



NUDGING HOTEL GUESTS FOR REDUCING FOOD WASTE - A FIELD EXPERIMENT -

Master Thesis | Cand. Soc. Service Management

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List of abbreviations

- UNEP United Nations Environment Programme
- FAO Food and Agriculture Organization
- EPA Environmental Protection Agency
- BSR Business for Social Responsibility
- WRAP The Waste and Resources Action Programme
- REFED Rethink Food Waste through Economics and Data
- EC European Commission



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Abstract

Given the considerable negative impact food waste has upon the environment and the tourism industry (Gössling et al. 2011) alongside the lack of research attributed to this topic (Gössling and Peeters 2015), the present study aims at making use of behavioural economics principles to address this matter. Our Master thesis will be searching to understand how the business impact of service firms can be maximized by making use of behavioural economics principles and integrating them within the service design mechanisms. Even though there is ongoing research that emphasizes the benefits of incorporating behavioural economics within a business, this still does not represent a mainstream practice within the service industry. Hence, this paper introduces the concept of "nudging" as a strategy to correct guests' behaviour when it comes to generating food waste. "Nudging" incorporates a multitude of behaviour change tools created for suggesting choices of action by simplifying the decisionmaking process. This is achieved by taking into consideration the behavioural flaws known for influencing individuals' capacity to make decisions. By considering successful applications of nudge interventions to guide human behaviour in other previous studies, the present paper aims at underlining how similar strategies can be applied for reducing food waste in the hospitality industry. Thus, we present two non-intrusive nudges (reducing plate size and implementing a tax on leftovers) that achieve a decrease in food waste by approximately 30%. The results of our research prove to be statistically significant and environmentally sustainable since food waste is considered as an extensive contributor to climate change and degradation. In addition, the two nudge interventions do not affect customer satisfaction and decrease the quantity of food to be purchased, resulting in increased profits for the business. Hence, the measures proposed in the present research constitute potential advantages for both, the hotel applying it and the environment.



1. Introduction

Nowadays, it is very important for the tourism industry to have an interest in both, short-term profits and long-term survival. The latter is mainly concerned with the conservation of natural resources and the adoption of sustainable processes. The short-term gains are induced by the competence of a company to charge a high price while maintaining the operating costs low. In the tourism industry, it is often encountered the situation in which processes adopted for securing long-term sustainability are in direct opposition to the ones enabling maximisation of short-term gains (Moeller, Dolnicar, and Leisch 2011). As an example, we can look at the positive effects capacity restrictions have upon the environment but are not adopted by the hospitality sector due to its negative effect upon profits.

However, there are cases where these two goals can be achieved at once by benefiting the tourism businesses and also minimizing the environmental footprint. An example would be the reuse of towels in hotels where the guests are encouraged to utilize them more than once before they are changed. This would, in turn, lead to a smaller use of environmental resources while reducing considerably the hotel's operating costs. Another example which also represents the core focus of the present study is the reduction of food waste generated by hotels.

Given the considerable negative impact food waste has upon the environment and the tourism industry (Gössling et al. 2011) and the lack of research attributed to this topic (Gössling and Peeters 2015), the present study aims at making use of behavioural economics principles to address this matter. Our Master thesis will be searching to understand how the business impact of service firms can be maximized by making use of behavioural economics principles and integrating them within the service design mechanisms. Even though there is ongoing research which emphasizes the benefits of incorporating behavioural economics



experience and the end to end journey, while the latter zooms in on the explicit, individual moments of decision-making where nudges can be incorporated to strategically cause a considerable impact. In this way, the behavioural design will provide us an understanding of how service firms can improve the customer experience by taking a human-centred approach to make services more effective, intuitive and efficient. The reason for choosing to incorporate behavioural principles within service design stands behind the fact that not only they will provide insight into the less rational behaviour of consumers but it will also enhance the possibility to improve the customer journey, reduce customer effort, stimulate profitmaximizing behaviours and boost long-term customer lifetime value. Additionally, the implementation of nudges within the customer journey when using services can drive consumers towards adopting a sustainable behaviour by reducing waste and unnecessary costs for service firms.



The aim of our research is to shed light upon the pre-consumer and post-consumer origins of food waste, and the effects and challenges that may come with the attempt of reducing it. More specifically, we will test if there is a behavioural change on the guests' behalf when being exposed to two treatments relying on the use of external cues to influence consumption norms analysing their willingness towards adopting a sustainable behaviour. The first section will go in more depth into the definition of food waste, terminology, the cause and effects of it alongside the challenges of reducing it. Additionally, in this chapter, we will discuss potential practices and approaches for reducing food waste in the hospitality industry. The following section will introduce the research methodology, alongside the data collected and its analysis, where we also assess the reliability and the validity of the research. The third section will bring clarifications upon the concept of behavioural economics and the use of nudges in driving individuals towards adopting sustainable practices. Moreover, during this part of the present study, we will present the concept of service design focusing on the individual moments of the customers' decision-making process where nudges can be implemented. The fourth and final chapter presents the conclusions of the case study, alongside the evaluation of the research followed by our recommendations and a set of sustainable practices which can be adopted. Thus, we are aiming at emphasizing how food waste is currently being handled in the hospitality sector and what strategies can be adopted to enhance the overall outcomes and the management of the hotel.

2. Problem statement

The issue of food waste has represented the subject of debate for a long time, but less attention is attributed to finding suitable solutions for it. Given the reports presented by the Food and Agriculture Organisation of the United Nations, there is a waste of approximately one-third of the total food produced for human consumption every year, equalling to a total of



1.3 billion tons of thrown food (FAO, 2017). In the meantime, out of a population of 7.5 billion people living on this planet, there are 796 million hungry individuals. This roughly translates into one out of nine people suffering from chronic malnutrition (World Hunger News, 2016). Thus, with the amount of food disposed every day in the landfills the whole starving population can be fed with.

Given that 40% of waste is generated by consumer-serving businesses, it becomes clear that hotels play a major role in tackling this issue. The highest percentage of the waste is in fact generated by the buffet services where customers' have no limit upon their consumption. Thus, it appears that the only sustainable resolution to this problem is to change the perception of guests and their behaviour towards consumption. However, this appears as a great challenge given the risk associated with losing customers or decreasing their satisfaction. Hence, this problem requires an in-depth analysis of the service design and the points where it can be intervened for influencing customers' attitudes. According to Thaler and Sunstein, one way of changing people's behaviour towards a more sustainable one is by modelling the choice architecture (2008). This implies the use of behavioural principles in designing a nudge intervention that can influence the choice of behaviour adopted by customers.

Consequently, the purpose of our research is to shed light upon the pre-consumer and post-consumer origins of food waste, and the effects and challenges that may come with the attempt of reducing it. We will do this by testing if there is a behavioural change on the guests' behalf when being exposed to two treatments relying on the use of external cues. More specifically, we will test the effect of plate size and the implementation of a waste tax upon the generation of food waste. These interventions are aiming at influencing consumption norms and analysing the customers' willingness towards adopting a sustainable behaviour.



The reason for exploiting this subject stands in the fact that food waste has a negative impact not only upon the environment but also the society and finances of a business. Hence, solutions for managing food waste should be discussed with more depth and sustainable courses of actions must be taken.

All things considered, the waste of food is a constant, hard to avoid problem that occurs in every restaurant and hotel daily. However, this issue does not always receive the attention it deserves, and it is most often ignored and neglected due to various motives. For these reasons, the present study focuses on providing an in-depth rationale of how this issue can be tackled through the application of behavioural economics principles.

3. Food waste in the hospitality industry

Throughout this chapter, we will discuss and bring clarifications upon the terminology, the causes and impacts of food waste alongside the challenges that must be tackled along the way in the hospitality sector.

3.1. Terminology

Food waste represents food which is not consumed, and it can occur at all stages, starting from production and ending in consumption. In the consumption phase, plate waste is considered to be representing served food but not eaten (Kuo and Shih 2016). This type of waste is further divided into three distinct categories: edible, inedible and possibly edible food (Stenmarck et al. 2016). The edible waste, which represents the most significant fraction of the total debris (Marthinsen et al. 2012) is food which could have been eaten but in the end, it was not (Cox and Downing 2007; WRAP 2013). Between the reasons for the production of such waste, we include the personal preferences, low quality and the overestimation of the prospective amount of food to be consumed (Cox and Downing 2007; BIO Intelligence



Services 2010; Kuo and Shih 2016). The inedible waste is made out of the food parts which could not be consumed such as bones, shells, peels etc. The third category consists of possibly edible waste which represents food that some people choose to eat and some do not (e.g. chicken skin, potato peels etc.)

According to Cuglin and other previous studies, it appears that there is a distinction between food waste and food loss, and this must be taken into account when tackling food waste. Thus, it is emphasized that food loss is associated to a decrease in food mass or quality, making it improper for human consumption (FAO, 2014, in Cuglin, Petljak, and Naletina, 2017), (FAO, 2011, in Cuglin, Petljak, and Naletina, 2017). Moreover, it is further underlined by Lipinski that food loss can occur due to food spills, reduction in quality or spoils, more often taking place during the production, processing, storing and distribution phases of the food value chain (Lipinski, 2013). On the other hand, food waste is defined as food that is regarded as being of fine quality and suitable for human consumption but it does not get eaten due to being discarded. Waste is usually produced during the retail and consumption processes in the food value chain due to carelessness or being thrown away consciously. Even though both of these phenomena occur worldwide on a regular basis, it appears that food loss happens more in developing countries while food waste is more frequent in developed countries (Lipinski, 2013). Thus, given the different approaches and solutions that come with each of these phenomena, food waste should be regarded as a specific part of food loss (FAO, 2017). When looking at the food and beverage sector, an item can be regarded as waste when it is not consumed by the employees or the customers of a restaurant or food service. Further, food waste can be divided into two main categories: pre-consumer and post-consumer food waste. The first one refers to waste which occurs due to overproduction, spoilage and expiration (Shakman, 2013). The latter, regarding the post-consumer food waste, also referred



to as plate waste, describes the items which are thrown away and not consumed by the guests. Here it can be included the leftovers, beverages and unused seasonings which end up in the trash bin (Baldwin & Shakman, 2012, 57).

Further, Constello (2016, in Cuglin, Petljak and Naletina 2017, 538) differentiates between two other categories of food waste as follows:

1. food waste before consumption where we include kitchen leftovers and materials thrown during food preparation (e.g. fruit, peels, vegetables) and food which is considered inedible due to expiration or becoming rotten

2. and food waste after consumption which describes the one thrown away after being served to the guests and not eaten

For a better understanding, Cuglin, Petljak and Naletina (2017) created a more comprehensive categorization which is explained in the following figure:



Figure 1. Classification of food and drink waste relating to the possibility of mitigating their production (Cuglin, Petljak & Naletina, 2017)



As it can be observed above from the present figure, the food waste which is considered avoidable is believed to be the food which was overproduced or delivered in a huge amount, cooking which was destroyed during the preparation phase (e.g. burnt food) and also edible material which was not consumed before the expiration date. Most of this food does not represent a threat towards the environment and it should be split between different waste programs (Voća, 2014, in Cuglin, Petljak, & Naletina, 2017, 539).

3.2. Causes of food waste in the hospitality industry

During this section of the paper, we will discuss the central causes of generating food waste within the hospitality industry and when it is most regularly created. When considering the different phases of the food chain, food waste is considered to be occurring at each and every one of them, starting from the supply to the after-service. Thus, we consider that food waste is mostly inevitable, and it does not necessarily signal a problem within the operating practices since it may occur due to understandable and often unavoidable causes. As discussed previously, food waste falls in two categories such as, pre-consumer and post-consumer waste, which are caused by different factors (Baldwin & Shakman, 2012, 57-59). As underlined by Baldwin and Shakman (2012, 58-59) in their book "Greening Food and Beverage Services", the reasons for which food waste occurs in the hospitality industry are as follows:

• Pre-consumer food waste causes: unidentified demand, overstocking, inefficient production, poor communication, staff behaviour, unskilled trimming, over-merchandising, food safety

• Post-consumer food waste causes: large portion sizes, inefficient service model, customer's menu acceptance

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Thus, the main and most frequent driver of food waste is believed to be the unidentified demand caused by the kitchen operators' inability to estimate the number of clients for which they must prepare, and which menu is more convenient and profitable. In this way, if there is a high variety in the number of menus and dishes offered by a restaurant, it can be difficult to foresee which is more likely to be ordered and which not. As a result, for reducing waste it is critical to analyse customers' predilection towards a certain dish, taking into account elements such as the weather patterns, current season, local offers (Baldwin & Shakman, 2012, 58).

Another driver of waste is represented by overstocking which happens when a restaurant prepares more food than needed with the intention of satisfying all their clients' desires. However, even if there are a lot of situations in which this margin of error can work, when there are too large margins of error these can lead to waste (Baldwin & Shakman, 2012, 58).

Additionally, unsustainable production procedures such as cooking food in a batch can also represent drivers of pre-consumer food waste. Batch cooking is usually believed to help preventing food waste, but this varies according to the size of it and the serving time. For a better understanding, we take the example of a breakfast buffet which should be running in a hotel from 7 a.m. up until 10 a.m. Thus, by cooking in a batch regardless of the fact that around the closing time the demand is decreasing, results in high amounts of food waste. However, this can be prevented through the adoption of a cook-to-order model or having the food presented in smaller containers (Baldwin & Shakman, 2012, 58-59).

Another aspect that must be paid attention to is represented by the communication flow amongst the employees of the hotel since this can also lead to food waste generation.



Thus, if the front-end operators are not clearly conferring information to the back-end ones, miscommunications occur alongside the failure of administering food production.

At the same time, the attitude shared by the staff and its behaviour can either limit food waste or increase it. In this case, if for a certain dish there is a need of 2,5kg of meat and this one only comes in batches of 3 kg, instead of preserving it for another dish he can either use it all or throw the rest away. Even though this action is not carried due to the bad intentions of the chef, it can still lead to enormous food waste.

A different source of waste which is also staff-related is the unskilled trimming of the vegetables, fruits or other edible products when being prepared for use. Thus, it would be very efficient for the kitchen staff to go through specific training and acquire the necessary skills for preparing food while diminishing waste. Going further, over-prioritizing of food can also result in considerable amounts of waste due to the constant desire of maintaining products fresh looking and plentiful on the tables during buffets or on the shelves of the kitchen.

Moreover, food safety although it deals with minimizing health risks posed by specific food items, it can represent a constant source of waste. Even though food having issues with timing, temperature or ways of being handled will be thrown away due to health considerations, the times when this happens must be limited to a minimum.

Regarding the drivers of post-consumer food waste, there are three of them which are mentioned by Baldwin and Shakman in their writings (2012). The first one is represented by the large sizes of food portions these usually being way over the quantity which can be consumed by the customers. Thus, a faulty service model results in creating significant amounts of excess food which eventually ends up being discarded. At utmost risk are the self-



service food points and buffet restaurants where individuals tend to take more than they can actually consume.

Additionally, having low customers' acceptance regarding the menu can also lead to waste in a way that food which will not be appealing to customers will end up being uneaten. This can occur due to some condiments not being used properly, low quality of the food served, or the repulsion caused by certain ingredients. In an alternative study conducted by Hogan (2016), food waste drivers are separated according to the stages in which they may occur, proposing five causes as being the most common.



Figure 2. Factors Driving Food Waste in Food service (Hogan 2016)

As previously emphasized by Baldwin and Shakman (2012), the most frequent factor driving waste is over-production. In an attempt to maintain the stock of products constant, restaurant managers as well as chefs, take all kind of measures to prevent the scenario in which they are running out of an item. Due to this, it often happens that they tend to stock up



and at the same time prepare large amounts of food. Even though the adoption of this kind of behaviour is at its base led by positive intentions, it can lead to large quantities of waste. For this reason, in the hospitality sector, overproduction is considered a high management risk which leads to financial losses (Hogan, 2016).

Additionally, there is an increasing tendency observed in food service operations towards over-merchandising which can ultimately lead to food excess. In order to create attractive displays for customers to get a sense of high variety during buffets, food service businesses tend to create a surplus of food which will end up not being eaten. In order to avoid such cases, food merchandising can be set up in a way which can diminish waste by cutting down on buffet and customer serving sizes (Hogan, 2016). Furthermore, puzzling food safety policies in various food service operations can result in unanticipated food waste footprint. Since food safety represents a priority for service providers, there is a strict protocol maintained which necessitates a considerable margin of error in order to comply with the safety regulations. However, most of the times it happens that the margin is created around the first one resulting in throwing out food which would normally be qualified for being served.

The trade-off between labour and waste should also be considered when debating about the reason for creating excessive food which ultimately ends up thrown in the trash. With the purpose of decreasing labour costs, food is created and provided in large batches without being considered the waste of resources and the costs of it (Hogan, 2016). Another explanation for the waste created within the hospitality sector is related to the desire of providers to satisfy all the needs and wants of customers having a high range of choices available from the beginning of the day until the end. Thus, the aim is to serve the last customer of the day with the same array of dishes as the first one was. While maintaining



consistency in their services throughout the whole day ensures a positive customer experience, waste is in fact generated.

Further studies emphasize that food spoilage occurs at various stages within the supply chain due to various reasons such as: mishandling the products, improper storage of raw materials, imprudent transportation or not suitable preservation of food resulting in their expiration (Parfitt, 2010, in Cuglin, Petljak, & Naletina, 2017, 540). The following figure outlines better these causes.



Figure 3. Critical points of food waste in the supply chain (Cuglin, Petljak, & Naletina, 2017, 540)

Thus, as presented above, waste may occur at any of the five phases which make up the food supply chain. Moreover, it must also be underlined that after every phase there is a potential risk of waste occurring in the later ones. For this reason, it must be ensured that waste is reduced to a minimum from the early phases of the food supply chain (Cuglin, et al., 2017, 540).

In a recent case study conducted by the Natural Resources Institute from Finland, there have been outlined the drivers of food waste in fifty-one various service businesses such as schools, petrol stations, canteens, hotels, restaurants and day-care centres. During the



research, food waste was divided into two different categories as follows: edible and nonedible food waste. The first one is encompassing the waste which originates from the food preparation and service as well as from customers leftovers. The latter refers to the uneatable waste such as peelings, bones, seeds, coffee grounds etc. (Silvennoinen, et al., 2015, 141). The following table offers a better visualization of the two categories.

Type of waste/origin of waste	Kitchen waste, preparation and cooking	Serving waste, left from cooked and prepared meals	Customer plate leftovers
Food waste Originally edible (OE)	Spoiled products, incorrectly prepared food, expired date products	Overproduction, food left from the buffet	Food leftovers by customers on plate
Bio waste Originally inedible (OIE)	Inedible parts of vegetables, coffee grounds and bones	Inedible parts of vegetables, bones	Vegetable peelings, bones

Table 1. Definition of originally edible and originally inedible food waste (Silvennoinen, et al., 2015, 141)

As previously mentioned, waste can occur at all stages since it is prepared in the kitchen until it is served to the customer, varying according to the food service operation (Silvennoinen, et al., 2015, 143).

			\sim
Kitchen prepari	ng		\sim
- Food waste (OE),	Serving buffet,	order	\sim
e.g. spoiled food, incorrectly prepared	- Food waste (OE),	Customer	_ /
- Bio waste (OIE),	from buffet	- Food waste (OE), plate leftovers	V
e.g. inedible parts, peelings, bones, coffee grounds	- Bio waste (OIE), inedible parts from serving and buffet	- Bio waste (OIE), e.g. peelings, bones	

Figure 4. Different waste and how they were sorted (Silvennoinen, et al., 2015, 143)



We must also consider the fact that the amount of edible food waste is connected to the type of restaurant or outlet which is serving it. Thus, it will be a great difference in the volume of waste generated by a buffet type service rather than an à la carte one. The reason behind this stands in the fact that in the self-service type of outlets where overproduction occurs, waste reaches higher levels (Silvennoinen, et al., 2015, 143).



Figure 5. Estimates of food waste (OE) as percentages of food prepared in different food service outlets and from different origins. (Silvennoinen, et al., 2015, 143)

As observed from the previous figure, the waste generated from restaurants and diners is considerably higher than the one resulting from the operations run by other food service providers. Additionally, it can be observed that the percentage of serving waste generated by restaurants and diners is very low in relation to the customers' leftovers which accounts for 9.5 per cent and is considered as the highest waste volume created.



The type of food being wasted from the clients' leftovers and the ratio of it is emphasized in Figure 6.



Figure 6. Contribution of the customer plate leftovers in restaurants and diners. (Silvennoinen, et al., 2015, 144)

According to the findings of Silvennoinen, the diversity of the menu plays an important role in the quantity of waste generated, these two factors being directly proportional (2015). However, it seems that the customers are more inclined towards leaving on their plates vegetables, potatoes, rice, bread, pasta and other starchy foods while main courses tend to be less wasted (Silvennoinen, et al., 2015, 143).

3.3. Impacts of food waste

The total amount of wasted food produced in the hospitality and tourism sector is still unknown, but it is estimated that the restaurants, hotels and catering business amount for approximately 14% of the total food waste generated in the European Union (BIO Intelligence Services 2010). This percentage can be further translated into more than twelve



million tons of food waste per year or between twelve and twenty-eight kilograms of waste per person, each year for all the 27 member states of the European Union. Thus, it is considered that the hospitality industry generates more food waste than the wholesale, production and retail sectors (BSR 2012; Stenmarck et al. 2016). In the European Union, the food waste from the tourism and hospitality sector varies from seven kilograms in Slovenia up to fifty in the United Kingdom (BIO Intelligence Services 2010). On average, there is a food waste of approximately twenty-one kilograms per capita, per annum (Stenmarck et al. 2016). In the Scandinavian region, the hotels produce approximately 120 grams of food waste per served meal (Marthinsen et al. 2012). However, the tourists are not the only ones catered by the hospitality businesses but they "provide a significant proportion of the market for restaurants and cafes around the world" (Mitchell and Hall 2003, 62).

A third of the food produced for human consumption gets wasted every year (FAO, 2017). In Denmark, "food accounts for more than one-third of the environmental impact of overall Danish consumption and about one-quarter of the climate impact of consumption." (Silvennoinen, et al., 2015, 140). A pilot study conducted by the Sustainable Restaurant Association (SRA) in ten different restaurants located all around London, underlines the fact that an average diner may produce around 21 tonnes of food waste annually (Giorgi, 2013, 6). Moreover, it is emphasized that food does not get the proper treatment and suitable measures must be taken in order to limit the quantity of waste associated with this factor. Another study from 2014, ran by the Food Waste Reduction Alliance, indicates that only 14.2% of food waste gets recycled and 1.4% gets donated (Business for Social Responsibility (BSR), 2014). The rest of 84.4% of waste gets discarded resulting in serious damages to the society, its economy and environment.



3.3.1. Environmental impacts of food waste

During this section, we will outline and discuss the main influences of food waste upon the environment. For a better understanding of the footprint, this has upon the surroundings, for the production of one kilogram of vegetables there is generated between 0.036 kilograms of CO2e for carrots and up to 28.5 for tomatoes. Transporting them will additionally create between 0.015 and 0.725 kilograms of CO2e (Gössling et al. 2011). Moreover, the numbers increase when the food is processed and later disposed into the landfills, where it produces methane gas, representing "one of the largest sources of greenhouse gas emissions from the waste sector" (UNEP 2013, EPA 2016).

According to Gössling, food production and consumption are believed to be the "key issues for climate change mitigation" (Gössling et al. 2011, 535). Moreover, food waste also implies the waste of natural resources such as land and water needed for processing it (Gössling and Peeters 2015). Given the latest estimations made by the BIO Intelligence Services, one kilogram of wasted food equals to two kilograms of CO2 equivalent (CO2e) emissions and it results in the exhaustion of approximately three tons of natural resources where we include the extinction of species and diminished biodiversity. In addition, food waste is usually ending up in landfills where it generates methane gas which is considered to be twenty-five times more damaging than CO2 (EPA 2016).

The figure below aims at summarizing and better visualizing the negative impact generated by food waste such as air, water and land pollution, toxicity, energy waste and greenhouse gases.





Figure 7. Environmental impacts of food waste

The food waste effects upon the environment can be divided into two categories as follows: upstream impacts and downstream ones (Baldwin & Shakman, 2012, 60). The upstream environmental effects are encompassing the influences a food item has upon the environment before actually reaching the service operation (Baldwin & Shakman, 2012, 60). Most of the times these may be difficult to be observed by stakeholders, but they account for a high portion of the food wastage. Thus, according to data provided by FAO, the upstream food wastage which occurs during the handling, storage and production processes it accounts for approximately 54% of the total food waste. Figure 8 aims at outlining the volumes of global food waste created along the food supply chain.





Downstream



Figure 8. Food wastage volumes, at world level by phase of the food supply chain (FAO, 2013, 13)

Regarding the upstream impacts, when food gets thrown away the resources that helped at producing them are also wasted. Here we include natural resources used for the production of food such as water, land, fertilisers and pesticides as well as the carbon generated by transporting the products. Further, the food needs to be stored in proper conditions which often require the use of energy and water and can also generate water and air pollution. Thus, once a food item gets discarded, a considerable amount of carbon is also wasted alongside water, energy and other natural resources which helped at creating it (Baldwin & Shakman, 2012, 60).

Daily, wasted food ends up in landfills where it is accumulated and added on top of the previously discarded items, blocking them from decomposing and leaving no oxygen for this process. As a result, the emissions generated by the landfill are having a composition of



50% methane gas and 50% carbon dioxide (Baldwin & Shakman, 2012, 61). What all of the food items have in common is that when they get in contact with the ground and start being absorbed by it, they all generate powerful biogenic greenhouse gases (GHGs) such as nitrous oxide (N2O) and methane (CH4). The latter weights approximately 25 times more than the carbon dioxide and it is currently present in our atmosphere more than it was in the last 400.000 years according to EPA's recent statistics (IPCC, 2007, in FAO, 2013, 18; Intergovernmental Panel on Climate Change, 2007, in Baldwin & Shakman, 2012, 61, EPA, 2010, in Baldwin & Shakman, 2012, 61)



Figure 9. Global Atmospheric Concentrations of Methane over time (EPA, 2016)





Figure 10. Top 20 of greenhouse gases (GHGs) emitting countries vs. Food wastage (FAO, 2013, 17)

It can be observed that there is a strong connection between climate change and the greenhouse gas emissions generated by waste. Thus, reducing waste in different phases of the food supply chain enables the reduction in gas emissions and helps at dealing with climate change by limiting the number of items discarded in the landfills. There has been noticed a pattern in the production of food waste between the developed and the developing countries. While in the developed areas food waste is expected to occur during the downstream phases of the food supply chain, the opposite can be observed for the developing countries where this is encountered mainly during the upstream ones (FAO, 2013, 14). An imperative factor that must be taken into account in addition to the aforementioned ones is the use of blue water. This is better defined as representing "the consumptive use of irrigation water taken from ground or surface water" (FAO, 2013, 27). Its importance is related to the fact that "blue water use in irrigated agriculture has the potential for causing severe environmental problems, such as water depletion, salinization, water-logging or soil degradation" (Aldaya, 2010 in FAO, 2013, 27). Across the globe, the volume of blue water used for the agricultural



production of food waste exceeds 250 cubic kilometres (km3), which represents approximately four times the blue water footprint of the USA total consumption (Mekonnen & Hoekstra, 2011, in FAO, 2013, 27). The blue water resulted from food waste equals three times the volume of the Geneva Lake or the yearly water discharge of the Volga River (FAO, 2013, 27).



Figure 11. Top 10 of national blue water footprint accounts for the consumption of agricultural products vs. Food wastage (FAO, 2013, 28)

As it can be observed from the figure previously presented, the volume of water used for dealing with the food wastage produced globally is higher than the normal consumption of water of any country, including India or China (FAO, 2013, 28). Additionally, it is believed that the amount of food wastage produced yearly on a global scale amounts for the use of over 1.4 billion hectares of land, which can be translated into approximately 28% of the agricultural land worldwide. Moreover, if the food waste produced worldwide would be



discarded in only one place alone, this would represent the second largest country after the Russian Federation (FAO, 2013, 37).



Figure 12. Top 20 of the world's biggest countries vs. Food wastage (FAO, 2013, 37)

It is thus imperative to consider the outstanding negative effects brought to the environment through the creation of landfills for food waste given the contamination of groundwater and the leachate toxicity derived from it. In addition, the ecosystem and biodiversity are also damaged during the process of converting wild lands into landfills for food waste to be decomposed. Even though the harm brought to the environment is trying to be reduced by sending the wasted food to be incinerated, this represents an ineffective measure given the amount of energy necessary for this process. Thus, it is critical that food waste is limited before it reaches incinerators and landfills, food service operators having a fundamental role in building a sustainable environment (Baldwin & Shakman, 2012, 61).



3.3.2. Economic costs of food waste

Another important factor which must be taken into account when discussing the impacts of food waste is represented by the financial costs derived from it. Besides the environmental issues previously outlined, the economic ones pose a major threat to the food service businesses given the losses incurred due to it. The value of wasted food in the UK hospitality sector only amounts to 2.5 billion pounds per annum (WRAP 2013). According to the reports presented by Sodexo, one of the biggest catering companies in the world, with a reduction of 47% in food waste the company lowered costs by 53% with a nearly 5% per meal (2011). Another survey conducted by the members of the Sustainable Restaurant Association in 2010, emphasizes that a restaurant with a turnover of over 10,000 pounds per weeks can save approximately 2,000 pounds on an annual basis through food waste reduction (2010).

The costs incurred due to the creation of food wastage in restaurants and diners can be divided into four different categories: labour costs, raw material costs, energy costs and food waste disposal costs. These occur progressively at all stages of the food supply chain starting from the production phase, going through the serving one and ending when this gets discarded in landfills (Baldwin & Shakman, 2012, 62).

To begin with, once an item is thrown away it becomes clear that the money invested in its purchase and production is also wasted. At the production stage, wastage can occur multiple times due to various causes such as the food being improperly cooked, stored or delivered, the dishes becoming inappropriate for serving. Thus, the creation of waste during the pre-consumer phase should be closely observed and suitable measures must be applied predominantly to the kitchen operations. Recent statistics emphasize that the hospitality sector losses annually about 4 to 10 per cent of their investment in food acquisition. More



specifically, approximately 40.000 to 100.000 Euros are wasted for every 1.000.000 Euros spent on purchasing raw materials (Baldwin & Shakman, 2012, 62). Given for these figures alone it becomes imperative for suitable action to be taken in order to reduce pre-consumer food waste and the costs that come with it. In addition to the costs of raw materials, labour and energy costs must also be considered given the fact that preparation, refrigeration and proper storage are necessary for getting an item ready for serving. Thus, these expenses become imminent for all the businesses which provide food services (Baldwin & Shakman, 2012, 62). In addition to the aforementioned costs, service operators will further incur additional expenses while handling the food wastage being imperative for them to provide proper trash bins and suitable staff handling it. In this phase, money is also spent on garbage disposal for hauling companies which will later come and collect it. Having these activities occurring on a regular basis, the overall costs associated to processing and discarding food waste can impede considerably the functioning of a business and its revenues (Baldwin & Shakman, 2012, 62-63).



Figure 13. Economic costs of food waste



3.3.3. Social effects of food waste

Food waste does not have negative repercussions only upon the environment or the economy, but it also affects society in an unfavourable way. To begin with, once edible food ends up in the trash there is a deficit created within the food chain while 795 million people out of 7.3 billion in the world are suffering from chronic malnourishment (World Hunger News, 2016). Given these numbers, food waste becomes an alarming issue affecting people worldwide. Even though there is enough food produced to feed all the human population worldwide, a huge amount of this goes to waste. More specifically, global food wastage is believed to reach over 1.6 Gigatonnes per year (FAO, 2018) despite the fact that there is a considerable amount of people who die from hunger every day. According to the data recently collected by FAO, with the amount of food currently wasted in Latin America more than 300 million individuals could be fed. The same numbers apply for Africa while regarding Europe, the amount of wastage recorded here could provide for 200 million people. More importantly, if only a quarter of the food wasted globally would be saved this means that at least 870 million people who are suffering from hunger could be fed (FAO 2018). These statistics are made based on the fact that most of the food thrown in the bin is actually edible rather than rotten or contaminated. Thus, according to FAO, out of the 1.6 Gigatonnes of the wastage approximately 1.6 Gigatonnes contains perfectly comestible food (FAO 2017,10). In addition to this, during the production of food, there is a high amount of water used for farming which also dissipates once wastage is created. More specifically, the water used for irrigating the food which ends up in the trash could cover for the needs of more than 9 billion people (Vaughan, 2009, in Baldwin & Shakman, 2012, 63). In order to better illustrate the social drawbacks created by food waste, we present a summary in the figure below.



Figure 14. Social losses caused by food waste

Recent studies show that tourists tend to consume more food than in their home country and also have a tendency towards preferring imported foods (Gössling 2015). In this way, tourists increase their environmental footprint upon the country of destination (Hunter and Shaw 2007). Given the importance given to food when analysing a touristic experience, there are very high chances that different types of food will be tried and some of them disliked, resulting in more food waste being created (Mitchell and Hall 2003).

Thus, we can conclude that food wastage does not only hurt the environment, but it also has financial and social repercussions. These facts stress the need for adopting practices which can limit this phenomenon, in the hospitality industry in particular and worldwide in general.


3.4. Challenges of dealing with food waste in the hospitality industry

According to ReFED's report (Rethink Food Waste Through Economics and Data) from 2018 more than 40% of food waste is created by the consumer-serving businesses such as hotels, reconfirming that the hospitality industry has an incremental role in the generation of food waste. Given the greater interest in this topic and the increased awareness related to food waste, hotel managers aim at dealing with this issue by overhauling their operations. The main challenge faced by hotels in this realm is represented by the management of the waste generated by the buffet type of services.

Buffets represent a form of self-serving meal service where tourists can enjoy as much food as they want to, having no limitation upon the quantity. This represents a very widespread practice adopted in the hospitality sector and it signals service quality in hotels (Wilkins, Merrilees, and Herington 2007). The buffets are typically made out of multiple food stations where a high variety of dishes are available, together serving as a full meal course. They mainly include starters, salads, cheeses, fruits, main courses and desserts. This type of service has a direct effect on the hotel's performance through customers' spending and it indirectly leads to higher guest satisfaction and decreased service costs (Tanford and Suh 2011). Buffet style meals are mainly adopted due to the easy and fast way of getting food served and the higher variety of options offered to the guests (Cohen and Avieli 2004).

However, in spite of all the aforementioned advantages of the buffet style meal plan, this can also raise the food service costs due to more food being consumed or wasted (Kuo and Shih 2016, Wansink and Ittersum 2013). The reason behind this stands in the fact that individuals have a tendency towards overloading their plates having plenty of dishes to choose from, in any quantity desired with no additional costs (Kuo and Shih 2016). As a result, in their attempt to experiment and taste as many various foods as possible, tourists tend



to "bite more than they can chew" and thus create more waste (Quan and Wang 2004). Due to this type of behaviour, there is an increasing need for production, transportation, storage and process of food, a fact that impacts the environment negatively. Besides the consumption of water and the land used for processing this waste, buffets are also known for having a negative social impact over individuals, driving obesity through overconsumption (Duerksen et al. 2007; Wansink and Payne 2008; Kuo and Shih 2016). For these reasons, we consider that employing a buffet-style service can have a negative impact because it increases food production and consequently consumption while generating more waste.

However, given the fact that decreased buffet sizes may increase the likelihood of running out of food and startling the all-you-can-eat expectant customers, dealing with food waste from buffets becomes a great challenge for hotel managers. This self-service type of option has an influence over guests' expectations and has a direct effect upon their level of contentment with the hotel and its services (Yen-Soon, Bergman, and Raab 2010, Wilkins, Merrilees, and Herington 2007). Thus, reducing food waste poses great risks upon customers' satisfaction and their perception of the quality of the services provided.

This idea is also reinforced by the fact that guests suffer from a fear of not getting enough food, experiencing a tragedy of the commons phenomenon resulting in them overfilling their plates. This is related to the individuals' desire to get a fair share of the service they paid for. Hence, they have high expectations regarding what they get in return for what they paid for and any change in this may lead to dissatisfaction.

Another challenge that managers may face when attempting to tackle food waste is related to the lack of legislative regulation regarding standardized food donation policies. This further result in confusion regarding the laws that regulates or prohibits the donation of food



that is otherwise safe for consuming. For these reasons, it becomes difficult to manage waste that was already created and measures must be implemented before this happens. Hence, we consider that a sustainable solution can only be reached when measures are implemented for changing customers' behaviour and perception upon food waste. This reinforces the scope of the present study to implement nudges that aim at reducing food waste before it is created, without distressing the customers. In this way, the perception of quality will not be affected, and the waste generation would be diminished.

4. Research question

Using the case of two hotels, namely Hotel X and Hotel Y, our research study revolves around one main question: *"What is the effect of nudges upon reducing the amount of wasted food from the morning buffet at Hotel Y?"*.

However, in order to narrow down our research and provide more elaborate analysis of the factors that contribute to the findings, two secondary research questions were elaborated:

- "What are the causes and consequences of food waste and how can it impact the environment and the hospitality industry?"
- 2. "What is the effect of reducing plate size upon food waste at Hotel Y?"

Hypothesis 1: Decreasing plate size will reduce the amount of food waste generated at the morning buffet.



3. "What is the effect of implementing a 2 Euro tax per 100 g of leftovers in reducing food waste at Hotel Y?"

Hypothesis 2: The tax will push guests towards loading less food on their plates every time they serve themselves resulting in decreasing the amount of waste created.

In the end, some possible recommendations and practices regarding the improvement of food waste management will be presented and discussed.

5. Methodology

The current chapter underlines the choice of strategy and design applied to the present study alongside its characteristics, validity and reliability.

5.1 Research strategy

When employing scientific research studies there are two main strategies which can be chosen between: quantitative and qualitative. The decision regarding which one to choose is determined by the nature of the research question guiding the study. Most commonly, the qualitative approach is used for explorative purposes when the underlining questions are open and the researcher wants to investigate it in "great depth, with careful attention to detail, context and nuance" (Patton, 2002, p. 257). Thus, the application of qualitative methods results in getting detailed insights upon a limited amount of entities (Patton, 2002) and further driving theories and interpretations based on that (Ghauri & Grønhaug, 2010).

Conversely, quantitative methods are applied when the frequency and purpose of specific phenomena are analysed. In this case, the researcher aims at exploring certain patterns and offering a general picture without getting so much into details (Bryman & Bell, 2007). This approach aids the investigation of interactions between multiple variables and offers insight upon how they are affecting one another. In addition, this research strategy



allows for information to be more structured and causal relationships to be more visible (Jacobsen, 2005).

Since the purpose of our study is to analyse the effects of plate size and "waste tax" upon the amount of food waste generated in the hospitality industry, the quantitative approach appears to be more suitable for answering our research questions. Thus, we are applying a deductive approach where a positivist position is chosen for isolating variables and identifying the frequency and the causality between them. The philosophy of science is a mix between the integration of realist ontology, where the reality is perceived as objective and singular, and a positivist epistemology, where the knowledge is gained through observation and factual information. Hence, the study is designed as a deductive one, the strategy being outside-in, where we test theories related to human behaviour and the capacity of influencing it. The following sections aim at bringing extended clarifications upon the research design and data collection followed by the limitations and delimitations of our research.

5.2. Research design and data collection

The research design represents the overall strategy for connecting the problem statement of the research with the applicable empirical studies (Ghauri & Grønhaug, 2010, p. 54). This one should be chosen in a way that it maximizes effectiveness in relation to the research question and the information needed for answering it. There are multiple designs which can be employed depending on the scope of the study. Thus, we distinguish between the following types: exploratory, descriptive and causal research (Ghauri & Grønhaug, 2010).

As the name implies, the exploratory research is applied where the research problems have not been clearly studied before and its purpose is to develop operational definitions that



can benefit the final research design. This would not result in offering conclusive solutions to a particular problem, but its aim is to bring more information upon the subject matter.

Conversely, the descriptive research design requires a structured research problem which is investigated without manipulating the environment and it is targeting mostly the "what" of the research problem rather than the "why". This implies the use of an observational method through which the studied variables are not influenced in any capacity. Due to the quantifiable information resulted from it, the descriptive research represents a quantitative method which aims at driving statistical data that can be further used in subsequent research. For these reasons and also for increasing the reliability and validity of our results, we decided to make use of an observational quantitative study in the first phase of our research. The observations are resulted from applying statistical methods upon the data provided by the two hotels presented in our study without intervening and influencing the environment. During the study, we make use of the pre-existing differences in plate size across both hotels representing the treatment and the control group. For the analysis, we employed a panel regression where the independent variables are represented by the plate size and the tax on waste while the dependent one is emphasized by the food waste.

However, since our research question revolves around the effects of nudges upon manipulating human behaviour, we do need to complement our data by intervening upon the environment. Thus, we consider that the use of a causal research design is an optimal and effective approach to exploring the "cause and effect" issues. The aim of the causal research is to segregate "cause X" and analyse for any "effect Y" (Ghauri & Grønhaug, 2010). Even though we can not assume with high certainty that "X" leads to "Y", we can evaluate if the presence of "X" increases the chances for "Y" to happen (Cooper & Schindler, 2013). In order to do this, there must be an existing correlation between "X" and "Y", where the cause



(X) happens before the effect (Y) and other alternative causes are dismissed. The most appropriate method to study the potential causal interaction between variables is the employment of an experiment (Cooper & Schindler, 2013). This method allows us to manipulate the independent variables (plate size, waste tax) and record any possible modifications in the dependent variable (food waste). Additionally, this would provide us with more control over the incidental variables and study their impact individually while concentrating upon the variables of interest (Cooper & Schindler, 2013). As previously observed by Cappelen and Tungodden (2012) the experiments are most commonly employed in economic research and specifically in behavioural economics. The current thesis is designed as a field experiment, supported by a complementary observational study, which analyses the effect of two nudges upon the decrease of food waste. Field experimentation represents the conjunction of two methodological strategies, experimentation and fieldwork (Cooper & Schindler, 2013). Experimentation is a form of investigation in which units of observation (e.g. individuals, groups, institutions, states) are randomly assigned to treatment. Field experimentation represents a departure from laboratory experimentation, which attempts to simulate as closely as possible the conditions under which a causal process occurs, the aim being to enhance the external validity of the experimental findings. In order to analyse the effect of decreasing plate size and imposing a "tax waste" within the restaurant of the control group, we will employ a difference-in-differences model. The use of this method has become more widespread since Ashenfelter and Card first discussed upon it in 1985 and it entails the observation of outcomes in two groups for two time periods. The two groups will be represented by the control and treatment, where the first is not exposed to any treatment in both time periods while the latter receives a treatment in the second period. To test the effect of the intervention upon the dependent variable (food waste) the average gain in the control



group will be subtracted from the average gain in the treatment group. This will aid at removing biases resulted from trends and permanent differences between the two groups. More specifically, we will test if the effect upon the quantity of food wasted is due to our nudges or there are other variables which are influencing it.

Given the nature of our research questions, we thus decided to test our hypotheses through the implementation of a field experiment complemented by an observational study. The experimental data will be analysed through a difference-in-differences model while for the observational data we will make use of a regression panel.

5.3. Limitations

This section presents the main issues that the research will pose with regards to the validity and reliability criteria and the main advantages and disadvantages of the chosen method. On one hand, validity refers to whether an indicator is representative of the measurement of a certain concept or not (Bryman & Bell, 2007). On the other hand, reliability indicates whether a measure is consistent or not by checking for its stability over time, internal reliability and inter-observer consistency (Bryman & Bell, 2007).

The benefit of using a field experiment as a research design is that it takes place in a real-life setting where the participants are not aware that their interaction is being studied resulting in them acting naturally. Hence, the guests of the hotel on which the treatment is applied will act in a way that would be reflective of their real behaviour. This provides us with a high ecological validity of the results. Additionally, the participants will not act upon certain demand characteristics and will react as they would in their natural environment. Thus, the effect upon the dependent variable will reflect the change in the independent variables rather than characteristic demands.



The drawback that comes with this method of study is represented by a low control over the variables. Hence, the extraneous variables which may influence the behavioural responses of participants, such as noise, quality of food or weather are very difficult to get control over. This would affect the internal validity of the study making it challenging to establish the right cause and effect relationships. In order to avoid this in our current study, we included six dummy variables which we control for, namely: the location, the existence of a swimming pool, concierge services, pet friendliness, music and barbecue facilities. These represent differences between the two groups which are most likely to influence our results. The nature of the variables has a great impact on the final result and given the natural setting in which the study takes place, this one might be difficult to replicate. Thus, the chances of getting the same results in another place and at another time are reduced resulting in a relatively low internal reliability for the experiment.

However, in order to supplement and support our findings, we decided to complement our research with an observational study which will be employed in the first phase of the study. The reasoning behind this choice stands in the fact that we want to increase the internal validity of our output and check for the pre-existing differences in plate size before the treatment is applied. In this way, we would maximise the chances of establishing to what extent the nudges are influencing the behaviour of the participants. However, in this case, the same limitation regarding internal reliability is maintained. Thus, even if we make use of an observational study to get insights upon how things were before the implementation of the treatment it would still be difficult to replicate it in another environment at another time. This issue is encountered due to the natural design of our study which does not allow for a full control over variables.



5.4. Delimitations

This section aims at bringing clarifications upon the scope of the research and it presents the aspects that were purposely left out of the study. To begin with, the focus of our research was represented by the two hotels which served as a control or treatment group. For this reason, a first delimitation is related to the size of the study which is restricted to analysing the food waste generated only by Hotel X and Hotel Y. Regarding the time period in which the study took place, this one is limited to three months, starting at the beginning of February and finalising at the end of April. Thus, we did not consider data which was not collected during this interval of time is strictly focused on the immediate pre and post effect of our experiment. A third delimitation comes in relation to the methods of collecting and analysing data. Given the chosen research design for the present study, we did not employ any qualitative methods of collecting data since we needed factual, statistical information for answering our research questions. In addition, we only made use of the difference-indifferences model alongside a panel regression to analyse data, excluding other methods. This strategy was chosen due to the scarce time resources and the need to narrow down our study. By imposing these delimitations to the present study, we managed to maintain the focus on answering the research questions and organize our data so that the causal relationships are clearer.

6. Presentation of the case

In order to test the impact of our nudge intervention over the guests' behaviour, we decided to focus on two different cases. Due to privacy concerns formulated by one of the parties we attributed an alternative denomination for both of the hotels, namely Hotel X and Hotel Y.



In our case, Hotel X represents the control group while Hotel Y is the one receiving the treatment. Both of these hotels are located in Romania, more specifically in Poiana Brasov, one of the most sought-after destinations in the country. The reason for which this location is attracting a considerable number of tourists is due to its placement in the Carpathian Mountains and the high number of slopes available for skiing and snowboarding. In addition, Poiana Brasov is only 22 kilometres away from the infamous Bran Castle, most commonly referred to as Dracula's Castle, making it a top destination for foreigners. Due to the fact that this location is visited by both, locals and foreigners, we considered it a suitable starting point for running our experiment. Further, we got in contact with multiple accommodation sites in the area but just a few of them agreed to provide us with the resources for running the experiment. Out of the ones which showed interest in working with us we chose two which were similar in terms of capacity, offering, price and location. This represented a critical point in our research since we were trying to limit the number of unobserved variables which could affect our result. Thus, it was imperative for increasing the internal validity of the experiment to find two resorts which share comparable value propositions but which, at the same time, differ in some respects.

6.1. Hotel X

Hotel X is centrally located in Poiana Brasov, Romania, within a 20 minutes walk from the ski slopes in the area. During the wintertime, there are free shuttles from the hotel to the ski slopes which depart every 5 minutes. Besides various accommodation types, the guests staying at this resort are offered complimentary access to a semi-Olympic pool located on the premises.

Hotel X is spread across three buildings, encompassing a variety of accommodation types which can facilitate the needs of the guests in search of a hotel room, an apartment or a



motel type of service. The resort also includes four restaurants with two terraces, summer gardens, a spa centre and five halls where events and conferences can be held for up to 400 people. Most of the available rooms are equipped with a mini bar, a satellite TV, a safety deposit box, a private bathroom and free Wi-Fi. The guests can also benefit from two playgrounds for children that are placed both, indoor and outdoor, children's workshops and a children's pool. Other facilities include multiple bars, a nightclub, six escape rooms, a hot tub, a cardio and weightlifting gym and a dry or wet sauna. In addition, concierge services and valet parking are offered on a 24 hours basis at no extra charge. Hotel X also offers to their clients ski lessons during the winter and bicycle lessons during the summer. Moreover, other trips and hiking activities are offered all year long. The check-in may take place between 4 p.m. and 12 a.m. while check-out can begin with 6 a.m. and end at 12 p.m.

The restaurant of the hotel is offering a blend of international and traditional Romanian food alongside refined wines, in a modern setting which benefits from a view of the Carpathian Mountains. Every morning, there is a buffet-type of breakfast which runs from 8 a.m. to 11 a.m. and guests can acquire it in advance when booking their room. From 5 p.m. to 7 p.m. the customers are able to enjoy live piano music in the reception area where a cafe is also located. The buffet service can only be purchased for the breakfast meal, without the possibility of extension for the lunch or dinner. The maximum capacity of Hotel X is of 320 guests and its facilities are rated as four stars ones.

The prices for the accommodation range between 642 DKK for the economy standard double room up to 1.828 DKK for the deluxe suite. These prices are for two people, per one night, all of them including the morning buffet breakfast.



6.2. Hotel Y

Hotel Y represents a resort composed out of twelve villas located in Poiana Brasov, Romania, which can accommodate up to 280 guests. Each villa enjoys access to green space, owning both a terrace and a balcony and providing a view of the surrounding forest and the Carpathian Mountains. Hotel Y offers multiple types of accommodations including apartments, junior suites, double rooms and twin studios all equipped with high-quality furniture which makes this resort four stars one. All of the rooms are having flat-screen satellite television, private bathroom, hairdryer and a security box. The guests of this hotel can also enjoy spa facilities, two bars, free Wi-Fi, child-friendly rooms and pet-friendly services.

In addition, the resort is offering access to a tennis playground, barbecue facilities, a skiing school open during the winter and a biking school during the summer. The resort also encompasses a wet and dry sauna, a spa, one wellness centre and a fitness gym. For an additional charge, guests can benefit from massages, horse riding lessons or ski lessons. On the site, the guests can also find a ski storage room and a ski equipment rental. There are also opportunities for organized trips provided by the hotel for which the guests must register beforehand. The Bradu ski slope is located 1.2 kilometres away which roughly translates into a 10 minutes walk and tours led by an authorized mountain guide can also be purchased. In addition, the medieval town of Brasov is only 10 kilometres away from the resort, making this a very attractive location for tourists. The check-in starts at 3 p.m. while check-out can be done by 12 a.m.

The lounge area of the hotel encompasses the Great Hall and the Small one. The first has a capacity of maximum 220 guests while the later accommodates up to 60 people. The restaurant of the hotel serves both, international and Romanian dishes and a buffet breakfast



which is available from 8.30 a.m. to 11 a.m. The prices for accommodation range between 398 DKK for the standard twin room up to 813 DKK for the superior twin room (for two persons, per night). The one-bedroom apartment which can accommodate 2 people is charged with 720 DKK while the four-bedroom villa, where the price covers for up to 12 people, is charged with 2.600 DKK. In addition to these costs, the buffet breakfast is charged with 50 DKK per person, for each morning.

7. Literature review

To understand the concept of "nudge" and how it can be used to alter human behaviour in reducing food waste, it is critical to begin by defining the theoretical origins of behavioural economics. Hence, this chapter aims at bringing clarifications upon the two concepts, followed by the presentation of the service design implications, the Dual Process theory and the types of nudges which can be employed for altering human behaviour.

7.1. Introduction to Behavioural Economics and the concept of "Nudge"

Behavioural economics represents a study field which seeks to comprehend the way in which humans make choices based on social, psychological, behavioural and emotional factors. Through the release of the book "Nudge: Improving Decisions About health, wealth and happiness", the law scholar Cass R. Sunstein alongside the behavioural economist Richard H. Thaler (2008) introduces the use of behavioural economics principles for explaining and creating decision-making contexts. Through their findings, they emphasize the fact that the "choice architects" such as the policy makers should use nudges for steering individuals towards adopting a more sustainable behaviour for the well being of the society and their own (Thaler & Sunstein, 2008, p.253). The writers present and promote a multitude of nudges which can be used in different contexts for correcting human behaviour, but we will



only focus on the situation in which food waste can be decreased. According to the definition coined by Thaler & Sunstein nudges represent "any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives" (2008, p.6). Based on this interpretation, there are three architectural choices which define the concept of "nudges".

Firstly, they are considered as being interventions which aim at modifying human behaviour in a predictable way. Secondly, nudges can achieve this change without prohibiting any alternative or modifying the economic incentive. Thirdly, the design of the nudge is created by the choice architect who according to the writers "has the responsibility for organizing the context in which people make decisions". This role is attributed to the ones responsible for regulating the public policy, the health professionals and also the private businesses which aim at doing good besides their employees and customers. The "choice architects" are in charge of creating the design that will better drive sustainable changes for the welfare of their target individuals. Similar to the concept of traditional architecture, it is critical to acknowledge that in the creation of specific design there is nothing random or neutral. Every aspect is carefully thought, and it respects certain requirements which aim at influencing behaviour in a particular way, leading towards a certain path.

The theoretical and practical value of nudges is decided upon their ability to alter behaviour in the long run (Frey & Rogers, 2014). According to critics, the liberal paternalism philosophy, upon which nudges are relying, assumes that individuals lack rationality (Gigerenzer, 2015). Non-cognitive constraints can limit nudges due to demographic differences in individuals which can be ruled out only through testing the behavioural interventions in a field experiment before implementing it.



Referring back to the definition provided by Thaler & Sunstein (2008) regarding the "nudge" concept, there is an automatic assumption that there are actions which must be taken for pushing individuals towards taking better decisions. This assumption is based on the ideology that humans do not always act based on rational thinking and as a result, a "paternalistic attitude" must be adopted. The concept of paternalism refers to refraining one's autonomy and freedom by taking actions which aim at promoting their own good. Taking the context of reducing food waste, we believe that individuals often do not act in their best interest due to the lack of information, cognitive ability or control they own over their actions. Following the same logic, policy makers, public health professionals and private companies should take responsibility and intervene for steering human behaviour towards healthier decisions. This can be done by prohibiting certain foods or advertisements which do not support healthy or sustainable lifestyles (Buchanan, 2008).

The second critical principle mentioned by Thaler and Sunstein (2008) in the definition regarding the concept of "nudges" is that the freedom of choice must be respected. This comes from the libertarian ideology which stands opposite from the paternalist one. According to liberalism, the freedom of the individual represents a right which is fundamental having a superior value and which should be respected even though it creates harm to the general welfare (Holm & Ploug, 2013). Given the antithesis between the "paternalistic" and "libertarian" ideologies, the struggle to comply with both led to the concept of "libertarian paternalism". Thaler and Sunstein (2008) aim at addressing the issue of this paradox by arguing that the errancy of the human mind to make rational choices calls for designing the context so that it nudges people to act right. However, the context must be designed by the choice architect in a way in which it does not limit the individual's ability to take another



decision than the one introduced by the architect. This is the reason for which the nudge is considered to follow a "libertarian paternalism" ideology.

In contrast with the prevalent economic theories, behavioural economics takes into consideration the lack of rationality individuals act upon when making decisions. There is no surprise that people do not behave as self-reported and thus primary research must be conducted and designs must be tested beforehand through prototypes. For these reasons, instead of basing their beliefs upon self-reported hypotheses, designers should aim at inspecting the natural human behaviour in-situ. However, although people are not expected to behave in the most rational way, there is a certain predictability to their actions. According to Dan Ariely, there are specific patterns which can be identified in one's behaviour when being under specific circumstances. The researcher names this a "predictably irrational" behaviour through which behavioural economics principles can be applied for explaining contentment and also predict where interventions can occur for successfully steering human conduct. These principles help at making sense out of the individuals' irrational actions by presenting certain patterns which are adopted by most people when being under some specific circumstances. More specifically, the behavioural economics principles help designers in explaining current behaviours and how to change them by intervening at a precise moment in the decision-making process. These principles are general research insights which describe decision making patterns that the users are most of the time unconscious about. In consequence, it is critical to consider the behavioural economics principles when nudging individuals towards adopting the desired behaviour. The key is to analyse the decisionmaking process and strategically interfere at key moments for maximizing impact upon altering behaviour.



7.2. Behavioural economics and Service design

In order to get a better insight into the decision-making process and translating it into behavioural interventions, the service design framework must also be considered. Behavioural economics and service design have distinct ways of determining and formalizing insights, the two approaches complementing each other and resulting in a more in-depth analysis of human behaviour.

On one hand, service design can be observed in the business context where it adopts a holistic generative approach when forming hypotheses. In order to achieve this, there is a mix of primary and secondary research alongside prototyping, synthesis, testing and iteration. The holistic perspective upon human behaviour is that this one is influenced by a more general social, cultural and economic context. Thus, the generative approach aims at generating a multitude of outputs such as touch points and curated experiences through which behaviour can be influenced. Design thinking aids at gathering insights about the needs of the users in relation to services, products or markets. This is done through an iterative process which aims at redefining problems and challenge assumptions in order to determine strategic solutions which may not be apparent initially. Models, such as journey maps and personas help at translating complex data into actionable observations. In addition, alongside the design process which goes from hypothesizing and testing to iterating, new insights are gathered at every stage.

On the other hand, behavioural economics is analysing individuals' attitudes strictly through the lenses of the decision-making process. When doing so, it is believed that humans make choices based on cognitive shortcuts that often result in adopting irrational behaviour. These heuristics are highly impressionable by the framing of the choices, resulting in considerable opportunities to "nudge" decisions when this frame is adjusted. Although this



research mainly occurs in academic contexts, lately it is more often observed in consumer settings. Most of the times behavioural economic insights are developed on the basis of empirical research taking the form of randomized control trials (RCTs). Thus, the purpose of the studies is relying on restrained measurable variables which exist in a replicable but controlled circumstance. Hence, the behavioural insights must be backed by quantitative data which often makes the scope of the study considerably narrow in comparison with the service design outputs. At the same time, design research analyses a vast multitude of interactions which arise throughout the whole process in the context of business rather than academics. Thus, it is not required that every part of insight gets quantifiable since this can consume a lot of resources and time. For this reason, we consider the combination of the two frameworks as being the most suitable for driving behavioural change.

In contrast with an academic, controlled setting, the purpose of the service design interventions is open-ended with a holistic basis. Multiple users alongside various touch points, services or products are analysed over a certain time span where all cases are considered. Translating insights into a feasible design requires creativity as well as a deep level of inference through which theoretical insights are transformed into tangible actions.

However, within the behavioural economic studies inference is strictly forbidden since it is considered non-scientific. For transforming a behavioural insight into an intervention, the scientific method must be reused again for creating the hypothesis, testing and measuring it within a study which considers multiple variables and tests them. For this, researchers usually employ A/B testing methods through which they are searching to analyse the variations of a single feature and choose the one which delivers the desired result. In order for behavioural insights to maximise their impact within the design, it is imperative to be applied at the right time to a suitable decision-based issue.



In our case, service design will aid at getting a wide perspective over the guests' experience at Hotel Y, the one receiving the treatment, while the behavioural economics principles will help in getting a deeper understanding for optimizing decision making. The incorporation of the two theories led us towards using the Behaviour Change Framework. This one will integrate behaviour economics principles within the design process for creating and testing our nudge within the presented case study. The practical application to our case will be described in Chapter 9, where we discuss the development of our nudge intervention.

7.3. The Dual Process Theory

In the last decades, neuroscience and modern psychology have been constructed on the principles of the dual-process theory. These encompass a set of considerations which explain how the mental process of social behaviours, decisions and judgements arise in the human brain (Gawronski & Creighton, 2013). According to the theories described by Daniel Kahneman (2011, pp. 20-21), the cognitive processes in our brain can be divided into two major categories as follows: system one which operates on an intuitive and automatic basis and system two which requires reflective and controlled thinking. The philosopher illustrates the way in which the human mental processes are working when being activated by an external factor and the impact it has over one's behaviour.

Based on the latest research, system one which is in charge of our automatic responses to outside factors is defined as being an effortless reaction rooted in intuition. This is commonly activated by impulses, emotions and habits that define one's behaviour without questioning a certain reaction but rather doing "what it feels right". For these reasons it is believed that this system is not actually related to the process of "thinking" (Hansen & Jespersen, 2013, p.13-14; Gawronski & Creighton, 2013).



On the other hand, system two oversees the reflective capabilities of an individual and it is defined by a set of controlled, deliberate concessions where information from external sources is actually processed and analysed. Thus, this system is highly related to one's ability to be self-aware and its autonomy (Kahneman 2003, pp. 698-699).

System 1/ Automatic thinking	System 2/ Reflective thinking	
• Fast	• Slow	
• Uncontrolled	• Controlled	
• Parallel	• Serial	
• Effortless	• Effortful	
Skilled Unconscious Emotional	• Rule-following	
• Can be overridden by 'system 2'	• Self-aware	
	• Rational	

Figure 15. System 1 and System 2 (Kahneman, 2003)

The automatic system operates independently triggering reactions instantly, but the reflective part of the brain is activated by the context provided through automatic thinking. Thus, if a certain situation comes across as being familiar and well known, individuals will take decisions based on their automatic system. However, if this is not the case, the reflective system will take over forcing the brain to analyse the situation and make a choice. When it comes to nudges, these will instantly trigger an automatic reaction of the brain, but this does not necessarily mean that the reflective system will also set off (Hansen & Jespersen, 2013, p.14).



7.4. Types of nudges and architectural interventions

Since Thaler & Sunstein coined the definition of the "nudge" in 2008 various studies have emerged trying to classify the choice architecture interventions and divide them into categories. Alongside Dolan et. al. (2012), Hansen & Jespersen (2013) and Hollands et. al. (2013), the Danish Center for Research and Customer Relations in the Food Sector has published in 2014 a study where the nudges were divided according to their effects upon human behaviour (Mørk et al., 2013). Every researcher interpreted different typologies of nudges in their own way, creating a multitude of types which could be applied across various behavioural and environmental contexts such as: saving energy, pension schemes, public health, organ donation, environmental protection etc. (Dolan et al., 2012; Hansen & Jespersen, 2013; Thaler & Sunstein, 2008). However, we will take into account only the ones which apply to our case, namely the interventions proposed for altering individuals' behaviour towards reducing waste and adopting sustainable behaviour. Given the latest studies, the architecture interventions aimed at achieving these are divided into three different classes visually explained in the figure below.



Figure 16. Typology of 'nudges' and choice architecture interventions in microenvironments, based on Hollands et. al. (2013), Mørk et al. (2014) and Thaler & Sunstein (2008)



Thus, the first class underlines the alteration of the properties characterizing the stimuli which make up the micro-environment. The second class focuses on modifying the placement of the stimuli within the environment. The third and final class encompasses the two aforementioned ones, presenting nudges which can alter both, the properties and the placement of the stimuli at the same time.

Within the first category, regarding the properties of the stimuli, the "ambience" refers to the intervention upon the aesthetic elements within the microenvironment surrounding the individual. Manipulations of such elements could include: the brightness within the room, the volume and rhythm of the music, the colour of the walls, the decorative details etc. (Hollands et. al., 2013). Going further, the "presentation" is similar to the "ambience" in the way that both focus on modifications brought for a better visual experience. However, this element actually refers to the alteration of the elements making up the visual design of a product or service which is actually delivered. As a result, the first is concerning the physical microenvironment surrounding the individual while the latter is mainly regarding the product. As an example, nudges can be applied here for changing the design of the packaging by including colours or changing shapes of it (Hollands et. al., 2013).

The "symbol" refers to nudges which can be applied to the micro-environment where information is distributed for making the message clearer and decreasing the number of mental concessions needed for processing it. An example of a nudge that could be applied would be the "green leaf" symbol presented on products which are ecological. Thus, we can not include in this category the nutritional information presented on the packaging of the product since this requires a deeper reflection for understanding it and it does not come automatically.



The "functional design" represents the modifications brought in the physical environment by providing various types of equipment or objects which can easier guide the individual towards taking decisions. Nudges in this area imply changes regarding the size of plates, glasses, eating utensils, bowls, eating trays or the lack of them in cafeterias etc (Hollands et. al., 2013; Mørk et. al., 2014).

Next, the "sizing" includes nudges which focus on modifying the size of a certain product, its packaging or the portion of an individual unit (Holland et. al., 2013).

The "incentives" are referring to aspects related to price and cost emerged from the context of behavioural economics. In the case of reducing food wastage, these ones address the nudges which aim at providing economically viable stimuli which steer individuals towards taking better decisions when consuming food. An example would be the case of providing low discount rates at certain times where there is not much demand in order to facilitate the consumption of more food, decreasing the amounts thrown in the landfills. This nudge relies on the idea that people enjoy immediate, small cash settlements and this can push them towards using a certain product or service outside the hours when they necessarily need it (Dolan et. al., 2012; Thaler & Sunstein, 2008).

Going further, the second class of nudges are related to the "placement" alteration of the stimuli creating the environment. There are researchers who argue for including them under the condition of "availability" considering them of one type only. However, we chose to present them as divided into "availability" as well as "proximity" for a better understanding of this class.

The first condition relates to nudges which change the availability of certain objects by incorporating behavioural elements within the micro-environment. This can be



exemplified by interventions in the quality of a product such as a menu or buffet of a restaurant (Holland et. al., 2013).

On the other hand, "proximity" entails interventions which aim at facilitating the interaction within a certain option by reducing the amount of effort required or making them outstanding. This can be achieved by making modifications in relation to the visibility and accessibility of the targeted element or service. The placement of objects in more or less visible spots for driving certain behaviours towards them is an example of such nudges. More specifically, a company can choose to switch positions of dishes on a menu in order to push individuals towards taking healthier decisions (Hollands et. al, 2013; Mørk et al., 2014; Thaler & Sunstein, 2008).

Regarding the last category, namely the combination between the modifications brought through both, property and placement, there are often confusions concerning "priming" and "prompting". Thus, we will begin by describing them separately for better clarification.

"Prompting" concerns nudges which make use of standardized explicit verbal or visual information in order to raise awareness towards acting in a certain way. Thus, these interventions are relying on activating the reflective system of the brain by influencing the behaviour rooted within the automatic one. Nudges of this kind can be observed under the form of posters, footprint symbols or signs where audio elements can also be included (Hansen & Jespersen, 2013; Hollands et. al. 2013).

On the other hand, "priming" makes use of nudges which place incidental cues within the physical micro-environment for making a certain option more mentally available. The primes are ultimately having an influence upon the reflective side of the brain by triggering



semantic responses or associative processes (e.g. the smell of a certain food, elements of decor which suggest a certain ethnic theme or prime the consumption of a specific type of food) (Hollands et al., 2013; Mørk et al., 2014; Thaler & Sunstein, 2008).

Furthermore, most decisions have a "default" choice which creates the perfect environment for nudges which involve the modification of the final result if no action will be actively taken. Examples of this kind include the sale of pre-made lunch boxes or standard menus in a restaurant (Dolan et. al., 2012; Thaler & Sunstein, 2008).

Finally, the "social influence" encompasses the last category of nudges which can be adapted for altering the placement and properties of stimuli. This one refers to social norms which are shaping the human behaviour within a group for reaching an ideal form. Nudges of this kind will focus on providing information with regards to the norms of a specific social group to which individuals must conform to. These interventions are similar to the ones relying on "priming" and "prompting" intending to affect the reflective side of the brain by influencing the automatic one (Dolan et. al., 2012; Thaler & Sunstein, 2008).

8. The Consumer Attitude-Behaviour Gap

The development of behavioural economics principles emerged from recognizing that human behaviour often differs from the neoclassical economics' assumption that people are rational actors (Camerer & Loewenstein, 2004). The assumption that individuals are rational was based on the fact that they make decisions according to their self-interest or to what gives them greater satisfaction (Becker, 1976). Thus, it was believed that people are motivated by their desire to maximise utility. However, behavioural economics challenges this idea by emphasizing the fact that decisions are influenced by social norms rather than personal interests (Dolan et al., 2010). As underlined by Norwood and Lusk, consumers who adopt a



sustainable behaviour towards food waste may display social desirability bias, meaning that they act in a way they believe it is socially acceptable (2011).

Another assumption of neoclassical economics is represented by the fact that people make a decision according to a fixed set of preferences that do not change according to various contexts (Becker, 1976). This idea is challenged by behavioural economists which have proved that individuals' preferences modify depending on the context and how information is presented (Druckman, 2001). This idea is also emphasized by the citizenconsumer attitude-behaviour gap which states that people do not maintain their preferences stable and their attitude changes once they are in a consumer position. More specifically, even if hotel guests are normally concerned with food waste, once they are in a position where they can benefit from a buffet-type of service there is a high chance that they will not adopt a sustainable behaviour.

Another assumption developed by neoclassical economists and challenged by the behavioural critics is that a "rational" person will seek further information in case they do not have sufficient for making a decision (Becker, 1976). However, it has been proved that individuals have certain constraints when it comes to rationality (Todd & Gigerenzer, 2000). Hence, our capacity to search for more information and the analytical power to investigate is limited by time and the availability of information (Simon, 1982). This has an impact on food waste since "people do not take the time to consider it when making purchasing decisions" (Ingenbleek et al., 2012). Hence, the desire to acquire additional information is limited by the availability of time. In addition, there is a high percentage of consumers who do not wish to be educated and prefer to remain ignorant in the face of food waste issues. According to a study conducted by Bell (et al., 2017), a third of the survey participants (out of 1000)



preferred to stare at a blank screen rather than viewing an informative text regarding how pregnant sows are housed.

The central problem, from a policy design perspective, is that neoclassical economic principles continued to regulatory frameworks and models regarding human behaviour despite the consciousness of its limits (Levine et al., 2015). The purpose of behavioural economics is to take into consideration what the neoclassical economic framework would regard as "irrational" and using it for enhancing the behavioural realism of the economic models (Congdon & Shankar, 2018). For this reason, behavioural realism plays a critical role in developing evidence-based policy making through the application of behavioural economics principles. On a global scale, there are over 150 governments employing behaviourally informed "nudges" to influence human behaviour (OECD, 2018) through various "warnings, reminders, social norms and default rules" (Sunstein et al., 2018, p.3).

9. Development of the design intervention

In order to design a behaviour change intervention, it is imperative to start by defining the target of our nudge and what drives the current behaviour. This can be done by applying behavioural economics principles and analysing them against the current attitudes adopted by the guests of the hotel. After understanding what is pushing the customers towards overfilling their plates and creating waste, we go further towards setting the goal we want to achieve with our nudge. In the present paper, we want to alter the customers' behaviour for reducing the amount of waste created during their stay at the hotel. Thus, the ideal state we want to achieve is the adoption of a sustainable attitude towards food waste where people become more conscious with regards to the consequences of their actions. However, for the development of an effective nudge, it is imperative to analyse and apply to our case the behavioural economics principles which can drive this change. More specifically, we will analyse what



psychological factors are defining the current state of behaviour and how can the future, ideal state be achieved. By analysing both, the current and the future state alongside the service design and the behavioural economics principles we will be able to match the characteristics of the intervention with the context and the behavioural target. There is often the case that interventions are designed without undergoing this process, lacking analysis of either the theoretical mechanism of action or the target behaviour. Thus, for maximizing the effects of the nudge intervention we chose to apply to our case the Behaviour Change Framework. Through this approach, we will analyse not only the service design but also the behavioural economics principles which can be applied to it. In this way we will manage to understand the nature of the current situation and how can we intervene in the decision-making process to achieve better outcomes.

9.1. The Behaviour Change Framework

The Behaviour Change Framework represents a tool which incorporates behavioural economics principles within the design process in order to create the design of the behaviour change. Designers make use of this framework when wanting to decide upon where to apply behavioural economics within the service context and how to turn the behavioural insights into a design intervention.

The framework encompasses two parts. In the first stage, we will use the framework for defining the target of our intervention. We will outline the current situation and what drives guests towards adopting unsustainable behaviour. In the second phase, we will go indepth into the behavioural principles which can drive our target from the current state to the ideal one. More specifically, we will present the biases which support our nudge and explain our decision to use these types of interventions. In this way, we are looking to validate our



ideas and establish the details of our intervention on the basis of a strong theoretical background which combines service design with behavioural economics considerations.

The first step of the ideation process to define the current state of the guest's behaviour by making use of the research insights gained so far. These insights are based on the qualitative data acquired from the administration of the hotels and the review of the literature. To begin with, we must outline whose behaviour we want to change, more specifically who is the target of our design intervention. In our case, we want to influence the decision-making process of the guests staying at Hotel Y, the one which will receive the treatment. We include in our study all customers of the hotel, both male and female, regardless of age, ethnicity or the place of residence. Our focus is on the guests which acquired a buffet type of service where there is no limit upon the quantity of food consumed per capita. Thus, we are looking to gather information upon what is their current behaviour when benefiting from an all-you-can-eat service and how can this be altered towards reducing food waste. We will take into consideration variables such as the purpose of the stay, the number of children, the length of the stay, the age, sex and residency but only for testing our results after implementing the treatment.

After outlining the target of our intervention and the type of attitudes we want to alter, the behaviour change framework proposes two approaches:

- 1. Understanding and optimizing
- 2. Developing new features

By analysing both of these approaches, we will get a better overview of what is the current situation and how can it be further improved. In the optimization section, we will discuss the behavioural economics principles which might be used for explaining the current



state of behaviour. After outlining them we will go further and analyse how can these principles be applied to our case and what actions can be taken for its improvement. Thus, based on the behavioural biases applying to our case we will underline the principles which can support the mechanisms of our nudge and the achievement of the future, ideal state.

According to Dan Ariely, there are forty principles which can explain the irrationality behind some decisions individuals take in their everyday life. People can either inhibit or exhibit certain reactions which might seem incoherent but can be explained through these patterns of behaviour. The *decision paralysis* represents the first principle which can offer us insights regarding the reason for which hotel guests tend to overfill their plate during buffets. This bias relates to the incapacity of people to make one decision when being offered too many choices. In our case, it can occur when a guest cannot decide between the food courses offered at the buffet, ending up in overfilling his/her plate. Thus, when offered a high variety of choice at no extra costs, customers often take the easy way out, which most of the times is taking no decision at all. For this reason, people tend to overfill their plates when being conflicted upon what to eat, ending up in taking more food than they can actually consume.

A second principle which can explain this phenomenon is represented by the *ego depletion*. This behavioural economics bias refers to the fact that willpower and self-control rely on a finite amount of mental resources which can be accessed (Baumeister et. al., 1998). In other words, self-control depends on the amount of energy attributed to mental activity. Once this one is low, self-control becomes impaired which further results in a state of ego depletion. With respect to our case, this effect can occur when guests decrease their mental activity due to being in a state of relaxation. As a result, they will not make an additional effort to think about their actions and the consequences derived from it. More specifically, when taking seemingly unimportant decisions such as what to eat and how much, individuals



will often choose to conserve their energy and act upon their automatic system only. In this way, the reflective system will not be activated, and choices will be made based on past behaviour.

A third behavioural economic principle which brings further insight into the general tendency of hotel guests to overfill their plates is represented by the *omission bias*. This bias refers to the inclination of individuals to react worse to injurious actions than to similarly harmful inactions. In addition, the first is judged as less moral than the latter, a fact which can be also linked to our perception of "normality". Thus, inaction is more often justified as being normal rather than the action itself. Similarly, individuals tend to make the distinction between the two also based on the direct and indirect causation. In this case, action can be categorized as direct causation while inaction is more difficult to analyse. When applied to our case, this bias explains why hotel guests do not see the waste created by themselves as being something harmful. In most of the cases, the action of polluting the air with chemicals from a certain factory will be considered less moral than polluting by the inaction towards reducing food waste. Once we outlined the general drivers of the current state of behaviour which we want to influence, we will analyse the biases which can aid the process of bringing our nudge users from the current state to the future, ideal one.

First, we will discuss the *loss aversion* principle which we consider detrimental when attempting to alter human behaviour. According to Kahneman and Tversky (1979) "losses loom larger than gains" which mean that people are more afraid to lose something than they are happy to gain. This concept is linked to the prospect theory which states that individuals make decisions in terms of expected utility with respect to a reference point (e.g. current wealth) rather than absolute outcomes. It is thus believed that the pain endured for losing something is about two times higher than the happiness of gaining something. In



consequence, people tend to take more risks and move out of their comfort zone in order to avoid a loss rather than achieve a gain (Schindler & Pfattheicher, 2016). This is the reason for which penalties are viewed as more compelling and effective than rewards when attempting to change the behaviour of people and motivate them to act in a certain way (Gächter et al., 2009).

The second behavioural principle considered when developing our nudge intervention is represented by the *pain of paying*. This one is closely linked to the loss aversion concept, both of them forming the foundation of our nudge intervention. Thus, this principle emphasizes the fact that people are experiencing "pain" when they have to spend money due to being loss averse (Zellermayer, 1996). This helps them to maintain their finances in check and self-regulate their behaviour. However, this feeling is thought to be diminished when paying by credit card rather than cash, in this way the consumption of resources being less visible and tangible (Prelec & Loewenstein, 1998). When applying this principle, it must also be considered the type of personality a consumer has. Thus, given the spending behaviour of each individual, they can be more or less sensitive to the pain of paying. When applying this principle to our case, we believe it would increase the effectiveness of our nudge if we apply a certain tax for the food waste created. This feature results as a mix between the last two biases presented, namely the "loss aversion" and "pain of paying". Both of these underline the fear shared by individuals when facing the possibility of a loss and their tendency to take all necessary actions towards reducing it.

The third principle included into the design of our nudge is the *default bias*, where the default option represents what a consumer selects if he does nothing. It is believed that individuals hardly change the default settings and they often choose to behave in the same way as they previously did, regardless of the circumstances. This explained by the fact that



repeat choices become automated and they do not imply the use of the reflective, cognitive system anymore. This makes it easier for individuals to take decisions and comply with what is given to them. The reason for considering this bias when developing our nudge is because it emphasizes the power choice architectures have upon influencing behaviour. Thus, by offering from the beginning a default option which aims at reducing food waste will make the guests automatically comply with it in most of the cases. For this reason, we considered that by changing the whole set of plates within the restaurant with smaller ones, will push people towards taking less food from the buffet. In this way, the amount of waste created will diminish without customers feeling a huge difference in service that decreases customer satisfaction.

The fourth and final principle which we rely upon when developing the nudge intervention is represented by *mindless eating*. According to this, different cues affect the amount and quality of food consumed by people, having a non-conscious effect on human behaviour. These cues may include labels, packaging, people, atmospheric factors etc., suggesting what and how much it is normal or appropriate to be consumed (Wansink et al., 2009). Since perceptual biases create a wry sense of consumption, social cues play a critical role in shaping behaviour. For this reason, we believe that the size of the utensils used by customers when serving themselves and the messages displayed in the canteen (regarding the tax on waste) will have a considerable impact upon the consumption behaviour of the guests.



The analysis of the service design and the behavioural principles applying to it led to an in-depth understanding of what are the forces driving behaviour, offering insight into what can be done for altering it. In order to get a visual representation of the framework and how these principles are applied to our case, we provide the following figure:

CHEAT	SHEET Be	haviour Change Framework		
CURRENT STATE	BE PRINCIPLES \rightarrow	DESIGN IMPLICATIONS		IDEAL FUTURE STATE
Define whose behaviour you want to chonge: Guests staying at Hotel Y who acquired a buffet breakfast What key decisions do you want to influence: Stop overfilling their plates and reduce in this way	Identify BE Principles that might be causing the Current State behaviour. Decision paralysis- when affered too many choices people tend to make no choice at all Ego depletion - willpower and self- control rely on a finite amount of mental resources Omission bias - the inclination of individuals to react worse to injurious actions than to harmful inaction	Develop Design Implications or rules to combat or leverage each BE principle you selected. Limit the number of choices available Make it easy for guests to take decisions Raise awareness towards harmful inaction	Ideate ways to optimize your product or service's features based on your Design Implications. Limit the number of dishes displayed at the buffet (e.g. only a few choices) Present only one type of plates which can be used for the buffet Inform customers which are the consequences derived from food waste	How might we nudge hotel guests towards adopting a sustainable behaviour through which food waste is reduced?
post-consumer food waste What are the current outcomes of the user's decisions: Increased waste, environmental pollution, increased food expenditure, negative impacts upon society	Identify BE Principles that you think could help nudge users towards the Future State. Loss aversion - losses loom larger than gains Pain of paying- people are experiencing a "pain" when they have to spend money Default bias- what a consumer selects if he does nothing Mindless eating - different cues affect the amount and quality of food consumed by people	Develop Design Implications or rules to leverage each BE principle you selected. Create a pain that can trigger a response in the guests' behavior Create a default choice which automatically reduces food waste Create a social pressure for guests to behave in a sustainable way	Ideate new features for your product or service based on the Design Implications. Implement a 2 Euro tax per 100g of leftovers Reduce the size of the plates used by the hotel guests in the canteen Posters displayed in the canteen regarding the "green" strategy of the hotel	Now: customers are more aware of the consequences of food waste and they are more considerate towards overfilling their plates and leaving food behind So that: their footprint upon the environment is decreased and waste is minimized

Figure 17. The Behaviour Change Framework

Based on the observations resulted from the application of the Behaviour Change Framework, we developed two nudges which we believed suitable for the case. These are further presented in the following section.



9.2. Presentation of the Nudge intervention

The aim of our research is to shed light upon the pre-consumer and post-consumer origins of food waste, and the effects and challenges that may come with the attempt of reducing it. The issue of food waste has represented the subject of debate for a long time but less attention is attributed to finding suitable solutions for it. This matter becomes more pressing since more than a third of all food produced for human consumption is lost or ends up in the trash (Gustavsson et al., 2011). Thus, it appears that food waste represents a significant, but mainly overlooked issue which has a negative impact upon the society, environment and the economy. According to Thaler and Sunstein, one way of changing people's behaviour towards a more sustainable one is by modelling the choice architecture (2008).

In the present research, we will test if there is a behavioural change on the guests' behalf when being exposed to two treatments relying on the use of external cues. These aim at influencing consumption norms and analysing the customers' willingness towards adopting sustainable behaviour. Given the latest research regarding nutrition and obesity, it appears that "the eating situation often (but not always) provides clues allowing us to infer how much we can eat without eating an inappropriately large amount" (Herman and Polivy, 2005). This is mainly part of the choice architecture which can influence the eating habit of individuals. The focus of our research is on reducing the amounts of food waste generated, in this way decreasing the amounts of greenhouse emissions, the unnecessary waste of money that come with it and better management of resources. Some of the observations we rely upon during our study are related to the fact that a lot of the measures taken for reducing the food intake have proved to also work in the case of decreasing food waste (Freedman and Brochado, 2010).


In order to find a viable solution to the issue of food waste, we employed a field experiment where two variables of interest were manipulated through a nudge intervention. Additionally, the results of the experiment are backed up by an observational study where pre-existing variation in one of the core variables is analysed. The complementarity of the two studies will help us in achieving a higher validity and reliability for the results of our study.

During the field experiment, we chose to apply two treatments which aimed at reducing the amount of food waste generated, their effectiveness being tested for during our study. Both of our nudge interventions have their basis on impacting consumption norms by providing external cues. More specifically, the first treatment is concerned with the relation between food waste and plate size. Thus, we wanted to test which is the effect of reducing the size of the plates upon decreasing waste. In previous research studies, it has been debated that "plate shape and size delineate norms for appropriate amounts of food to eat at a meal" (Sobal and Wansink, 2007) and it has been shown that over-serving is connected to big plates and conversely, underserving is generated by small ones (Ittersum and Wansink, 2012). Moreover, it has been argued by Ittersum and Wansink (2012) that larger plates also provide a visual illusion which makes individuals have biased perceptions upon the amount of food they are serving and consuming. In addition to these findings, it has also been proved that the increase in portion size affects the increase in food intake and food waste (Freedman and Brochado, 2010). Taking these insights into consideration alongside the behavioural default bias, we hypothesize that by reducing plate size the amount of waste will also be reduced. During the field experiment, the average size of the plates was of 25 cm and we reduced it down to 20 cm. Since the focus of our study was to observe the change when individuals are offered a buffet type of service, we were concerned only with the size of the plates used for the morning breakfast. This was due to the fact that breakfast represented the only meal of the



day in both of the hotels where an all-you-can-eat service was provided. In the pre-treatment, observational study, the size of the plates had an average of 24 cm, ranging between 15 and 28 cm.

The second treatment was represented by a social cue through which customers were informed that there is a new policy in place for the buffet where they have to pay only for the edible food they leave on the plate. This information was transmitted through the use of multiple fliers posted in the restaurant of the hotel in which the treatment was applied (presented in Appendix 15.2.). The idea behind using this strategy was to encourage customers to eat as much as they need or want but be more considerate towards what they are leaving behind. The text was displayed in both, Romanian and English and it read: "Love food, hate waste. Eat as much as you want but pay what you can't. A tax of 2 Euros will be applied at check-out." The posters were reinforcing the idea that it is socially acceptable to return to the buffet as many times as wanted but it is not adequate to leave waste behind. Thus, the behaviour might be altered in the way that "just as people often look to portion size for guidance in eating situations ... so they may rely on the example of others for guidance, when such examples are salient" (Herman and Polivy, 2005). Our hypothesis was that the sign will stimulate guests towards not overfilling their plates each time they serve themselves and in turn, the amount of leftovers will also decrease. In addition, we based our hypothesis on the two aforementioned behavioural principles regarding the pain of paying and the loss aversion displayed by individuals in situations where they have something to lose. For this reason, we thought that by setting a minimal tax of 2 Euros per 100 grams of edible leftovers will enable us to increase the effectiveness of our nudge intervention. However, this approach came with a great risk of decreasing customer satisfaction since they had already paid for the buffet service and an extra tax would not come as something easy to accept. In our case, we avoided



this risk by letting guests know at check out that the implementation of the tax was only part of a study and there will not be any extra charge on their bill. In exchange, we asked the customers to complete a survey regarding their opinion upon food waste and the fliers displayed in the canteen. The survey helped us gather additional data regarding customers' behaviours and establish a more reliable connection between variables.

10. Data analysis

Both nudge interventions were tested through the use of an experimental study conducted in association with two hotels. Hotel X represented the control group while Hotel Y implemented the two treatments. The study was implemented from the 1st of April until the end of March. Both hotels recorded the food waste resulted from the morning buffet daily during this period and at the end of the research, they reported it back to us. The treatment was applied in Hotel Y during a one-month period starting from the 1st of February. For organising and analysing our data we used a difference-in-difference model where we applied a fixed effect panel regression to record the effects of the treatments. The rationale behind using this model was that it can control for pre-treatment differences between the two hotels and offer us insight into the trends which might be unrelated to our intervention (Card and Krueger, 1994). The difference-in-difference estimation uses data from the pre and post treatment and from the participant and non-participant group. By using this model, we could overcome the selection bias on fixed traits and the time trends which might affect our results. Our purpose was to compare the treatment group with the control group, before and also after the implementation of the experiment. Moreover, in order to get a better overview of the number of breakfasts served, we chose to control for the number of guests staying at the hotel and the food sales revenue. The latter would provide us with insight regarding the number of



meals served excluding the breakfast since this one was paid in advance by the guests. In theory, the diff-in-diff estimator is:

 $DD = (\bar{Y} \text{ post treatment} - \bar{Y} \text{ pre-treatment}) - (\bar{Y} \text{ post control} - \bar{Y} \text{ pre-control})$

Where:

Cross-sectional units: $i \in \{1, ..., N\}$

Time periods: $t \in \{0 \text{ (pre-treatment)}, 1 \text{ (post-treatment)}\}$

Group indicator: Gi = 0 (control group), Gi = 1 (treatment group)

Treatment indicator: $Zit \in \{0, 1\}$

Units in the treatment group receive treatment in t = 1:

	Time Period Group		
Group	t=0 t=1		
<i>Gi</i> =1 (treatment group)	Zi0 = 0 (untreated) $Zi1 = 1$ (treated)		
<i>Gi</i> =0 (control group)	Zi0 = 0 (untreated) $Zi0 = 0$ (untreated)		

Table 2. The difference-in-differences model



Potential outcomes Yit(z):

- 1. Yit (0): potential outcome for unit i in period t when not treated
- 2. Yit (1): potential outcome for unit i in period t when treated

Causal effect for unit *i* at time *t* is $\tau it = Yit(1) - Yit(0)$. Observed outcomes *Yit* are realized as *Yit* = *Yit*(0)(1 - *Zit*) + *Yit*(1)*Zit*. Because *Zi*1 = *Gi* in the post-treatment period:

Yi1 = Yi1(0) (1 - Gi) + Yi1(1)Gi

Pre-Period (t = 0) *Treatment Group* (Gi = 1) E[Yi0(0) | Gi = 1]

Control Group (Gi = 0) E[YiO(0)/Gi = 0]

Post-Period (t = 1) E[Yi1(1)/Gi = 1]

7m E[Yi1(0)/Gi = 0]

In our case, food waste from hotel *i* at time *t* is modelled as follows:

Waste _{it}= $\beta_{11} D_{1i}$ + $\beta_{12} D_{2i}$ +... + $\beta_{1n} D_{ni}$ + β_2 Guests _{it} + β_2 Food Sales _{it} + γ_{ti} + δ (T_i × t_i) + e_{it}

Where D $_{1i}$... D $_{ni}$ represent dummy variables, which are specific to the hotels and are coded so that D $_{1i} = 1 \rightarrow i = 1$, otherwise 0; D $_{12} = 1 \rightarrow i = 1$, otherwise 0 ... D $_{1n} = 1 \rightarrow i = n$, otherwise 0. These variables help us control for the moderate permanent variations between the two hotels, before and after implementing the treatment. In our study, we included six dummy variables which will transform the qualitative data into a numeric value in our regression analysis. The first dummy is represented by location, where Loc = 1 if the hotel is located less than 1.5 kilometres away from the ski slopes and 0 if otherwise. The second dummy is checking for the existence of a swimming pool within the two hotels, where SwP =



1 if there is and 0 if otherwise. Another dummy variable we took into consideration is represented by the concierge services where we noted Con = 1 where they exist and 0 when they do not. Further, we checked for the pet friendliness of the two hotels, where Pet = 1where the resorts accepted animals on the premises and 0 where they did not. Another dummy variable we included in our study was the opportunity to have a live music program within the hotel. In this case, we noted Music = 1 for the hotel which offered this service to the guests and 0 in the cases where it did not. The sixth and final variable in our experiment is represented by the existence of barbecue facilities at the two resorts. Thus, following the same logic, we noted Bbq = 1 where guests could benefit from such facilities and 0 where they could not. Even though these dummies might not seem as having any connection or impact upon the amounts of food waste, we decided to not leave these differences out since they might provide an important insight during our research.

At the same time, t_i controls for the time trend in both groups namely, treatment and control. In our case $t_i = 0$ before the treatment and $t_i = 1$ after the treatment.

On the other hand, T_i controls for the group we are addressing, so that: $T_i = 0$ for the control group while $T_i = 1$ for the treatment group. The random error factor, which appears in our equation as e_{it} , is expected to be i.i.d. normal, measuring the effect of the treatment through the interaction between t_i and T_i . Each of the two treatments was analysed separately by estimating regressions for each of them.

In addition to the experimental research, we decided to validate our data beforehand by employing an observational study during the pre-treatment period. The aim of the study was to bring clarifications upon the impact plate size has on reducing food waste without intervening and just analysing the data provided by the hotels. During the study, we made use



of the pre-existing differences in plate size across both hotels representing the treatment and the control group. For the analysis, we employed a panel regression where the independent variable was represented by the plate size and the dependent one by the food waste generated. Given the fact that the fixed effects model cannot be employed in cases where variables are constant over time, we made use of a random effect model. This one was applied as follows:

Waste $_{it} = \beta_1 + \beta_2$ Plate Size $_{it} + \beta_3$ Guests $_{it} + \beta_4$ Food Sales $_{it} + e_{it} + \nu_i$ where β_1 represents the average intercept and ν_i are hotel specific random variations.

11. Results

There are four elements which must be studied in the output resulted from our linear regression. First, we must look at the R^2 value ("**R-squared**" row) which gives insight into the variance proportion in the dependent variable that can be interpreted based on the independent variable, representing the variation justified by the regression model beyond the mean one. However, it must be taken into consideration that the R^2 value represents a positively biased estimate in relation to the proportion of variance accounted for by the regression model. Hence, the second element we must take into account is the **Adjusted** R^2 value that aims at correcting the positive bias by outlining the value that can arise in the population. Going further, the third element which must be looked for is the *F* value that shows the degrees of freedom and the "**Prob** > **F**" row that gives insight upon the statistical significance of the regression model. Finally, the coefficients resulted from the regression regarding the constant and independent variable ("**Coef.**" column) must be accounted for since they provide information upon predicting the dependent variable (food waste) through the independent one (plate size).



Given our analysis, the results of the experiment indicate that reducing the size of the plate by 5 cm (from 25 cm to 20 cm) will generate a decrease in food waste of 34.8%. Regarding the second treatment, which implies the inclusion of a 2 Euro tax upon 100g of leftovers, it reduced food waste by 30.35%. Thus, both nudge interventions tested during our experiment generated positive results with regards to reducing food waste. The descriptive statistics by treatment group and time period are presented in Table 1.

Time period	Hotel X (food waste	Hotel Y (food waste	
	average per month, kg)	average per month, kg)	
Pre-treatment	52.5	38.7	
Treatment 1	53.1	31.7	
Treatment 2	48.2	28.2	

Table 3. Descriptive statistics by treatment group and time period

In order to support the findings of the field experiment, we decided to conduct an observational study through which we measured the level of association between food waste and plate size within both of the hotels in the pre-treatment period. The regression results of the observational study are presented in Table 2.



Reg. Food waste	Coef.	Standard error	t	P> t
Sales	0.0004542	0.0008255	0.55	0.585
Guests at breakfast	0.0330523	0.0371938	0.89	0.378
Plate size	1.423913	3.475122	4.10	0.000

Table 4. Regression 1 – Observational analysis

The R-squared value equalled 0.32 (Adj. R-squared 0.39) and the percentage value of the effect was established by dividing the coefficient by the average quantity of waste recorded in the pre-treatment period. The resulted outcome indicates that a reduction of 1 cm in plate size decreases waste by 1.4 kg which translates into 3,2% of the overall mean in the period before the treatments. Thus, a cutback of 5cm as presented in our field experiment would result in a decrease of 16% out of the total waste generated. This value is between the limits of the confidence interval that reaches in our case 95%.

The effects of the treatments were computed by dividing the coefficient value by the pre-treatment means presented in Table 1. The results of the random effect estimations proved to be inconsistent when running the Hausman tests. Consequently, we reported the fixed effect estimations.

The proportion of variance in food waste that can be explained by plate size is of 0.51 (*Adj. R-squared 0.49*). The regression model is statistically significant F(5,112) = 23.5, p = 0.0000. Hence, the model applied to our case proves to be significant in predicting food waste. The results of the regression ran for the first treatment, are presented in Table 3.



Reg. Food waste	Coef.	Standard error t		P> t
Sales	0001528	0.0004419	-0.35	0.730
Guests at breakfast	0.0320806	0.0213502	1.50	0.136
Plate size	18.51641	.8737111	2.12	0.036

Table 5. Regression 2 – Treatment 1

The R-squared value of the regression ran for the tax on leftovers is of 0.49 (*Adj. R-squared 0.48*). The model again proves to be statistically significant with F(4,111) = 27.73 where p = 0.0000. The results of the regression ran for the second treatment, are presented in Table 4.

Reg. Food waste	Coef.	Standard error	t	P> t
Sales	0.0005111	0.000531	0.96	0.338
Guests at breakfast	0.0516196	0.0226577	2.28	0.025
Plate size	14.63095	2.111196	6.93	0.000

Table 6 - Regression 3 - Treatment 2

12. Discussion and research implications

Given our results, it appears that we managed to determine and quantify two noregrets factors that can considerably decrease the amount of food waste generated from hotel restaurants. In addition, the findings resulted from the nudge intervention regarding plate size can be further applied to alternative contexts. Hence, our results may represent a valuable input not only for hotels but for any institution dealing with food service which includes



buffets (schools, prisons, hospitals, etc.). In addition, the results for the effect of the two treatments have higher reliability due to the observational study which supports them.

The costs of implementing either of these treatments are negative. Since hotels are compelled to changing plates on a regular basis, smaller ones can be purchased and most often at a lower price. Regarding the costs of the second measure, these ones are minimal since designing and printing a few flyers requires a small input. In addition, the tax upon waste will bring an immediate return on investment, the financial sacrifice being almost non-existent. Moreover, the revenues incurred from decreasing food waste represent a substantial gain for the hotel. Based on the estimations resulted from our data, it seems that hotels will save up to 7 Euros per kilogram of food that was not wasted. In addition, one kilogram of food waste makes up for approximately 1.9 kg of CO2e which roughly translates into a negative cost of more than 4.200 Euros per ton of CO2 (European Commission, 2010).

However, there are certain drawbacks which must be considered when incorporating nudges within the service design of the hotel. Thus, we must take into account that customer satisfaction might be negatively affected by the two treatments. Firstly, guests will have to return more times to the buffet due to the small size of the plates and the luxurious feeling induced by larger plates will be decreased. Secondly, customers might get disturbed by the fact that they can get charged for the food left in their plates. Thus, this risk must be carefully considered and proper communication between the staff and the hotel guests is required. Since guests pay in advance for the breakfast buffet it might become difficult for them to understand why an extra tax is applied for the food they left behind, resulting in dissatisfaction and low customer retention. However, in order to mitigate these risks, we conducted an online survey regarding customer satisfaction where the guests of both hotels



had to provide input. The result of running a difference-in-differences regression is that satisfaction with the breakfast buffet remained constant in both groups (control and treatment), being no significant change between the pre and post-treatment periods.

Due to the limitations of our study, some issues remain unaddressed and can be further investigated in future research. Given the fact that we tested the effect of each treatment separately, we did not check for the impact they would have when being implemented jointly. Moreover, further research can be attributed to deciding upon which is the optimal plate size for reducing food waste while maintaining customer satisfaction high. The same can be considered for the value of the tax applied to the customers' leftovers.

These issues leave an open space for discussion and require further investigation, but the present study offers a valuable input which can guide future research. Hence, our results emphasize that the use of nudge interventions for reducing food waste represents an effective approach which can be considered by hotel managers when dealing with this issue. In addition, based on the analysis of the data provided in our study, it seems that the implementation of these two treatments is privately profitable. The reason behind this stands in the fact that by reducing food expenditure and imposing a minimum tax on the customers' leftovers, costs will be minimized while increasing revenues. Moreover, the costs of implementing the two proposed nudges are negative but their impact upon reducing waste is tremendous. For these reasons, we consider that by employing these two treatments within the service design of a hotel, there would be a positive effect not only upon the business but also the environment, creating a win for both.



13. Conclusion

All things considered, the waste of food is a constant, hard to avoid problem occurring in every restaurant and hotel daily. However, this issue does not always receive the attention it deserves, and it is most often ignored and neglected due to various motives. For these reasons, the present study focuses on providing an in-depth rationale of how this issue can be tackled through the application of behavioural economics principles. In order to find a viable solution to the issue of food waste, we employed a field experiment where two variables of interest were manipulated through a nudge intervention. Additionally, the results of the experiment were backed up by an observational study where pre-existing variation in plate size was analysed. The complementarity of the two studies contributed to achieving a higher validity and reliability for the results of our research.

During the field experiment, we chose to apply two treatments which aimed at reducing the amount of food waste generated, testing for their effectiveness throughout the study. Both of our nudge interventions were based on impacting consumption norms by providing external cues. More specifically, the first treatment was concerned with the relation between food waste and plate size while the second one was represented by the implementation of a tax on guests' leftovers. The idea behind using this strategy was to encourage customers to eat as much as they need or want but be more considerate towards what they are leaving behind. For organising and analysing our data we used a difference-indifference model where we applied a fixed effect panel regression to record the effects of the treatments. Hence, we controlled for pre-treatment differences between the two hotels that offered us insight into the trends which might be unrelated to our intervention.

The results of our study support the hypotheses set at the beginning of our research, managing in this way to identify two no-regret measures which can reduce food waste within



the hotels offering buffet services. In addition, the results prove to be statistically significant, the two nudge interventions aiding at cutting down waste with about 30%. Given the negative costs of implementing these treatments and the tremendously positive effects upon the administration of food waste, we can confidently state that the tested nudges offer win-win opportunities for the hotel, society and environment.

According to Michael Porter and Claas van der Linde (1995), rigorous environmental regulations can increase performance and result in innovations that would further enhance commercial competitiveness. Due to its effectiveness on achieving positive gains not only economical but also environmental, the implementation of the two aforementioned nudges serves as an informal example of the hypothesis formulated by Porter in 1995 and strengthen out the hypothesis that nudges can be used for achieving the "best of both worlds".



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15. Appendices:

15.1. Poster for the second treatment regarding the tax on leftovers, English version





15.2. Poster for the second treatment regarding the tax on leftovers, Romanian version

