's very beautiful"
6	"Yes, I think it's all right"
7	"I think it's great"

potential. "You cannot change anything big anymore" (Interview 3). Also, interview partner 8 did not see any short-term effects by such a project because attitude changes would take "[. . .] a long time" (Interview 8).

Since the participants had taken food from the refrigerator before the questioning, it was interesting for the author whether the participants already had a concrete idea and what they would like to do with the food. This applied to almost all interview partners and ranged from a pragmatic "Well, eating" (Interview 3) to defined plans, such as having dinner with a friend (Interview 6) or baking with the family (Interview 2).

3.2 Survey

The quantitative survey was conducted over a two-week period by the author in the project supermarket. For the survey, supermarket visitors were addressed by the author and asked to answer the questionnaire. A total of 88 persons took part in the survey. The socio-demographic data of the sample are shown in Figure 2. The total number of participants varies depending on each question, as only the question regarding the opinion about the model project was a mandatory question.

3.2.1 Best before date. Similar to the interviews, the participants were also asked how they deal with the BBD in food. The given answer possibilities for the multiple choice question on BBD were worked out based on the interview results. The analysis depends on the number of answers (58 participants, 111 answers). More than 30% of respondents stated they rely on their senses when the BBD of a food product has expired. For more than 25% of the participants, the BBD estimate depends on food type and just under 24% consider it a reference value. Approximately, 6% of the respondents were uncertain about the BBD, and for 4.5% of respondents, an expired BBD was a reason to discard the food. About 5% of the interviewees did not pay attention to the BBD declaration (Figure 2).

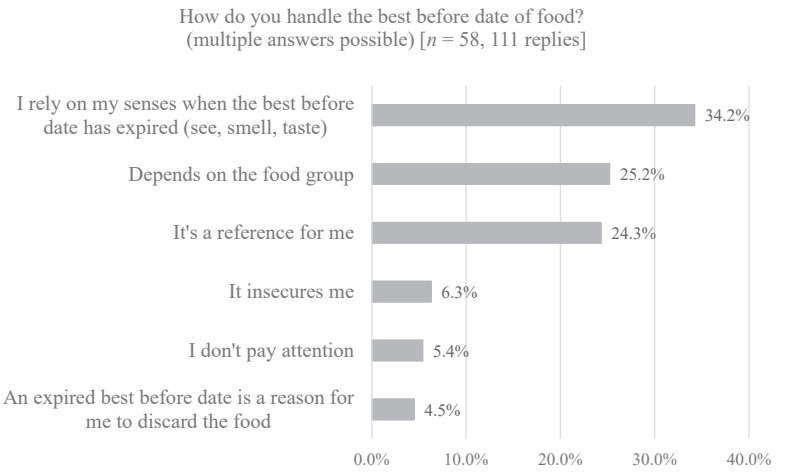
3.2.2 Food waste. One of the tested statements based on the interview results and in the context of food waste was "The model project can change our thinking when it comes to throwing away food". More than 60% of the participants ($n = 55$) agreed with this statement. More than 30% see a possibility for a change in thinking with their answer "maybe" (Figure 4).

3.2.3 Appreciation. The statement based on the interview results and in the context of appreciation "The model project can improve the appreciation for food" was tested using a five-stage rating scale ("consent" to "no consent"). More than 60% of the respondents agreed with this statement. Over 30% stated that the project " maybe" can improve the appreciation of food (Figures 3–5).

3.2.4 Model project. The acceptance for the model project was also determined using a symbol scale (smileys) with additional verbalization. The description of the scale ranged from "very good" to "good", "neutral", "less good" and "not good at all". More than 90% of respondents rated the project as "good" or "very good" (Figure 6). And almost all respondents agreed with the statement that there should be such a project in every supermarket in Germany.

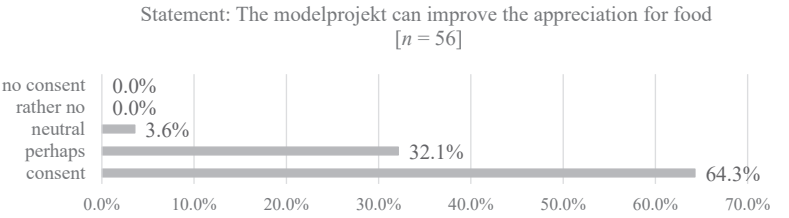
Interview	Statements approval extension
1	"Very good. I'd support that, yes"
2	"Excellent. I'd really like that if nothing got thrown away [. . .]"
3	"Yeah, that'd be fine"
4	"Yes good"
5	"I'd love that. Very great"
6	"Yeah, I'd like that, 'cause there's too much thrown away"
7	"Great"
8	"There would certainly be more attention"

Table 4. Statements that agree with the possible expansion of the model project (own illustration, interviews 1–8)



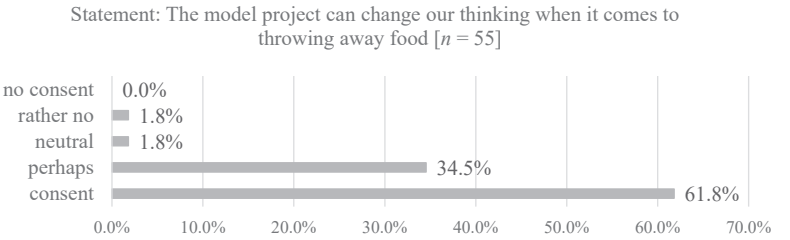
Source(s): Own illustration

Figure 3.
Distribution of answers to the question about the meaning of the BBD in relative proportions



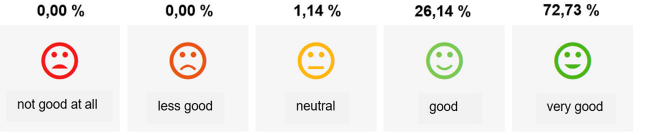
Source(s): Own illustration

Figure 4.
The participants estimation of the potential influence of the model project on the appreciation for food



Source(s): Own illustration

Figure 5.
The participants estimation of the potential of the model project to cause a rethinking when it comes to throwing away food



Source(s): Own illustration, $n = 88$

Figure 6.
Relative distribution of the answers to the question "How do you like the model project?

In addition, the answers in the comment section were analysed. The tendency of the responses in the comment section to express additional opinions can be considered positive. The project was largely praised via this option. On the one hand, the idea of the model project was positively rated with statements such as "great idea [. . .]", "a good idea [. . .]", "great idea" and, on the other hand, the project itself. The project was described as "a great thing", "a very good and meaningful thing" or as an "all-round successful project".

4. Discussion

The key aspects of the study, such as BBD, food waste, food appreciation as well as acceptance for the project were outlined in the central research questions. We found out that the interview partners and the participants from the larger sample were informed about the BBD. In both surveys, it was observed that the respondents subjected products with expired BBD to a sensory test and did not simply dispose them. A differentiated classification of BBD in foods depending on the product group was revealed both in the interviews and in the quantitative survey. According to this, the respondents determine, depending on the type of food, whether it is still suitable for consumption after the BBD has expired or not. Neither the interviewees nor the participants of the survey showed any aversion towards the food in the project fridge. However, it was not verified whether the food taken was actually consumed or disposed at home. But most of the interviewees stated a concrete plan of what they would do with the food.

The people questioned were aware of the problem of food waste. In both the interviews and the quantitative survey, it was specifically asked whether the project could have an impact on the consumer's behaviour according food waste and discarding food. Almost all participants confirmed this possible impact. Concrete manifestations of the influence or effects on society as a whole were not tested. In this context, the participants also frequently mentioned the aspect of the global food and hunger situation and rated it negatively that food is wasted.

This study also focused the appreciation of food. In the interviews, the participants stated that the appreciation of food in Germany was rather low. In both research strands of this work, a majority of the participants stated that such a project could improve the appreciation.

The model project was generally very highly rated and endorsed by the respondents. This is positive overall. The results of the interviews and the quantitative survey show that such projects are supported and accepted by consumers.

The results of the study are also confirmed in the current literature. According to a recent survey by the Thünen Institute, an expired BBD is currently no longer a primary reason for German consumers to throw away food (Schmidt *et al.*, 2018). The German Nutrition Report for 2020 also showed that the BBD is not a throwaway reason (Federal Ministry of Food and Agriculture, 2020). The sensory testing of the expired products mentioned in the study is also described in the report of the Thünen Institute (Schmidt *et al.*, 2018). Likewise, the differentiation by different product groups (Göbel *et al.*, 2015). At the same time, in a survey by the Federal Ministry of Food and Agriculture, more than 80% of consumers consider it important to have the BBD indicated on the packaging (Federal Ministry of Food and Agriculture, 2021a). Therefore, it is important to continue to inform about the meaning of BBD and to raise awareness among consumers. Projects such as the one described here can make an important contribution by showing that food whose BBD is approaching is still safe to eat.

The problem awareness of the overall population for food waste is more difficult to map than in the study. However, a report by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety states that the German population in general is aware of climate and environmental protection (Federal Ministry for Environment, Nature

Conservation and Nuclear Safety, 2017). Therefore, projects such as those mentioned above could maintain this awareness and contribute to its sustainable establishment. The topics of feeding the world and hunger are also taken up in the literature. In the German Nutrition Report 2020, 2021, a large proportion of respondents also named the reduction of food losses as a solution for securing food for a growing world population (Federal Ministry of Food and Agriculture, 2020, 2021a).

The issue of food appreciation is also addressed in the literature. In its report, the Thünen Institute also calls for further sensitisation to the appreciation of food (Schmidt *et al.*, 2018). Further testing of influences on appreciation using defined parameters and collecting more scientific data can legitimize the argumentation for future implementation of such projects. So far, only a few projects address the supermarket setting, so the experience values are to be considered preliminary. Overall, this positive trend showed that such projects can contribute to make consumers more aware of food waste and to improve food appreciation.

In the study, a few participants expressed their concerns that non-commercial organisations, such as Tafeln e.V., which give food to people who are in need, would receive less food as a consequence of these projects and that the unrestricted access to the project refrigerator would also allow people to take food that they could still afford to buy. The model project was carried out in a supermarket where there was a need to save food in addition to donating it, so there was no competition with a non-profit association. With its concept, the project is intended to be a supplementary initiative for the FRS in order to exhaust the full potential of food rescue and to sensitize consumers at the point of sale. In addition to save expired food, the project should encourage consumers to think and rethink, whether or not they are in financial need, since food waste and the appreciation of food are problems for society as a whole.

At the time this study was conducted, no scientific data or surveys on model projects of this kind were available or known for Germany. The number of international scientific surveys that depict comparable interventions is also still small. This is confirmed in a recently published study in which systematic behavioural interventions from the area of food loss, among others, were mapped. A total of 18 studies were identified that address interventions in the field of food waste. Most of them were published after 2015 (Reisch *et al.*, 2021).

Hence, no previously tested methods were available for the evaluation of this model project. For this reason, the survey was conducted using an explorative mixed methods approach (Mayer and Mitterer, 2014; Creswell and Plano Clark, 2018). Further surveys could aim at a larger sample size for qualitative and quantitative research and to extend the survey period. Research could also be conducted to determine whether such projects can make an additional contribution to reducing food waste in the retail sector and how strong the effect is on improving appreciation.

Overall, the results of the evaluation of this model project are positive. The results of the interviews and the quantitative survey show that such projects are supported and accepted by consumers.

5. Conclusion

The study aimed to investigate what consumers think about food waste, BBD and appreciation of food in the context of a model project in the food retailing sector. In addition, it was asked how the participants rate the project.

The majority of respondents were aware of the problem of food waste. They also put the issue in the wider context of hunger and feeding the world's population. Many stated that such a project can bring about a change in thinking when it comes to disposal of food.

This kind of awareness was also shown in the context of BBD. Respondents were aware of the meaning of BBD, described how they handled it and differentiated it between different food groups.

We also found out what those surveyed thought about food appreciation. They rated these as low within the society. At the same time, they again established a connection with hunger and world nutrition. Respondents considered impacts on food appreciation through such projects as possible.

Participants were very positive about the project and would like to see it in many supermarkets.

In conclusion, each project in this area makes a meaningful contribution to reducing food waste, whether directly at the point of sale or indirectly by raising consumer awareness.

References

Alexander, P., Brown, C., Arneth, A., Finnigan, J., Moran, D. and Rounsevell, M.D.A. (2017), "Losses, inefficiencies and waste in the global food system", *Agricultural Systems*, Vol. 153, pp. 190-200.

Baur, N. (2018), "Food sharing: committed against waste of food", *Social News* No. 2, p. 40.

Brunner, K.M. and Schönberger, G. (2005), *Sutainabilty and Nutrition: Production-Retail-Consumption*, Campus, Frankfurt/Main.

Creswell, J.W. and Plano Clark, V.L. (2018), *Designing and Conducting Mixed Methods Research*, 3rd ed., International Student Edition, Sage, Los Angeles, London, New Delhi, Singapore, Washington DC, Melbourne.

Federal Ministry for Environment, Nature Conservation and Nuclear Safety (2017), *Environmental Awareness in Germany 2016: Results of a Representative Population Survey*, Berlin (accessed 21 January 2019).

Federal Ministry of Food and Agriculture (2019), "National Strategy for food waste reduction", available at: https://www.bmel.de/SharedDocs/Downloads/Ernaehrung/Nationale_Strategie_Lebensmittelverschwendung_2019.pdf?__blob=publicationFile.

Federal Ministry of Food and Agriculture (2020), "Germany, as it eats", (accessed 4 November 2020).

Federal Ministry of Food and Agriculture (2021a), "Germany, as it eats", (accessed 15 October 2021).

Federal Ministry of Food and Agriculture (2021b), "Guideline for the distribution of food", (accessed 27 September 2021).

FUSIONS (2016), "Estimates of European food waste levels", (accessed 2 December 2020).

Göbel, C., Langen, N., Blumenthal, A., Teitscheid, P. and Ritter, G. (2015), "Cutting food waste through cooperation along the food supply chain", *Sustainability*, Vol. 7 No. 2, pp. 1429-1445.

Gustavsson, J., Cederberg, C. and Sonesson, U. (2011), *Global Food Losses and Food Waste: Extent, Causes and Prevention*, Food and Agriculture Organization of the United Nations, Rome.

Hafner, G., Barabosz, J., Maurer, C., Kranert, M., Göbel, C., Friedrich, S., Ritter, G., Teitscheid, P. and Wetter, C. (2013), "Analysis, evaluation and improvement of food management systems - Part I. Definition of food losses and food waste", *Waste and Refuse*, Vol. 11/2013, ISSN 1863-9763, doi: 10.37307/j.1863-9763.2013.11.08.

Kienle, M. and Jüstel, M. (2017), "Engagement in environmental protection", *Feedback*.

Kuckartz, U. (2014), *Qualitative Content Analysis: Methods, Practice, Computer Supported*, Basic texts Methods, 2nd ed., Beltz Juventa, Weinheim, Basel.

Mayer, H. and Mitterer, M. (2014), "'Mix it up'. The combination of qualitative and quantitative research or mixed methods Research", *ProCare*, Vol. 19, pp. 12-16.

Mayring, P. (2010), *Qualitative Content Analysis: Basics and Techniques*, 12th ed., Beltz, Weinheim and Basel.

Monier, V. (2010), *Preparatory Study on Food Waste across EU 27*, Technical Report, 2010-054, European Commission, [S.l.], BIO Intelligence Service, Paris.

Noleppa, S. and Cartsburg, M. (2015), *The Great Throwaway: From the Fields to the Consumer: Extent and Environmental Effects of Food Waste in Germany*, WWF Germany, Berlin.

Noleppa, S. and von Witzke, H. (2012), *Tons for the Dustbin*, WWF Germany, Berlin.

Reisch, L.A., Sunstein, C.R., Andor, M.A., Doebbe, F.C., Meier, J. and Haddaway, N.R. (2021), "Mitigating climate change via food consumption and food waste: a systematic map of behavioral interventions", *Journal of Cleaner Production*, Vol. 279, p. 123717.

Schmidt, T.G., Schneider, F. and Claupein, E. (2018), "Food waste in private households in Germany", available at: http://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf (accessed 21 January 2019).

Schmidt, T., Schneider, F., Leverenz, D. and Hafner, G. (2019), "Foodwaste in Germany - Baseline 2015", Thünen Report, No. 71, Johann Heinrich von Thünen-Institute, Braunschweig.

Schobelt, F. (2018), "Rewe and AEZ: free food sharing in the supermarket", *W&V*, 7 February, available at: https://www.wuv.de/marketing/rewe_und_aez_kostenloses_food_sharing_im_supermarkt.

Schoonenboom, J. and Johnson, R.B. (2017), "How to construct a mixed methods research design", *Cologne Journal for Sociology and Social Psychology*, Vol. 69 No. Suppl 2, pp. 107-131.

United Nations (2015), *Transformation of Our World: The Agenda 2030 for Sustainable Development: Resolution of the General Assembly*, United Nations, New York City (accessed 5 June 2018).

Waskow, F. (2018), "Losses from the fields to the plate. Food waste in the supply chain and in consumption", *Home Economics and Science*, pp. 1-15, doi: 10.23782/HUW_03_2018.

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