# Food waste reduction in the food services sector – practical recommendations for courses of action

Manuela Kuntscher, Yanne Goossens, Thomas Schmidt


## Abstract

This article presents the results of the project Efficient Lowering of Food Waste in the Out-of-Home Sector (ELoFoS). Within the framework of this project, surveys were conducted using standardized questionnaires and guided interviews with experts. The aim was to develop practical recommendations for action to reduce food waste in food services with a self-service buffet and/or a food-serving counter. A total of 32 questionnaires and 7 expert interviews were carried out with kitchen managers from the care and business sector (rehabilitation hospitals, company canteens) were evaluated. Three recommendations for action could be established: (1) implementation of waste monitoring, (2) encouragement of kitchen and service staff, (3) optimisation of the guest area. In addition, various measures were identified for the implementation of the last two recommendations for action.


**Keywords:** food service sector, community catering, sustainability, food waste, waste monitoring

## Introduction

The production of our food requires the use of, among others, cultivated land, seeds, water, fertilizers and pesticides. In addition, greenhouse gases are produced along the entire value chain [1, 2]. Thus, economic and ecological resources are embodied in our food. If food becomes food waste, then the resources embodied in them are also disposed of. Consequently, the reduction of food waste can reduce the environmental impact.

The Sustainable Development Goals (SDG) from the United Nations therefore call for reducing food waste along the entire value chain (SDG 12.3) [3, 4]. Reducing food waste is also included in the European Waste Framework Directive in 2018 [5]. At retail and consumer level, a specific target of halving food waste by 2030 has been set. In 2019 the German Federal Ministry of Food and Agriculture published the 'National Strategy for Food Waste Reduction' to implement the reduction of food waste on a national level. In addition to primary production, processing, wholesale and retail as well as private households, this strategy also includes the food service sector [6].

The current level of food waste was calculated in the so-called 'Baseline 2015 - food waste in Germany' and was found to be just below 12 mio t fresh mass, with food services accounting for 14% [7]. The food services sector is a particularly heterogeneous sector, which is divided into individual catering and community catering. Individual catering includes system gastronomy and individual gastronomy. Community catering is divided into the areas of business (e.g. company canteens), care (e.g. rehabilitation hospitals), education (e.g. schools) and welfare (e.g. retirement homes) as well as others (e.g. correctional facilities) [8]. The qualitative, quantitative and nutritional requirements are correspondingly different. This leads to different procedures

**Peer-reviewed**
Manuscript (original) submitted: 12. August 2021
Revision accepted: 22. November 2021

**Citation**
Kuntscher M, Goossens Y, Schmidt T: Food waste reduction in the food services sector – practical recommendations for courses of action. Ernahrungs Umschau 2022; 69(2): 18-23.
The English version of this article is available online:
DOI: 10.4455/eu.2022.004

**Corresponding author**
Manuela Kuntscher, M. Sc.
Thünen Institute of Market Analysis
Bundesallee 63
38116 Braunschweig, Germany
manuela.kuntscher@thuenen.de

and processes in the kitchens. Even the serving of meals can vary from table service, over food-serving counters where staff serves customers, to self-service buffets; mixed forms are also frequently used.

Depending on where exactly the food waste occurs, a distinction is made between storage losses, preparation losses, losses from overproduction, serving losses and plate leftovers [9]. Storage losses include, for example, spoiled food, but also food that is disposed of due to an expired best-before date [10]. Preparation losses include, among other things, peels and cuttings removed during preparation, as well as food that is discarded due to production errors (e.g., overcooked pasta). Overproduction includes all food that is already prepared for consumption but has not left the kitchen [9, 11]. This food can be reused from a hygienic point of view, but quality requirements (e.g., for products that look and/or taste best fresh, such as lettuce) may stand in the way. In addition, rigid menu planning (e.g., inflexible weekly schedules) or lack of storage capacity, as well as lack of time, can lead to overproduction being discarded [12]. Serving losses include food that was already in the food-serving counter or on the self-service buffet but not served to the guest [11, 13]. Plate leftovers includes all food that guests leave on their plates and that is then disposed of by staff [9].

The aim of the ELoFoS[1] research project is to reduce food waste in the food service sector. For this purpose, food waste is being quantified in various food services, reduction strategies are tested and their transferability to other companies is examined. Data was collected by means of questionnaires and interviews with experts. The results of these surveys were published as a Thünen Working Paper [14]. This article presents the main results of this Working Paper.

## Research question and objective

The aim was to draw up practical recommendations for courses of action for food services with a self-service buffet and/or a food-serving counter. These recommendations should show the most important starting points for a successful food waste reduction and thus support the kitchen management. The research questions are:

- What recommendations for action can be made for food services with a self-service buffet and/or a food-serving counter?
- Which concrete measures can be used to implement these recommendations in practice?

## Methodology

Data were collected in 2019 by means of expert interviews (three rehabilitation hospitals; four company canteens) and questionnaires (26 rehabilitation hospitals; six company canteens). The average number of meals served per year was about 340,000 in the rehabilitation hospitals and about 174,000 in the company canteens.

Some of the rehabilitation hospitals have a retirement home attached to them. In addition, some of the participating companies also supply care centres and/or schools, whereas others offer meals on wheels. These areas were not considered in this study, yet they can influence the total food waste, since all meals are produced in one single kitchen. The serving systems of the surveyed food services varied. In company canteens, most meals were offered on food-serving counters (with exceptions such as soups, which are generally offered on self-service buffet stands). Rehabilitation hospitals on the other hand mainly offered a self-service buffet, complemented with a food-serving counter for the main component (e.g. meat).

The persons who are in charge of the kitchen were defined as experts. The contacts of the project and practice partners of the ELoFoS project were used for the acquisition of the experts. The kitchen managers put forward by the project and practice partners received the questionnaire as a Word document with active control elements, so that a direct answer on the computer was possible. The questionnaire mainly referred to key figures and estimations of food waste (e.g. quantity and frequency of loss types). When it comes to the expert interviews, the kitchen managers received the questions beforehand. No negative effects were to be expected from this, as the purpose of the interviews was to get a complete picture, not spontaneous answers. The interviews included questions about the causes of food waste and about reduction measures that had already been implemented. The response rate (in relation to the contacted experts) was 97% for the questionnaires and 88% for the expert interviews.

Two of the seven interviews took place in person at the respective company site, the others were conducted by telephone. The questionnaires and expert interviews were analyzed by using descriptive statistics and Microsoft Excel. For the evaluation of the expert interviews, the answers were first recorded in keywords, then categories were formed and frequency tables were created.

[1] The ELoFoS project has been funded by the German Federal Ministry of Food and Agriculture (BMEL) since 2018 until March 2022. The project executing agency is the Federal Office for Agriculture and Food (BLE).

## Results

Kitchen managers estimated that most food waste came from serving losses and plate leftovers, followed by losses from overproduction. The smallest amounts were estimated to come from preparation and storage losses. Consequently, foods that have already undergone certain preparation steps were disposed of in greater quantities and resulted in serving losses, plate leftovers, or losses due to overproduction. As preparing food, and making it ready to be consumed, requires the use of resources such as energy, water and labour, it is particularly problematic when large quantities of already prepared food are disposed of.

Based on the results of the questionnaires and expert interviews as well as the resulting conclusions, three recommendations for courses of action to reduce food waste could be drawn up for food services with a self-service buffet and/or food-serving counter: conduct waste monitoring, encourage kitchen and service staff, and optimise guest areas. In addition, some exemplary reduction measures could be identified for the implementation of the last two recommendations. ◆ Figure 1 shows how each of the recommendations affects the different areas of a food service business and its losses. Thus, 'waste monitoring' and 'encouragement of kitchen and service staff' affect all areas, while 'optimisation of the guest area' only affects the serving counter/buffet and consumption/dining room.

The three recommendations are explained in detail below. Where relevant, the response rates are given in parentheses as percentages.

### Conduct waste monitoring

In the first step, it is essential for all companies to carry out waste monitoring and have a detailed look at the kitchen and service processes. The waste monitoring quantifies food waste by weighing. In the best case, waste monitoring records the different types of losses separately in order to subsequently derive company-specific reduction measures from the waste data (◆ Figure 1). The success of these measures should also be evaluated by waste monitoring.

When it comes to planning and forecasting, the kitchen managers mentioned their experience as a particularly important factor (86% of respondents). In some cases, factors such as the weather or holidays were taken into account. One of the obstacles to reduce food waste, was the fact that the demand was hard to estimate (57%); this related to both the number of guests and the demand for individual dishes. As a result, the kitchens often produce more than necessary and losses occur. Waste monitoring provides data that allows optimisation of demand estimation and thus forecasting. Consequently, food waste can be reduced while meeting demand. In the case of company canteens, the expected number of guests was a particular problem, as, for ex-

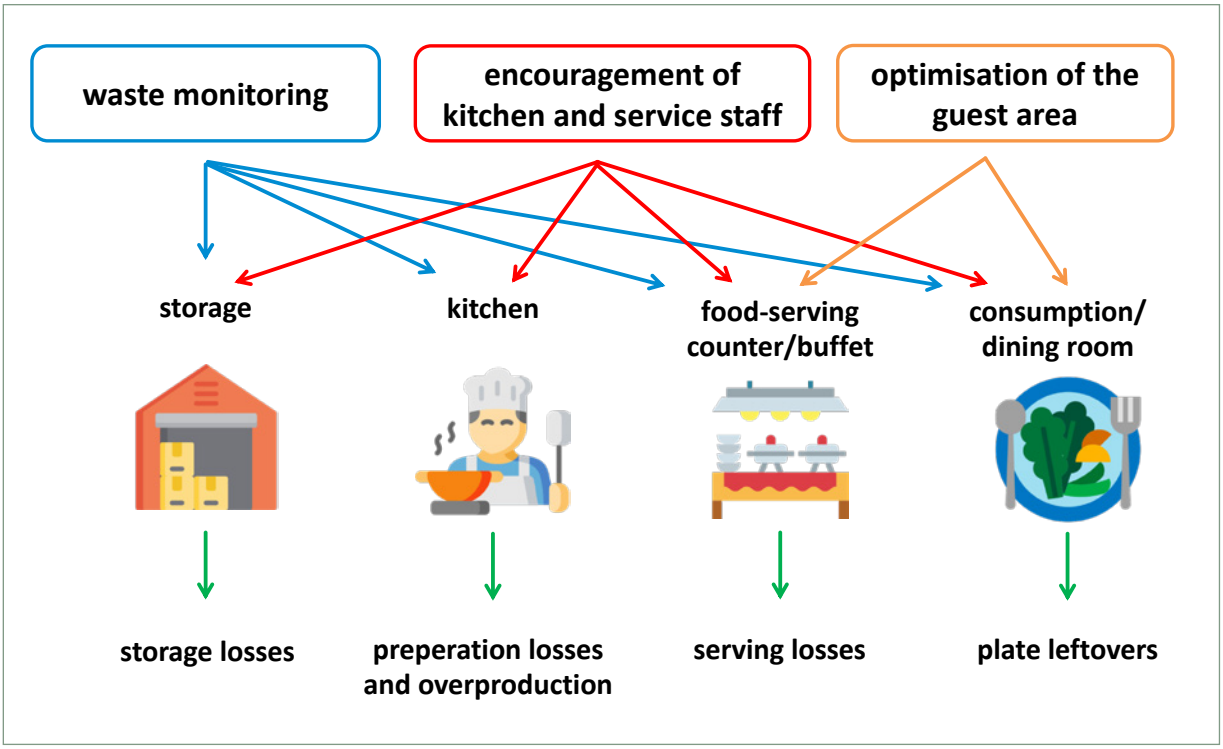


Fig. 1: **Influence of recommendations for action (own elaboration)**

ample, registered groups did not show up for meals or groups arrived unannounced. Here, above all, improved communication with the companies/institutions could enable better forecasting.
Three of the seven interviewed kitchen managers had already carried out waste monitoring and reported positive experiences, another three were planning waste monitoring, and one kitchen manager expressed interest. Accordingly, waste monitoring is widely accepted among the interviewed kitchen managers.

### Encourage kitchen and service staff

The encouragement of kitchen and service staff aims at supporting staff to contribute to reducing food waste in all areas (◆ Figure 1). To achieve this, it is important to optimise the working environment, motivate and involve staff, and improve communication. Good internal communication was rated by all kitchen managers as important for reducing food waste. For example, serving losses and losses due to overproduction could be reduced if the staff coordinated better and produced or replenished more in line with demand. Furthermore, almost half of the interviewees stated that improving communication with guests could help to reduce food waste. This could be done, for example, by actively requesting which meal components guests would desire. More than half of the interviewed kitchen managers rated extensive training of kitchen staff on the topic of food waste as useful. In addition, kitchen managers can transfer their own motivation, which they draw for example from the reduction of economic losses (43%) or for reasons of environmental protection (29%), to their staff by addressing them. In addition, the kitchen managers mentioned a number of reduction measures that are already being implemented in their companies and are a result of staff encouragement. These include reusing overproduction (100%) and demand-based replenishment (86%), both of which require a certain degree of flexibility on the part of the cooks and good internal communication.

The following staff support measures were identified as particularly successful in reducing food waste:

- raise staff awareness on food waste by communicating the ecological and economic effects associated with food waste (e.g. through training).
- involve staff in the development of reduction measures
- create clear areas of responsibility
- improve internal communication (e.g. through meetings, daily arrangements).
- approach guests more actively
- set incentives (e.g. rewards for achieving goals)
- allow cooks some flexibility so that leftovers can be reused optimally and stock can be used in a timely manner.

### Optimise guest area

Optimisation of the guest area can reduce serving losses and plate leftovers (◆ Figure 1). More than half of the kitchen managers interviewed mentioned the high expectations of guests as an obstacle to reducing food waste. Optimising the guest area therefore aims at reducing food waste without reducing guest satisfaction. In addition, the kitchen managers reported a number of reduction measures that are already being implemented in their companies and are related to the optimisation of the guest area, such as reducing the size of the gastronorm containers (GN containers) at the buffet or in the food-serving counter, especially towards the end of the meal (71%). Although the containers are filled in the kitchen, this has an influence on the presentation of the food in the guest area. Smaller amounts of food in the guest area can reduce serving losses. To reduce plate leftovers, for example, the serving cutlery at the buffet was adapted (43 %).

The following measures to optimise the guest area were identified as particularly successful in reducing food waste:

- offer side dishes of your choice
- offer different portion sizes
- smaller soup bowls, salad and dessert bowls for self-service reduce the size of serving cutlery (e.g. smaller ladles for self-service)
- optimise the arrangement of food at the buffet so that it remains fresh and attractive for a long time (e.g. stack sliced cold meat).
- smaller GN containers at the buffet or on the food-serving counter
- make guests aware of the reduction of food waste (e.g. table displays).
- enable guests to take their plate leftovers home (by doggy bag).

## Discussion

### Discussion of the results

Waste monitoring can support the process of reducing food waste; however, it is no guarantee for a reduction [15]. Nevertheless, it can help to raise staff awareness and thus initiate an optimisation of kitchen processes, which will reduce food waste [16].
The interviewees who had already carried out waste monitoring or were planning to do so, did so as part of a project. This means that the companies paid little or nothing for the waste monitoring technology and the professional support. If companies had to buy or rent this technology and services, this could reduce the willingness to implement waste monitoring. On the other hand, von Borstel et al. [13] estimated the realistic avoidance potential of food waste in food service sector to be up to 30–50%, which in turn could save considerable costs. This could be an incentive for many companies to reduce food waste. Educating kitchen and service staff about the economic and ecological effects of food waste is considered an important motivating factor [10, 17].

Furthermore, staff should first be made aware of the issue so that they can then successfully implement measures to reduce food waste [10]. In addition, it can be helpful to involve staff in the development of measures. For example, in a hospital, the two most effective measures came from the staff [18].
Behavioural and structural prevention strategies are often used in health care to prevent behaviour that is harmful to health and to support behaviour that promotes health [19]. In behaviour-based measures, the target group is provided with the necessary knowledge and skills to enable them to optimise their behaviour on their own responsibility. In structural or situation-based measures, the framework conditions are designed in such a way that the preferred behaviour is encouraged. This includes so-called nudging, which is intended to nudge people to exhibit the preferred behaviour [20]. These two strategies can be used both to support kitchen and service staff, e.g. through training (behavioural prevention), and to optimise the guest area, e.g. through smaller soup bowls (structural prevention). Various nudging measures have already been used successfully to encourage the preferred behaviour among guests as well as staff, resulting in a reduction of food waste [21, 22].

### Discussion of the applied methodology

In surveys, the effect of social desirability can lead to biased statements. In this case, respondents tend to make a socially desirable statement [23]. Since it is socially desirable to reduce food waste, response bias may have occurred due to this effect. In addition, the survey took place within a project dealing with food waste reduction. This may have exacerbated the effect. In addition, two interviews took place in person on site and five by telephone. This different setting could also have influenced the answers given.

### Data quality

In total, seven expert interviews and 32 questionnaires were analyzed. In a hermeneutic interpretation of qualitative interviews, the usual sample size is between six and 120 [24]. Consequently, the present study is in the lower range of the usual sample size. Furthermore, kitchen managers gave estimates on for example the amount of plate leftovers. These were not quantified and validated using waste monitoring. Due to the small sample size and the specific types of food services in which the surveys took place, the results are not representative for the food service sector. Nevertheless, three recommendations for action to reduce food waste could be derived for food services with a self-service buffet and/or a food-serving counter.

## Conclusion

To successfully reduce food waste in the food service sector, the heterogeneity of this sector must be taken into account. With this study, three recommendations for action could be established for food services with a self-service buffet and/or a food-serving counter. Next to waste monitoring, which itself can be classified as a measure, the recommendations include encouraging kitchen and service staff and optimising the guest area. Due to operational differences (e.g. in staff qualifications or the daily number of guests), measures for implementing these recommendations must be company-specific.
The reduction of food waste in commercial kitchens is a team task. Communication and the involvement and training of staff are therefore important factors to consider in the recommendation 'encourage kitchen and service staff'. However, not only the staff should be sensitised to food waste, but also the guests. This can be done, for example, by means of table displays, as suggested in the recommendation 'optimise guest areas'. In addition, the guest area can be improved by offering different portion sizes and the choice of side dishes. The most important first step, however, is the recommended action 'waste monitoring' in order to quantify food waste, show potentials, derive planning parameters and reduction measures, and make successes visible.

**Conflict of intrest**
The authors declare that there is no conflict of interest.

**Manuela Kuntscher, M. Sc.**[1]
**Yanne Goossens, Dr. -Ing.**[2]
**Thomas Schmidt, Dr.**[3]
Thünen Institute of Market Analysis
Bundesallee 63
38116 Braunschweig, Germany

[1] manuela.kuntscher@thuenen.de
[2] yanne.goossens@thuenen.de
[3] thomas.schmidt@thuenen.de

## References

1. *Kummu M, de Moel H, Porkka M, Siebert S, Varis O, Ward PJ: Lost food, wasted resources: global food supply chain losses and their impacts on freshwater, cropland and fertiliser use. Sci total Environ 2012; 438: 477–89.*
2. *Umweltbundesamt (UBA): Pflanzenschutzmittelverwendung in der Landwirtschaft. https://www.umweltbundesamt.de/daten/land-forstwirtschaft/pflanzenschutzmittelverwendung-in-der#zulassung-von-pflanzenschutzmitteln (last accessed on 20 February 2020).*
3. *Vereinte Nationen (VN): Transformation unserer Welt: die Agenda 2030 für nachhaltige Entwicklung. A/RES/70/1. 2015.*
4. *Food and Agriculture Organization of the United Nations (FAO): The state of food and agriculture. Moving forward on food loss and waste reduction. FAO 2019.*
5. *Abfallrichtlinie (EU) 2018/851 des Europäischen Parlaments und des Rates vom 30. Mai 2018 zur Änderung der Richtlinie 2008/98/EG über Abfälle. Amtsblatt der Europäischen Union: L 150.*
6. *Bundesministerium für Ernährung und Landwirtschaft (BMEL): Nationale Strategie zur Reduzierung der Lebensmittelverschwendung. Berlin: BMEL, Referat 216, 2019.*
7. *Schmidt T, Schneider F, Leverenz D, Hafner G: Lebensmittelabfälle in Deutschland – Baseline 2015. Thünen Report 71. Braunschweig: Johann Heinrich von Thünen-Institut 2019*
8. *Pfefferle H, Hagspihl S, Clausen K: Gemeinschaftsverpflegung in Deutschland – Stellenwert und Strukturen. Ernährungs Umschau 2021; 68(8): M470–83.*
9. *Göbel C, Blumenthal A, Niepagenkemper L, Baumkötter D, Teitscheid P, Wetter C: Bericht zum Forschungs- und Entwicklungsprojekt. Reduktion von Warenverlusten und Warenvernichtung in der AHV – ein Beitrag zur Steigerung der Ressourceneffizienz. Münster: Institut für Nachhaltige Ernährung und Ernährungswirtschaft (iSuN), Fachhochschule Münster 2014.*
10. *Waskow F, Blumenthal A, Eberle U, von Borstel T: Situationsanalyse zu Lebensmittelverlusten im Einzelhandel, der Außer-Haus-Verpflegung sowie in privaten Haushalten und zum Verbrau-cherverhalten (SAVE). Zusammenfassung. Deutsche Bundesstiftung Umwelt 2016.*
11. *von Borstel T: Modul Außer-Haus-Verpflegung. In: Waskow F, Blumenthal A, Eberle U, Borstel T von (eds.): Situationsanalyse zu Lebensmittelverlusten im Einzelhandel, der Außer-Haus-Verpflegung sowie in privaten Haushalten und zum Verbraucherverhalten (SAVE). Zusammenfassung. Deutsche Bundesstiftung Umwelt 2016.*
12. *Kranert M, Hafner G, Barabosz J et al.: Ermittlung der weggeworfenen Lebensmittelmengen und Vorschläge zur Verminderung der Wegwerfrate bei Lebensmitteln in Deutschland. Stuttgart: Universität Stuttgart, Institut für Siedlungswasserbau, Wassergüte- und Abfallwirtschaft (ISWA) 2012.*
13. *von Borstel T, Prenzel GK, Waskow F: Ein Drittel landet in der Tonne. Zwischenbilanz 2017: Fakten und Messergebnisse zum deutschlandweiten Lebensmittelabfall in der Außer-Haus-Verpflegung. Biberach/Riss: United Against Waste e. V. 2017.*
14. *Kuntscher M, Schmidt T, Goossens Y: Lebensmittelabfälle in der Außer-Haus-Verpflegung - Ursachen, Hemmnisse und Perspektiven. Thünen Working Paper 161. Braunschweig: Johann Heinrich von Thünen-Institut 2020.*
15. *Eriksson M, Malefors C, Callewaert P, Hartikainen H, Pietiläinen O, Strid I: What gets measured gets managed – or does it? Connection between food waste quantification and food waste reduction in the hospitality sector. Resources, Conservation & Recycling: X 2019; 4: 100021.*
16. *Leverenz D, Hafner G, Moussawel S, Kranert M, Goossens Y, Schmidt T: Reducing food waste in hotel kitchens based on self-reported data. Ind Mark Manag 2020.*
17. *Leanpath: Empowering & engaging culinary teams to prevent food waste. https://info.leanpath.com/whitepaper-empowering-engaging-culinary-teams-to-prevent-food-waste (last accessed on 13 May 2020).*
18. *Leanpath: How Swedish hospital cut its food waste by 53 percent. https://blog.leanpath.com/how-swedish-cut-food-waste-by-53-percent (last accessed on 04 June 2020).*
19. *Bundesministerium für Gesundheit: Begriffe A-Z. Prävention. https://www.bundesgesundheitsministerium.de/service/begriffe-von-a-z/p/praevention.html (last accessed on 20 May 2020).*
20. *Kraaibeek GmbH: Verhaltens- und Verhältnisprävention. Was versteht man unter den beiden Handlungsfeldern der Prävention, welche Vorteile ergeben sich für Unternehmen und warum ist ein Zusammenspiel beider Bereiche besonders wirkungsvoll? https://kraaibeek.de/bgm-bgf/verhaltens-und-verhaeltnispraevention/ (last accessed on 18 March 2021).*
21. *Kallbekken S, Sælen H: Nudging hotel guests to reduce food waste as a win-win environmental measure. Econ Lett 2013; 119: 325–7.*
22. *Visser-Amundson A, Kleijnen M: Nudging in food waste management: where sustainability meets cost-effectiveness. In: Närvänen E, Mesiranta N, Mattila M, Heikkinen A (eds.): Food waste management. Solving the wicked problem. Cham, Switzerland: Springer Nature Switzerland 2020; 57–87.*
23. *Winkler N, Kroh M, Spiess M: Entwicklung einer deutschen Kurzskala zur zweidimensionalen Messung von sozialer Erwünschtheit. DIW Discussion Papers, No. 597. Berlin: DIW Berlin, Deutsches Institut für Wirtschaftsforschung 2006.*
24. *Helfferich C: Die Qualität qualitativer Daten. Manual für die Durchführung qualitativer Interviews. 4. ed., Wiesbaden: VS Verlag für Sozialwissenschaften/Springer Fachmedien 2011.*