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Food waste reduction at Restaurant De Pleats: Small steps for mankind

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Every year, large quantities of food are thrown away in the catering industry. Restaurant De Pleats therefore started a pilot study for twelve days to weigh all discarded carrots, chips and bread in order to determine food waste within the company. The management decided to measure three product groups since measuring the total waste would make it difficult to determine which interventions would or would not work. A distinction can be made between pre-consumer and post-consumer waste. Therefore waste from the kitchen and from the restaurant was collected and weighed separately. What stood out was that during the week more fries were thrown away and on the weekend more carrots were discarded. One explanation for this is that on the weekends more families with children are dining in the restaurant. Prevention is the quickest way to reduce food waste. The most important recommendations for interventions are: weigh all portions, reduce portion sizes and calculate the impact of the waste. During the study a change of behaviour was already noticed in the kitchen. Cooks re-used more products and were much more aware of the fact that a few hundred grams of waste per cook per day lead to hundreds of kilos of waste per year.

Keywords: catering, hospitality, environment, sustainability, procurement, measuring

Introduction

In 2009 the Dutch government launched an ambitious target to reduce food waste by 20% within six years (Giessen, 2014). It is not clear by what percentage the waste has been reduced, but in all likelihood the objective hasn't been achieved. Over 42% of all food waste in the Netherlands is thrown away by households and consumers, 39% is discarded by the producers and 14% by the hospitality industry. 14% seems small compared to the other percentages, but it still involves tons of food. A study by the organisation Waste Watchers (2014) shows that on average 12% of the products in eating venues disappears into the dustbin. This is bad for the environment, but it's also a waste of food products when many people on earth do not have enough to eat.

Restaurant De Pleats (www.depleats.nl) is a family restaurant in Burgum, the Netherlands. Burgum is a small town with 10 000 inhabitants. The restaurant has a big hall for weddings and events. In total it can accommodate up to 500 guests. De Pleats is the Frisian translation of "farm" because it is situated in an old monumental farm building from 1773. It is a venue for coffee, lunch, dinner, weddings, and meetings.

Geesje Duursma has been the owner of De Pleats since 1997. She studied marketing and economics at the University of Groningen. Students from the Stenden Hotel Management School can do research in her restaurant. She is also an associate of the Academy of International Hospitality Research and recently started her PhD research on hospitality and entrepreneurship.

Sustainability and corporate social responsibility (CSR) are written into the DNA of De Pleats. In 2000, when CSR was still a relatively new concept, De Pleats won prizes for CSR at the World Young Business Achievers in the USA. In recent years, much has changed and the concept of sustainability is nowadays inseparable from the concept of "good entrepreneurship". In 2014 De Pleats received the Green Key Gold, the highest recognition by the Dutch certification agency Green Key.

In the past, the amount of waste at De Pleats wasn't measured. When a Green Key team started to work with the Green Key checklist, management and employees became much more aware of the fact that "numbers tell the tale". This article describes a first pilot project to get better insight into the waste flows within De Pleats restaurant. The main goal is to create awareness among the kitchen staff. Since this is the first time we have measured food waste, it will also teach us how to develop a more scientific and executable research project concerning food waste reduction in De Pleats and set a base measurement.

At first, the idea was to measure the total food waste, but measuring "all" would make it difficult to determine which interventions would work or not. Therefore it was decided to focus on three specific product groups: baguettes, carrots and French fries. These products are prepared on a daily basis and the waste of these products is measurable. To set a baseline measurement, the cooks and Green Key coordinator measured food wastage for 12 days. We, as management, chose to skip the highest and the lowest measurement of each product group to eliminate measurement errors. Although this is not a big dataset, we were able to draw conclusions about setting up the next measurement. The test had some unexpected positive side effects – during the measuring period, we noticed that the cooks were already carrying out interventions on their own.

This paper reports on the results of this limited project: it

is the first small step of a bigger project to reduce all waste production at De Pleats.

Literature review

As mentioned in the introduction, on average, 12% of the products in eating venues disappears into the dustbin. According to the Dutch Government (2015) producers, supermarkets and catering companies discard 2.5 billion kilograms of food every year. Some of this food waste is not avoidable. For example, as a restaurant, you want to guarantee the freshness of your products, and therefore you will always be left with non-usable leftovers. But in some cases, food waste is avoidable, for example because the portions are too big or good food is unnecessarily discarded.

With the distinction between avoidable and non-avoidable food waste (Sloan, Legrand, & Chen, 2013), we can create a matrix with four different types of food waste (Table 1) (Cavagnaro & Kruif, 2014).

According to Cavagnaro and Kruif (2014), major reductions in food have to be achieved in the pre-consumer quadrant. This is because it's the only quadrant where action is possible (Shakman, 2012). In the Netherlands and Europe, for example, it is forbidden to use post-consumer food waste to feed animals, in order to prevent animal infections such as foot and mouth disease. (see EG Regulation 1069/2009 art 11.1B).

Cavagnaro and Kruif (2014) also state that if we follow the definition given above, food that is not intended for human consumption is the only "non-avoidable" waste. All other forms of waste can be avoided and we should find ways to reduce them. This does not mean that non-avoidable waste should be completely ignored. At Restaurant De Pleats coffee grounds and other waste not intended for human consumption are separately collected. These forms of waste are converted into biofuel for diesel-powered cars. In the so-called Moerman's waste pyramid (Every Crumb Counts, 2013), which is a frequently used tool for understanding how food waste works, redirecting waste for industrial use is also mentioned (Figure 1).

But redirecting food waste to other uses isn't most preferable. The message the pyramid conveys is that the top options, such as prevention, are better solutions. According to Cavagnaro and Kruif (2014), two main tools to prevent food waste in restaurants and catering before the dish reaches the guest are menu engineering and menu portioning.

Menu engineering

The process of analysing the performance of a menu item in order to optimise its contribution to the margin is called menu engineering. It focuses on which dishes to serve, how the dishes are prepared and where the raw products for these dishes come from. This is a very complex issue and will therefore not be addressed in this article.

Table 1: Typologies of food waste in restaurants and catering, with examples

	Avoidable	Non-avoidable
Pre-consumer	Garnishes Usable leftovers from the kitchen	Non-usable leftovers from the kitchen
Post-consumer	Returned to the kitchen, e.g. portion too big	Returned to the kitchen, such as meat bones or fish skin

Portioning

Prevention through better portioning is a tool that is easier to apply. A portion is the amount of food per dish. In the hospitality industry portioning is necessary to control costs, to assure consistency during different shifts and to guarantee uniformity towards guests. Besides that, it can be used to control waste.

Different guests need different portion sizes. For example, many restaurants serve special menus for children. But woman and elderly people also prefer different sized portions. Restaurant De Pleats caters for the needs of "small eaters" by serving smaller senior portions. This is an example of a pre-consumer intervention that limits post-consumer waste.

Menu portioning to reduce food waste only works if all the employees are properly trained. This counts both for employees in the kitchen and employees who have contact with guests. Charts breaking down food items, lists with the amounts of every item needed for a certain dish, and photographs showing the presentation and portioning are important instruction methods in the kitchen. Calibrated measuring tools such as serving spoons and cups make menu portioning easier.

"The black brigade" has to ensure that guests get an extra serving if they desire it. To conclude, food waste can't be avoided completely, but with prevention the avoidable part can be reduced. For restaurants like De Pleats, menu portioning is the easiest solution for reducing food waste. Menu engineering is much more complex, and takes much more time to implement, but when it's implemented well it also has the

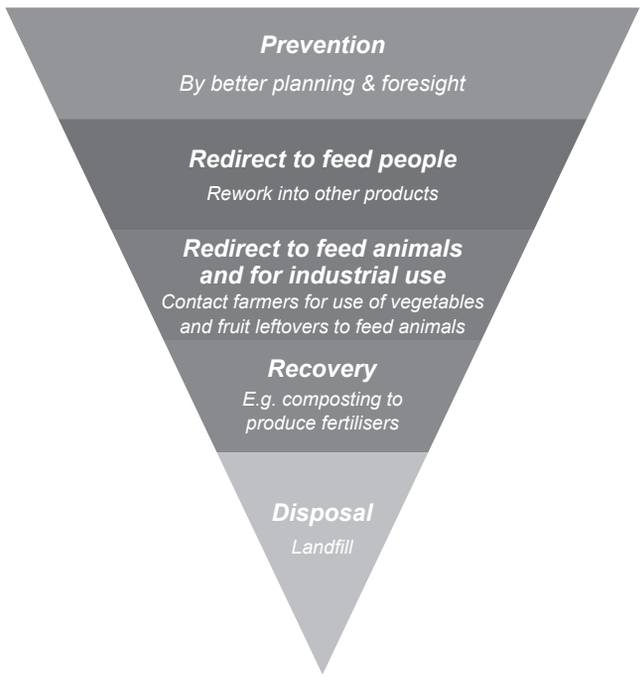

Figure 1: Moerman's waste pyramid with examples of actions (Source: Every Crumb Counts, 2013)

benefit that it leads to more insight into the processes in the kitchen. For the non-avoidable waste, other methods have to be found. Moerman's waste pyramid is an excellent tool to determine what methods are most preferable.

Methodology

Measuring is knowing

While we try to prevent food waste as much as possible, food is discarded every day at De Pleats. To get a good insight into food waste, the employees in the kitchen measured, over two different periods of six days, how many different products were discarded. This was done for the products baguettes, carrots and French fries, because it had been observed that relatively large amounts of these products were thrown away. In addition, these products are usually served separately in a dish, basket or bowl. It's relatively easy to realise savings by adjusting the size of the dishes or by refilling serving bowls less quickly. By focusing first on a few product groups, we can better measure whether performance is improved. In this report we describe the initial findings from the first two measurement periods. In a few months, we will measure again to see to what extent food waste has been reduced.

Design

De Pleats is a restaurant and party centre in Burgum, in the north of the Netherlands. Originally it was a community centre owned by the municipality. In 1997, Geesje and Eelke Duursma took over De Pleats and turned it into profitable company. Nowadays almost 50 employees (23 full-time employees) work at De Pleats. Approximately 30 employees work in the front office and seven cooks work in the kitchen. Others work as cleaning staff or serve as all-round employees. The capacity of the restaurant and foyer is 60 guests. By adding the different halls, this can be expanded to almost 400 guests.

Over two periods, from 29 October to 5 November, and from 30 November to 5 December, we measured how many grams of French fries, carrots and bread was thrown away. A distinction was made between products that were returned from the restaurant or from buffets and products that were thrown away in the kitchen. In the corner where the dishes are done, three buckets were placed where the waste from the restaurant was collected. Three buckets were also placed outside the kitchen to collect waste from the kitchen. The waste was weighed at the end of each day and the data recorded on an Excel sheet. The Green Key coordinator was responsible for overseeing the measurements. The employees in the kitchen collected and weighed the amounts of waste.

Research question

What is the food waste for the three product groups, baguettes, carrots and French fries, and what interventions can be taken to reduce wastage of these products?

This research question can be split into more sub-questions:

- What percentage of the products, French fries, carrots and baguettes, is discarded?
- Which days show outliers in waste percentages?
- How can these outliers be explained?
- What is the financial and environmental impact of the measured food waste?
- What are the averages, compared to deduce the "bigger picture" of food waste at De Pleats?
- What interventions can be taken to reduce food waste at De Pleats in the three measured product groups?
- How should the next experiment be designed, based on what is learnt from the setup of this pilot study?

Results and discussion

In this section, we explain and discuss the results of the pilot study, following the research questions outlined above. We also focus on the financial part of waste reduction. If we reduce waste, fewer products have to be purchased. Besides that, it's better for the environment. For the production of food, large quantities of water are used, so by reducing food waste, we also reduce water waste.

The results of the measurements are shown in Table 2.

The highest and lowest outliers were removed because these were probably incorrectly measured. These are the empty fields in the table. The waste percentages were calculated by dividing the total amounts of waste by the total amounts prepared. As mentioned, the averages over 5 and over 10 days were calculated by dividing the total amounts of waste by the total amounts prepared.

On average over 10 days, 17.1% of prepared baguettes were discarded. Compared to the average 12% of Wastewater Watchers as mentioned earlier, this is high. On 30 October, there was a lot of bread left in the kitchen. The cause is not clear; it might have been an error of judgment. Baguettes that are left over are reused, if possible, to make *croutons* or *crostini*, for example. Reused bread is thus already subtracted from the waste on the table. On 30 October, four whole baguettes were discarded (a baguette weighs 440 grams). These could probably not be re-used. The waste percentages of this item fluctuate much. On 5 December only 4.4% of baguettes were discarded, since this was a very busy day. The reason for these fluctuations is that the stick loaves are baked at the beginning of the day and then it also needs to be estimated how many baguettes are needed for the whole day. This is not always easy to assess because many guests also eat à la carte. The waste percentages and the waste per cover don't always correspond. Although the waste percentage on 30 October was higher than on 11 November, the waste per cover was much lower. On 11 November, there was probably too much food prepared for the number of guests. On 31 October, the waste percentage was average, but the waste per guest was very low. This is because this Saturday was a very busy day with 214 covers.

On average over 10 days, 6.3% French fries were discarded. Compared to the 17.1% baguettes and the 12% of discarded products in the research by Waste Watchers, this is relatively low. Nevertheless, about 8.5 kilograms of chips were thrown away over 10 days. It is striking to see that the peaks were on weekdays. On Thursday, 5 November as much as 16.2% of the chips were discarded. It is not clear what the cause was. Because the waste per cover was also very high, it could be that a group ordered extra fries but didn't eat them. Pre-consumer waste, that is the food which is prepared but not served, can be prevented more easily on busy days such as Fridays and Saturdays than on weekdays because the turnover rate is much higher then. On weekends, fewer chips are wasted. This is because more families with children visit De Pleats then. The chips from the plates are then often eaten. During the week,

there are more guests who come for lunch or a corporate event. They probably eat more vegetables and fewer chips. Another explanation could be that on weekends, with many clients, the garbage is collected less accurately and chips are also discarded with the other trash.

On average over 10 days, 11.6% carrots were discarded. This comes close to the average percentage of discarded products of 12% in the Dutch hospitality industry as investigated by Waste Watchers. In both periods, almost 9.5 kilograms of carrots were discarded. It is noteworthy that the waste percentage on Saturday, 31 October was the highest in two weeks. On other days the waste per cover might be higher, but this is also because many more guests visit De Pleats on Saturdays. The earlier explanation then seems logical that, on

Table 2: Waste measurements over 12 days

	Total amount prepared (g)	Waste kitchen (g)	Re-used (g)	Waste restaurant (g)	Total amount consumed (g)	Waste total (g)	Waste total (%)	Cover	Waste per cover
Baguettes									
Thursday 29 Oct	5 280	0	0	420	4 860	420	8.0%	51	8.2
Friday 30 Oct	7 040	1 760	440	768	4 512	2 528	35.9%	96	26.3
Saturday 31 Oct	8 800	50	0	1 240	7 510	1 290	14.7%	214	6.0
Tuesday 3 Nov	3 080	220	0	228	2 632	448	14.5%	19	23.6
Wednesday 4 Nov	3 520	660	0	370	2 490	1 030	29.3%	45	22.9
Thursday 5 Nov	3 080	580	0	392	2 108	972	31.6%	21	46.3
Total/average*	30 800	3 270	440	3 418	24 112	6 688	21.7%	446	15.0
Monday 30 Nov	2 640	0	0	0	2 640	0	0	14	0
Tuesday 1 Dec	4 400	880	440	1 700	1 820	2 580	58.6%	24	107.5
Wednesday 2 Dec	2 640	109	660	150	2 381	259	9.8%	37	7
Thursday 3 Dec	3 080	480	880	120	2 480	600	19.5%	40	15
Friday 4 Dec	7 040	120	0	850	6 070	970	13.8%	127	7.6
Saturday 5 Dec	8 360	244	0	126	7 990	370	4.4%	159	2.3
Total:	21 120	953	1 540	1 246	18 921	2 199	10.4%	363	6.1
Total/average over 10 days*	51 920	4 223	1 980	4 664	43 033	8 887	17.1%	809	11.0
French fries									
Thursday 29 Oct	20 000	340	0	400	19 260	740	3.7%	51	14.5
Friday 30 Oct	25 000	980	0	1 100	22 920	2 080	8.3%	96	21.7
Saturday 31 Oct	25 000	102	0	1 264	23 634	1 366	5.5%	214	6.4
Tuesday 3 Nov	3 000	84	0	276	2 640	360	12.0%	19	18.9
Wednesday 4 Nov	4 500	300	0	60	4 140	360	8.0%	45	8.0
Thursday 5 Nov	4 500	322	0	409	3 769	731	16.2%	21	34.8
Total/average*	82 000	2 128	0	3 509	76 363	5 637	6.9%	446	12.6
Monday 30 Nov	3 000	0	0	98	2 902	98	3.3%	14	7.0
Tuesday 1 Dec	5 000	100	0	430	4 470	530	10.6%	24	22.1
Wednesday 2 Dec	2 500	170	0	238	2 092	408	16.3%	37	11.0
Thursday 3 Dec	5 000	63	0	210	4 727	273	5.5%	40	6.8
Friday 4 Dec	20 000	270	0	650	19 080	920	4.6%	127	7.2
Saturday 5 Dec	15 000	343	0	254	14 403	597	4.0%	159	3.8
Total:	45 000	776	0	1 544	42 680	2 320	5.2%	350	6.6
Total/average over 10 days*	127 000	2 904	0	5 053	119 043	7 957	6.3%	796	10.0
Carrots									
Thursday 29 Oct	10 000	160	0	700	9 140	860	8.6%	51	16.9
Friday 30 Oct	10 000	338	0	944	8 718	1 282	12.8%	96	13.4
Saturday 31 Oct	7 500	277	0	1 475	5 748	1 752	23.4%	214	8.2
Tuesday 3 Nov	1 000	23	0	68	909	91	9.1%	19	4.8
Wednesday 4 Nov	6 000	810	0	173	5 017	983	16.4%	45	21.8
Thursday 5 Nov	1 500	0	0	302	1 198	302	20.1%	21	14.4
Total/average*	36 000	1 608	0	3 662	30 730	5 270	14.6%	446	11.8
Monday 30 Nov	1 000	0	0	88	912	88	8.8%	14	6.3
Tuesday 1 Dec	1 000	100	0	680	220	780	78.0%	24	32.5
Wednesday 2 Dec	7 500	0	0	60	7 440	60	0.8%	37	1.6
Thursday 3 Dec	7 500	40	0	343	7 117	383	5.1%	40	9.6
Friday 4 Dec	15 000	120	0	205	14 675	325	2.2%	127	2.6
Saturday 5 Dec	15 000	180	0	2 375	12 445	2 555	17.0%	159	16.1
Total:	38 500	340	0	3 011	35 149	3 351	8.7%	340	9.9
Total/average over 10 days*	74 500	1 948	0	6 673	65 879	8 621	11.6%	786	11.0

*The average percentages are calculated over the total amount of waste and the total amount prepared. These are not the averages of the percentages of each day; this would lead to biased results because of the different amounts prepared per day. The covers are based on main dishes.

the weekends, guests eat more chips and fewer vegetables. There were no carrots re-used, since there is relatively little waste in the kitchen. An exception was 4 November, when there were quite a lot of carrots left in the kitchen. It's not clear why these carrots weren't re-used, but this was probably done to guarantee quality. On 29 October the waste percentage was low, but the waste per guest was relatively high. This means the waste percentage could have been even lower that day. There is no clear explanation for the difference.

Procurement

Products that are thrown away must be procured. By discarding fewer products a restaurant can save on purchasing costs. In Figure 2 is calculated how much De Pleats can save each year on the purchasing costs of the three food items measured. The total annual procurement over 2014 per product is multiplied by the percentage of waste. For a restaurant, it's quite impossible to work completely without waste. But if we could reduce the waste by 50%, we can save around € 350 per year on procurement of only French fries, carrots and baguettes. This seems very little, but this is only for three products. If we try to reduce waste of all products, we can save much more on procurement. The motto should be "prevent, instead of produce".

Environment

Another important aspect is the environment. Procurement savings are nice, but by reducing waste, we also burden the environment less. For the production of food, water is needed. According to the Water Network Footprint (2015) 195 litres of water are needed for the production of one kilogram of carrots, 1 040 litres of water for the production of one kilogram of fries, and as much as 1 608 litres of water for one kilogram of bread.

Many thousands of litres of water were needed for the production of the wasted products. For the wasted 261 kilograms of baguettes, 420 473 litres of water were used (Water Network Footprint, 2015). It's important to inform all the employees but also the guests about the impact of waste in order to change the behaviour of guests too. On a daily basis a waste reduction of a few hundred grams of carrots won't impress employees or guests. But if you inform them about the impact of those small reductions for each product per year, it will give pause for thought for cooks, waiters and guests. It would be good to inform employees each day about the waste. A good key performance indicator would be waste per guest. This can be shown every day on the monitor screens in the kitchen, or can be sent by email to all employees. By also calculating the expected total waste per year (based on cumulative figures and figures from previous years), people will be more aware of the impact of waste. Besides that, as a restaurant you can set up a competition to reduce waste. The savings in money can be donated to charities or to projects for the employees. This can lead to a paradigm shift.

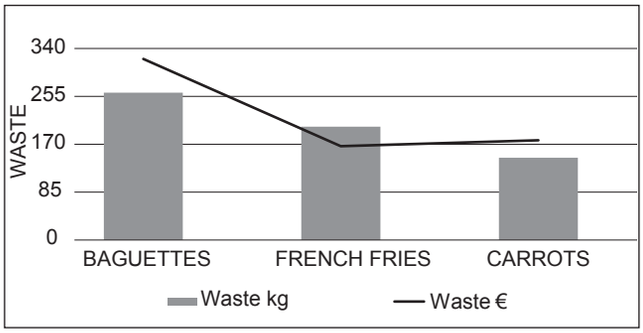

Figure 2: Waste in kg and Euros

Conclusions and recommendations

This pilot study was a first, modest trial for input for a more serious and scientific research project. It created greater awareness.

The measurement setup was quite simple. The main thing we learned is that the kitchen staff and dish washers need better instructions and that everybody should be aware of the importance of good measurement. Incidents were reported such as: "too busy", "thrown in the wrong basket", "forgot to write down how much bread was baked in the morning". Research by Cavagnaro and Kruif (2014) showed the same problems. My advice is to make it as easy as possible to measure, with no hurdles. Also, having one employee in charge and making this person responsible for the measurements (and doing the measuring yourself as an owner on his/her day off) is important. In our type of family restaurant there is usually not a culture of "measuring" or corporate programmes like "lean working". I think this can be attributed to a lack of knowledge and focus. The lack of focus is due to day-to-day worries and because it's always busy in the kitchen.

As mentioned in the introduction, the cooks have already made their own interventions. They re-use more products and are much more aware of the fact that few hundred grams of waste per cook per day leads to hundreds of kilos of waste per year. It seems that even just announcing the measurement has a waste-reducing influence. This has already had an influence on the numbers. Further research is needed.

More data are needed, but by comparing the figures it can be concluded that less food is wasted when the number of guests rise (Figure 3). So, better planning and forecasting is needed in the future. The average waste per person is 32 grams; on a busy day, with over 100 guests, it is around 20 grams. Although, as mentioned, it could also be that we have to consider that at the weekends a different type of guest visit our restaurant or that during busy times the measurement is less accurate.

Recommendations for interventions

Prevention is the quickest way to reduce waste.

French fries

- Weigh the amount of fries in the baskets and reduce the portion size
- Work more with supplements instead of serving standard large quantities of fries.

Carrots

- Use smaller bowls for the carrots and reduce the portion size
- Menu engineering: calculate the quantity that has to be prepared every day.

Baguettes

- Count the pieces of bread per basket or serve one bread roll per person

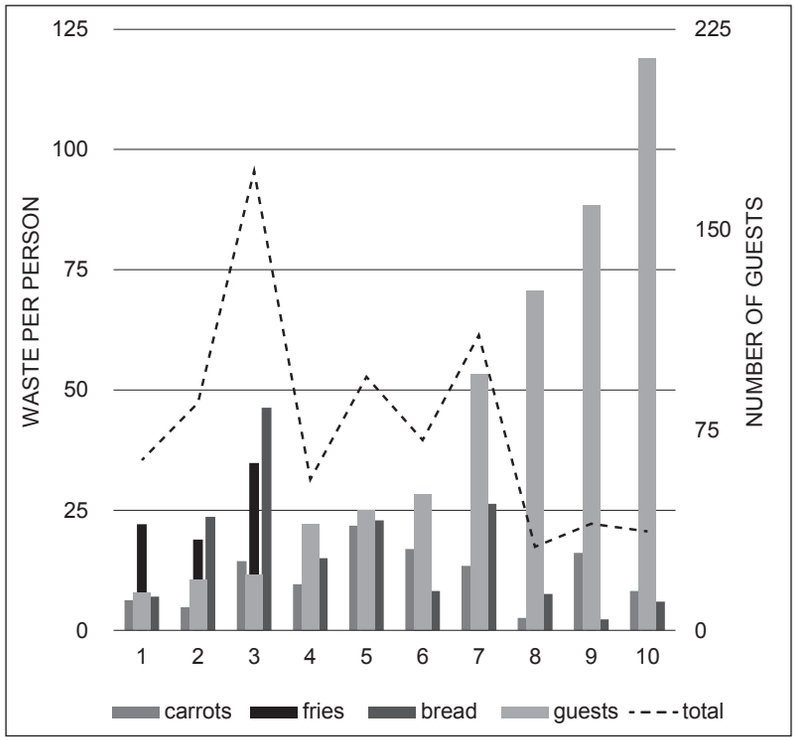

Figure 3: Waste per person/number of guests

- Menu engineering: calculate how many baguettes have to be baked every day.
- Re-use more bread, for example, as *crostini* or *croutons*.

Tips and directions for future measurements

Technical

- Weigh more different product groups to make it possible to take interventions and check if these interventions work
- Besides that, weigh the total amount of waste in the company
- Use different key performance indicators, such as waste per guest, to measure performance
- Predict, on the basis of menu engineering
- Make the standard portions smaller and work more with supplements.

Behavioural

- Calculate and show the impact of the waste over a year
- Inform employees and guests on the impact of waste
- Use smaller plates for serving meals
- Reward sustainable behaviour: for example, give guests a green button with the text "I'm sustainable", so that they are reminded that they have to take care of the environment.

Recommendations for future research

This pilot study can be expanded for other product groups like soup and potatoes. Buffets lead to much waste; this can also be a topic for further research.

As an acronym for the waste programme, we propose WASTE: Workable, Attractive goals/rewards, Simple, Tangible and Economic value.

What motivates employees to help reduce waste? Besides behavioural, psychological and social issues, we suggest that it shouldn't be only the company that gains. Reduction should be visualised and the financial gain should go to new CSR projects. Working together, it is possible to create a culture where wasting food is "simply not done".

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