

Reducing food waste: The influence of meal-kits on food waste compared to instant food and traditional cooking

A quantitative analysis on minimising food waste

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Abstract

In recent years, food waste has been receiving increasing attention at both academic and social levels. The amount of food thrown away in households is a concern. However, literature to date focuses mainly on the economic, social, and ecological consequences of food waste and not on consumer behaviour. This, while cooking manner has an influence on food waste. Meal-kits are a relatively new form of cooking in which the consumer receives a box of (pre-cut) raw ingredients, bundled with a recipe card for a complete home-cooked meal. The aim of the current study was to find out whether differences could be found in the effect on food waste between cooking with a meal-kit, instant food, and traditional cooking.

36 Dutch households kept a food waste diary for seven days about their dinner. A multiple regression analysis was used to analyse the data. The results show that significantly less food is wasted when cooking with a meal-kit than when cooking traditionally. In addition, no difference in the effect on food waste was found between meal-kits and instant food. The moderators cooking skills, purchase manner (online vs. physical), and pre-cut ingredients did not significantly influence the relationship between cooking manner and food waste. The current study took the first step in examining the difference in effect of meal-kits and instant food on food waste. Additionally, the current study took the first step in researching the impact of the moderators on the main effect of cooking manner on food waste. The current study provides management of grocery stores, providers of meal-kits, and the Dutch government initial insight into possible measures to help combat food waste.

Keywords: meal-kits, traditional cooking, instant food, cooking skills, purchase manner, pre-cut ingredients

Preface

The master's thesis before you is about food waste. The current study is written in order to obtain my Master's degree in Marketing at the Radboud University Nijmegen. The research period is from autumn 2021 to June 2022. I would like to thank my supervisor Dr. M. Hermans for her expertise, time, and enthusiasm during the process. I would also like to thank the respondents who kept the food waste diary for seven days and my fellow student Evelien Rosmalen, with whom I conducted the data collection. Finally, I would also like to thank my family and friends for their support during the writing process.

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1. Introduction

The production and the consumption of food have remarkable negative effects on the environment. Global food waste in particular has a big environmental impact (Janssen et al., 2019). A third of all food produced for human consumption is wasted according to the Food and Agriculture Organisation of the United Nations (2013). In 2013, the Dutch wasted about 13% of their purchased food, this is equivalent to 150 euros per person per year (Van Dooren et al., 2019). Food wasted per person per year has been decreasing over the past years. Despite the decrease, 9.5% of purchased food is still wasted (Voedingscentrum, 2019). Dutch households wasted about 34.9 kilograms of food per person per year in 2019 (Voedingscentrum, 2019). Not only is this a waste of money on superfluous food, but it also has a big impact on the environment. For this reason, the United Nations aims to reduce food waste by 50% by 2030 (Government of the Netherlands, n.d.). EU agricultural ministers have endorsed these targets, saying that preventing food waste is ultimately up to consumers and industry (Government of the Netherlands, n.d.). Prevention of food waste at consumer level is therefore important to achieve the set target.

At the consumer level, the lack of planning and management of the purchase, storage, preparation, and reuse of food lies at the heart of the food waste problem (Aschemann-Witzel et al., 2015). As a result of a lack of planning, consumers buy superfluous products while they still have those in storage (Stefan et al., 2013). Also, most people are not able to estimate the correct quantities of food needed for a meal (Van Doorn, 2016). If both buying superfluous products and not estimating the right quantities of food are solved, food waste could be reduced at the consumer level.

A solution for reducing food waste at the consumer level could be meal-kits. Changes in lifestyle have led to more time pressure and thus lower priority for food-related tasks (Thyberg & Tonjes, 2016; Wolfson et al., 2016). With the change in lifestyle, products in the food industry evolved. An example of this evolution is convenience food, which is one of the biggest trends in the food business today (Brunner & Siegrist, 2012). As a category within convenience food, a possible solution to reduce food waste at consumer level is to use meal-kits more often during cooking (Albert Heijn, 2021; Heard et al., 2019; Hertz & Halkier, 2017; Maaltijdbox, n.d.). A meal-kit is a box of (pre-cut) raw ingredients bundled with a recipe card for a complete home-cooked meal (Yoon et al., 2022). Because the meal-kit consists of pre-defined portions, less food is wasted than with a grocery store meal where the portions are not pre-portioned (Heard et al., 2019). Since the introduction of the meal-kit to the grocery market

a few years ago, the meal-kit industry has experienced tremendous growth (Distrifood, 2018). HelloFresh, a German meal-kit delivery service, was even Europe's fastest growing delivery service after a growth of 13,159% in five years (Financial Times, 2017). In response to this fierce competition, and growing consumer needs, grocery stores themselves are starting to introduce meal-kit delivery services and a larger and more varied range of grocery store meal-kits (Maaltijdbox, n.d.). The grocery store meal-kits offered at for example Albert Heijn and Lidl make the sales of meal-kits delivery services like HelloFresh go down (Business Insider Netherlands, 2018). From 2017 to 2018, there was a 17% decrease in the number of Dutch households that were Hellofresh customers (Business Insider Netherlands, 2018). On the contrary, the market share of grocery store meal-kits continues to increase. In the last published figures, 37% of Dutch households had bought a grocery store meal-kit at least once (Distrifood, 2021).

According to Hertz and Halkier (2017), meal-kits cannot be categorised under the four original forms of convenience food, as defined by Brunner, Van der Horst and Siegrist (2010), because they differ in crucial aspects. Because meal-kits, just as the original forms of convenience food, save time in planning and shopping, a new form of convenience food is created. In the new form of convenience food, called convenient food, cooking activities are not eliminated as they are in the original forms of convenience food (Hertz & Halkier, 2017). In addition, because the cooking activities are not eliminated, a meal-kit also has characteristics of traditional cooking. Thus, a meal-kit has aspects of both the original forms of convenience food and traditional cooking (Hertz & Halkier, 2017). In the current study, a distinction is made between the original forms of convenience food and convenient food. The original forms of convenience food are referred to as instant food. The new form of convenience food, called convenient food, will in the current study be referred to as meal-kits. Both instant food and meal-kits are in that aspect categories within convenience food.

Meal-kits are a relatively new form of convenience food (Hertz & Halkier, 2017). Therefore, the environmental effects have not been sufficiently studied (Heard et al., 2019). To date, research has focused primarily on the earlier stages of the supply chain. Research by Heard et al. (2019) shows that meal-kits have lower greenhouse gas emissions than grocery store meals in terms of transport. This while, according to Papargyropoulou et al. (2014), the pursuit of a sustainable consumption approach is one of the components of the first feasible step to reduce food waste throughout the global food supply chain. While research to date has mainly focussed on the earlier stages of the supply chain of meal-kits, research about the later stage of the supply chain of meal-kits lacks in the literature to date. Therefore, looking at the later stage of the

supply chain is important. The later stage of the supply chain is the consumer stage which consists of the consumer buying and cooking the meal-kit.

Regarding the consumer and his cooking process, we know from existing literature that convenience food has a negative influence on food waste compared to other forms of cooking (Buckley et al., 2007). Convenience food is pre-portioned and more likely to be eaten completely, thus reducing food waste (Chandon & Wansink, 2012). However, how within convenience food, instant food and meal-kits differ in their effect on food waste, is not clear from the current literature. Therefore, to contribute to this gap in the literature, in the current study, the effect on food waste of meal-kits compared to instant food is central. Additionally, we know that meal-kits, because they are pre-portioned, lead to less food waste compared to traditional cooking (Heard et al., 2019; Quested et al., 2011). However, because research on the effect of cooking with a meal-kit on food waste compared to traditional cooking is slim, the current study replicates the study of the effect of meal-kits on food waste compared to traditional cooking. Thus, the main effect in the current study is the meal-kit and its effect on food waste in relation to instant food and traditional cooking.

Moreover, to gain new insights into the main effect, new boundary conditions are introduced. The probabilistic W4 model is used which stands for the keywords: 'who', 'where', 'what', and 'when' (Yuan et al., 2013). These keywords can be referred to as boundary conditions. Although the main effect of the current study has already partly been investigated, the boundary conditions 'who', 'where', 'what', and 'when' have not been applied to the main effect in the current literature. The 'who' is associated with the individual that cooks the meal. Of that consumer, the moderator that follows is his individual characteristic cooking skills. The 'where' is connected to the purchasing of the meal. The moderator that follows is the shopping characteristic purchase manner (online vs. physical). The 'what' is the meal. The moderator that follows is the meal's characteristic pre-cut ingredients. The first three keywords can each be linked to the choice factor 'effort' in buying a meal (Jaeger & Mieselman, 2004). The fourth keyword, 'when', is a time aspect and can therefore not be linked to the choice factor effort; only to the choice factor time. To date, much research has considered the choice factor time when it comes to convenience in cooking (Brunner et al., 2010). Therefore, the current study focuses on the choice factor effort. Consequently, the fourth keyword, 'when', is not included in the current study.

The current study will add to existing literature in the following seven ways. First, by examining the effect of meal-kits, compared to instant food, on food waste, the current study contributes to a gap in the literature. Second, by replicating the effect of meal-kits, compared

to traditional cooking, on food waste, the reliability and generalizability of the existing literature is increased. Third, current literature shows that consumers with more cooking skills are more able to estimate correct quantities of food and are better in reusing left-overs (Evans, 2011; Van Doorn, 2016). However, we lack knowledge on the difference in the effect of cooking skills between instant food, meal-kits, and traditional cooking on food waste. Adding the moderator cooking skills will contribute to the academic literature to get a more complete picture of the effect of meal-kits on food waste compared to instant food and traditional cooking. Fourth, Chandon & Wansink (2006) argue that physical shopping causes the stock at home to be mis-estimated, and superfluous food to be purchased. If shopping is done online, the stock at home can be estimated more precisely and food waste could be less. However, Ilyuk (2018) states that buying groceries online leads to a higher intention to throw away purchased food. While shopping online, less regard is given to which products are being bought, as it is just one click, as opposed to shopping physically (Ilyuk, 2018). Research on grocery shopping and its effect on food waste is, next to the papers of Chandon and Wansink (2006) and Ilyuk (2018), limited (Rodrigues et al., 2021). The contradiction in the literature between the papers of Chandon and Wansink (2006) and Ilyuk (2018) is resolved in the current study by adding the variable purchase manner (online vs. physical) as moderator of the main effect. Fifth, for traditional cooking, research has been done on the purchase manner (online vs. physical) and its effect on food waste (Chandon & Wansink, 2006; Ilyuk, 2018). However, research on the difference in effect of purchase manner (online vs. physical) on the three forms of cooking and their relationship with food waste lacks in the current literature. Adding the moderator purchase manner (online vs. physical) will therefore contribute to filling this gap in the literature. Sixth, Yoon et al. (2022) state that pre-cut ingredients lead to less food waste because consumers might not know how to correctly prepare certain vegetables. Additionally, meals in which ingredients are pre-cut are more likely to be eaten completely compared to meals in which ingredients still have to be cut by the consumer (Wansink et al., 2013). Contrastingly, De Laurentiis, Corrado and Sala (2018) state that pre-cut ingredients are more perishable and can therefore contribute more to food waste. The contradiction in the literature between the papers of Yoon et al. (2022), Wansink et al. (2013), and De Laurentiis et al. (2018) is resolved in the current study by adding the variable pre-cut ingredients as moderator of the main effect. Seventh and finally, current literature lacks research into the difference in effect of pre-cut ingredients on food waste between instant food, meal-kits, and traditional cooking. Adding the moderator pre-cut ingredients will fill that gap in the literature.

Based on the arguments above, the following formulated question is central to the current study: *To what extent do meal-kits influence food waste at the consumer level, compared to instant food and traditional cooking, moderated by cooking skills, purchase manner (online vs. physical) and pre-cut ingredients?*

In conclusion, the current study makes a theoretical contribution to the meal-kit literature in several ways. This can serve as a basis for the development of a model to combat food waste. The current study also gives first insights on how the management of grocery stores and meal-kit providers can design advertising strategies. What aspects they should or should not include in their advertising to reduce food waste. By setting up their strategy in the right way, they can convince consumers of the fact that they can prevent food waste themselves. In addition, the Dutch government can use the current study to take measures regarding taxes on specific meals or to impose requirements on grocery stores regarding the minimum variety of specific meals in their establishments.

The current study is structured as follows. In the next chapter, the literature review is set out, in which backgrounds of convenience food, meal-kits, and food waste are discussed. The third chapter includes the framework and conceptual model. In chapter four, the methodological choices that are made during the study are explained. In the fifth chapter, the results of the multiple regression analyses are addressed. Finally, the discussion and suggestions for follow-up research are addressed in chapter six.

2. Literature review

In this chapter, the concepts of the current study are explained in more detail. In 2.1, the literature to date regarding convenience food is elaborated on. Then, in 2.2, the current literature about meal-kits is regarded. Lastly, in 2.3, the literature to date concerning food waste is considered.

2.1 Convenience food

“The term convenience food is subject to diversification, lack of clarity and moral ambiguity” (Hertz & Halkier, 2017, p. 232). Therefore, it is not easy to define convenience (Buckley et al., 2007). Most authors for that reason remain vague about what they mean by convenience food (Candel, 2001; Scholliers, 2015).

In spite of the large amount of academic literature on convenience food, a unanimously agreed upon concept and definition of convenience food lacks in the literature. However, some consensus can be found in the various academic papers. Convenience can refer to the ease in which food can be obtained and the mental effort involved (Brunner et al., 2010; Candel, 2001). Convenience food thereby refers to foods that have been processed outside the home (Charles & Kerr, 1988). For this reason, according to Brunner et al. (2010), convenience food can be divided into four different groups: highly processed food items (e.g., instant pasta), moderately processed food items (e.g., ready bought sandwich), single components (e.g., frozen vegetables), and salads (e.g., green salad ready with sauce). These four different groups are in the current study referred to as instant food. Furthermore, in the current study, the following definition of convenience food is maintained: “food products that help consumers minimise time as well as physical and mental effort required for food preparation, consumption and clean-up” (Brunner et al., 2010, p. 498).

Over the years, academics have found several drivers for consumers to buy convenience foods. Family compositions and roles within the family have changed over the years due to women's labour force participation (Verriet, 2013). Workers who work more than 30 hours a week are more likely to eat convenience food than those who work less than 9 hours a week (Candel, 2001). Consumers experience more time pressure due to a changed lifestyle over the years and thus lower priority for food-related tasks (Buckley et al., 2007; Thyberg & Tonjes, 2016; Wolfson et al., 2016). Consumers also believe that convenience food gives them more value for money and that, by eating convenience food, they can reduce food waste (Buckley et al., 2007). Other, non-consumer related drivers, also play a role in the purchase of convenience

food. One of these drivers is the technologically more advanced kitchen attributes that have been developed, such as microwave ovens (Buckley et al., 2007). The different drivers have over the years contributed to changes in everyday routines. With, amongst others, different family compositions, more time pressure, and enhanced technological abilities in the kitchen, the cooking process changed. With the change in cooking process, products in the food industry evolved. An example of this evolution is convenience food, which is one of the biggest trends in the food business today (Brunner & Siegrist, 2012).

To date, little information is available on the full scope of the environmental impact of the life cycle of convenience food. Studies focus on individual foods or only on a limited number of environmental impacts such as acidification or energy consumption (Rivera, Orias & Azapagic, 2014). Moreover, convenience food is often considered an unsustainable food option due to its wasteful packaging and high dependence on imported products (Jackson & Viehoff, 2016). Convenience food uses resource-intensive ingredients that result in high greenhouse gas emissions (Jackson & Viehoff, 2016). Yet, the literature is not conclusive in determining the environmental impact of convenience food. Research by the independent Institute for Applied Ecology in Germany shows that the emissions of five different frozen products compared to a home-cooked and a refrigerated version of the same products did not yield significant differences in terms of respective carbon footprints (Jackson & Viehoff, 2016).

2.2 Meal-kit

Meal-kits are generally classified as convenience food because they have many similarities to the category convenience food (Hertz & Halkier, 2017). However, Hertz and Halkier (2017) state that classifying the meal-kit into one of the four different convenience food groups (i.e., highly processed food items, moderately processed food items, single components, and salads) as defined by Brunner et al. (2010), is difficult. The main reason for the difficult classification of the meal-kit in one of the groups of convenience food is that the meal-kit has characteristics of several groups (Hertz & Halkier, 2017). Furthermore, the meal-kit also has some characteristics of traditional cooking (Hertz & Halkier, 2017). Based on the four formulated groups of Brunner et al. (2010), Hertz and Halkier (2017) categorise a new form of convenience food called convenient food. In meal-kits, belonging to that new fifth category in convenience food groups, cooking activities are not eliminated in contrast to the other four categories of convenience food (Hertz & Halkier, 2017). Convenient food contains more nutrients by encouraging more varied meals with fresh ingredients.

Meal-kits can be purchased both online and in grocery stores. Meal-kit delivery services offer consumers the opportunity to have meal-kits delivered to their homes (Yoon et al., 2022). A (pre-cut) raw ingredient bundle with a recipe card is then delivered in a box for a complete home-cooked meal (Yoon et al., 2022). According to Hill and Maddock (2019), consumers are stimulated in this way to prepare high-quality meals in their own kitchen without wasting time on shopping. However, as opposed to online purchases, consumers prefer buying meal-kits in grocery stores (Yoon et al., 2022). The purchase of grocery store meal-kits is mainly a one-off purchase. Online bought meal-kits are mainly offered as a monthly subscription (Heard et al., 2019). However, in addition to the monthly subscription, meal-kits can also be bought online as a one-off purchase.

Meal-kits purchased online and delivered to the front door have, on average, lower greenhouse gas emissions than if a consumer were to physically go shopping (Heard et al., 2019). However, Gee et al. (2019) state that the potential energy benefits depend on consumer behaviour. The transport of the consumer to the grocery store plays an important role in energy consumption. The importance of all different aspects when it comes to the environmental impact of online shopping is not conclusively stated in the current literature.

2.3 Food waste

Food production and consumption have negative effects on the environment (Holt, Thompson, & Maltby, 2016). When it comes to the negative effects of food production and consumption, food waste is highly regarded (Janssen et al., 2019). “Food waste refers to excess ingredients that are not used for the prepared meal or subsequent meals, as well as uneaten portions of the meal that are discarded” (Heard et al., 2019, p. 191).

Food waste can be considered one of the greatest global challenges of our time because it has increasing environmental, social, and economic consequences (Block et al., 2016; Papargyropoulou et al., 2014). Globally, there is over-consumption in developed countries while in other countries there are conflicts due to food shortages (Gheorghescu et al., 2019). The world's population continues to grow so there will be an even greater necessity for reducing food waste in a few years' time (Gheorghescu et al., 2019). Reducing food waste is therefore one of the top priorities of the European Union (Do et al., 2021).

In developed countries, households are the guiltiest of food waste compared to the rest of the food supply chain (Janssen et al., 2019; Jörisen, Priefer, & Bräutigam, 2015). Food waste in households occurs through practices in consumers' daily lives that are unconsciously linked to food waste, such as shopping routines (Hebrok & Boks, 2017). With grocery

shopping, a consumer could buy something just because he always does so. If the consumer then already has enough of that product at home, he has to waste food because of his unconscious actions during his shopping routine. Because these practices take place unconsciously, consumers do not realise the motives behind the food they waste in everyday life (Hebrok & Boks, 2017).

Many academics have conducted research on how to prevent food waste. Research by Stefan et al. (2013) suggests that using a (mental) shopping list containing the products needed for a meal reduces food waste. This reduces the likelihood of people making impulsive purchases that lead to more food waste (Stefan et al., 2013). Moreover, by saving the food left over after a meal for a later time, less food is wasted (Aschemann-Witzel et al., 2005). Next to the ways mentioned above in which food waste can be prevented, individual characteristics also play an important role in the relationship between cooking and food waste (Hebrok & Boks, 2017). Van Doorn (2016) states that, with good cooking skills, you can better estimate the right amounts of food needed for a meal. In addition, good cooking skills prevent accidents, such as burning and having to throw away the food (Evans, 2011). However, people often feel insecure about their ability to assess food safety and are risk-averse when it comes to food waste (Van Geffen, Van Herpen & Van Trijp, 2020). Food is then declared unsafe when in fact it is not (Grunert, 2005). Applying labels with data on the products is a possibility to better assess food safety and thus prevent food waste. In addition, consumers can be taught on how to extend the use-by date. For example, people tend to put the temperature on the refrigerator too high (Aschemann-Witzel et al., 2005). As a result, products lose their flavour and spoil faster, making consumers more likely to waste them (Quested et al., 2011). By raising consumer awareness and educating them about this fact, food waste can be prevented. Research by Stefan et al. (2013) and Visschers et al. (2016) concludes that age is another individual characteristic that influences food waste. Young people are more likely to waste food compared to older people (Stefan et al., 2013; Visschers et al., 2016). Furthermore, the individual characteristic gender influences food waste too. Men tend to waste more food than women (Visschers et al., 2016). Moreover, Parfitt et al. (2010) conclude that households with children, depending on age, on average waste more food than households without children. Lastly, a lower level of education leads to a lower amount of food wasted (Secondi, Principato & Laureti, 2015).

Next to individual characteristics, there are other factors that play a role in the degree of food waste. Factors over which the consumer has less influence. In some cases, the desired portion size of a product does not exist, and the consumer has to buy a larger portion than necessary (Van Geffen et al., 2020). The geographical density of grocery stores in combination

with their opening hours also plays a role when it comes to food waste. Households that live at a greater distance from the grocery store, and/or have less time available during opening hours to go to the grocery store, waste more food (Evans, 2011; Van Geffen et al., 2020). These households have to buy larger quantities of groceries at a time, which increases the risk of overestimating the amount of food they consume and thus increases the risk of throwing away superfluous food (Evans, 2011). So, if changes would be initiated regarding portions, grocery store density and opening hours, food waste could be reduced.

3. Framework and conceptual model

In this chapter, the framework and the conceptual model of the current study are elaborated on. First, in 3.1, the conceptual model is explained. Then, in 3.2, the effect of cooking with a meal-kit on food waste, compared to instant food and traditional cooking is addressed, and the hypotheses are stated. In 3.3, the first moderator cooking skills is regarded, and the hypotheses about cooking skills are stated. After that, in 3.4, the second moderator purchase manner (online vs. physical) is explained and the hypotheses regarding purchase manner are stated. The third and final moderator pre-cut ingredients is elaborated on in 3.5 and the hypotheses about pre-cut ingredients are formulated. Lastly, in 3.6, the control variables are addressed.

3.1 Conceptual model

The current study investigates the relationship of cooking with a meal-kit, compared to instant food and traditional cooking, on food waste.

In the current study, a distinction is made between convenience food and traditional cooking. Within the category of convenience food, two forms of cooking exist: instant food and meal-kit. Here, instant food is the original form of convenience food as defined by Brunner et al. (2010). Meal-kit is the new form of convenience food called convenient food (Hertz & Halkier, 2017). Within the category of traditional cooking, only traditional cooking exists as a form of cooking. Traditional cooking here is defined as a meal cooked from scratch (Moisio, Arnould & Price, 2004). The three forms of cooking are distinguished based on the degree of convenience. Instant food is the easiest and the most convenient to prepare. This is followed by meal-kits in which cooking activity is not fully eliminated. Traditional cooking can be seen as the least similar to instant food on the meal's spectrum. With traditional cooking, all ingredients are bought separately, and it is least convenient to prepare. How the three different cooking forms relate to each other regarding the degree of convenience can be seen in Figure 1.

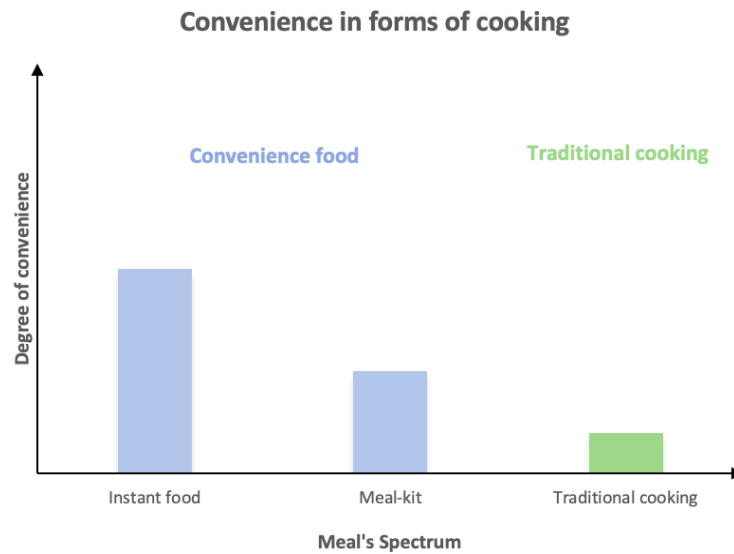


Figure 1: Degree of Convenience on the Meal's Spectrum

Regarding the degree of convenience of cooking, the concept of convenience must first be elaborated on. One aspect of convenience is saving time (Brunner et al., 2010). Brunner et al. (2010) furthermore state that, next to saving time, minimising physical and mental effort associated with planning and preparing meals, is recognized to be a part of convenience in cooking. Convenience in food is also central in the paper of Jaeger and Mieselman (2004). In their study, Jaeger and Mieselman (2004) regard food-related convenience by looking at each stage of the meal preparation process. One stage Jaeger and Mieselman (2004) particularly focus on is the purchase of ingredients for a meal. Their study revealed that the two most important choice factors when it comes to purchasing meals, are time (i.e., length of cooking time and preparation time) and effort (i.e., planning, purchasing, preparation, consuming, and cleaning). Wales (2009) also states that the factors time and effort are important perceptions of the degree of convenience. Because Brunner et al. (2010) consider the time factor in cooking convenience, the current study focuses on effort to base its moderators on. That is, the moderators on the difference in effect between instant food, meal-kits, and traditional cooking on food waste.

To choose the moderators, the probabilistic model W4 as proposed by Yuan et al. (2013), is used. In the W4 model, keywords 'who', 'what', 'when', and 'where' are central to model consumer's behaviour (Yuan et al., 2013). In the current study, the papers of Brunner et al. (2010), Jaeger and Mieselman (2004), and Wales (2009) are combined with the paper of Yuan et al. (2013). In combining these four papers, the keywords, 'who', 'what', and 'where' can be classified as aspects of effort, whereas 'when' classifies as a time aspect. Effort consists

here of planning, purchasing, preparation, consuming, and cleaning (Jaeger & Mieselman, 2004).

In the context of the current study, ‘who’ is the consumer. An individual characteristic that is part of that consumer are his cooking skills. In connecting the ‘who’ to the choice factor effort, cooking skills are linked to the preparation part of effort. Thus, the individual characteristic cooking skills is the first moderator. The ‘where’ is the purchase manner. Purchase manner here distinguishes between online and physical. In connecting the ‘where’ to the choice factor effort, purchase manner (online vs. physical) is linked to the purchasing part of effort. So, the shopping characteristic purchase manner (online vs. physical) is the second moderator. In the current study, the ‘what’ is the meal. A meal characteristic that is linked to the effort of preparation, is pre-cut ingredients. If ingredients are pre-cut, less preparation effort is asked of the consumer when cooking a meal. In connecting the ‘what’ to the choice factor effort, pre-cut ingredients are linked to the preparation part of effort. Consequently, the meal characteristic pre-cut ingredients is the third and final moderator. Summarising, the chosen moderators are the individual characteristic cooking skills, the shopping characteristic purchase manner (online vs. physical), and the meal characteristic pre-cut ingredients. A combination of the choice factor effort and the W4 model that models consumer’s behaviour, is expected to lead to moderators that influence the relationship between the type of meal and their effect on food waste.

Based on the variables above, the following conceptual model in Figure 2 is constructed.

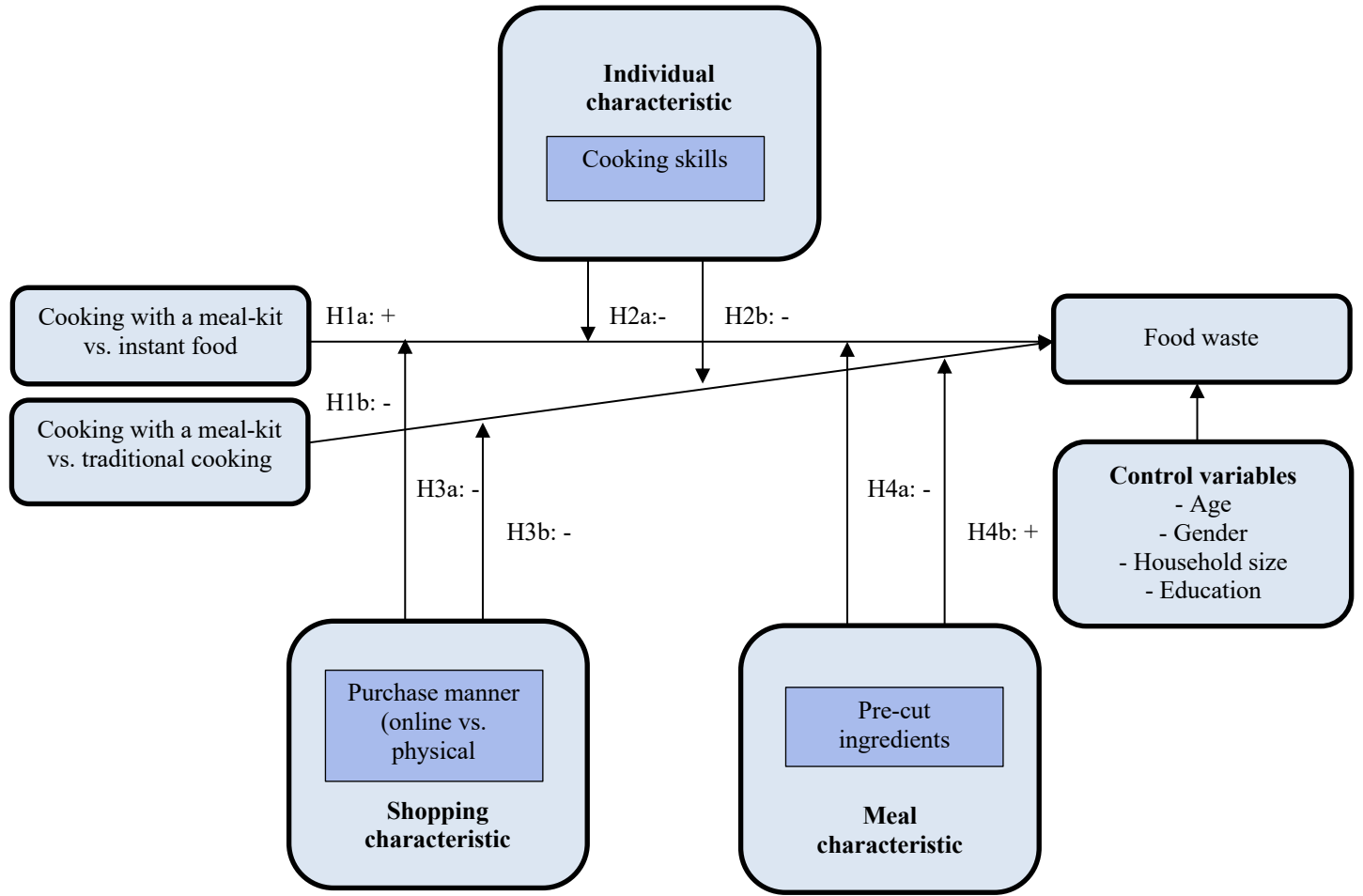


Figure 2: Conceptual Model

3.2 Effect of cooking with a meal-kit on food waste

In the current study, it is argued that the use of instant food and meal-kits reduces food waste compared to traditional cooking. Convenience food (i.e., instant food and meal-kits) consists of pre-portioned meals. Pre-portioned meals prevent food waste better than non-pre-portioned meals (Heard et al., 2019). In addition, convenience food, compared to non-pre-portioned food, is more often eaten completely (Chandon & Wansink, 2012). Because eating convenience food takes less effort, there is more motivation to eat the entire meal. If more is consumed, less food is wasted, and food waste is reduced. Additionally, households trying to reduce food waste are more likely to use convenience foods to reduce wastage of ingredients (Buckley et al., 2007).

A meal-kit consists of more different products than instant food. In that aspect, the meal-kit is less pre-portioned, and it requires more effort to consume than instant food. Given that pre-portioned meals prevent food waste better than non-pre-portioned meals, meal-kits do not

prevent food waste as well as instant food. Based on these arguments, the following hypothesis is proposed:

H1a: *Cooking with a meal-kit leads to higher food waste than instant food.*

According to research by Heard et al. (2019), cooking with a meal-kit results in several environmental benefits compared to traditional cooking. Not only are emissions reduced during transport, but food waste is also reduced. The explanation that is given for this is that, compared to traditional cooking, the meals are already pre-portioned. Additionally, in general, Quested et al. (2011) state that packages containing just the right amounts of food, like in meal-kits, minimise food waste. From the arguments above, it can be stated that cooking with a meal-kit, which is more pre-portioned than a meal that is cooked traditionally, prevents food waste better than traditional cooking. Based on these arguments, the following hypothesis is proposed:

H1b: *Cooking with a meal-kit leads to lower food waste than traditional cooking.*

In the literature to date, no research has been done into individual, shopping, and meal characteristics and their influence on the relationship between cooking manner and food waste. These three moderators, resulting from the boundary conditions ‘who’, ‘where’, and ‘what’ of Yuan et. al (2013), are explained in the next paragraphs.

3.3 Cooking skills

People with less cooking skills are less able to estimate the correct quantities for a meal (Van Doorn, 2016). If the wrong quantities of food are estimated, food may be wasted (Evans, 2011). In addition, people with less cooking skills are also less able to create a new meal from leftovers (Evans, 2011). Therefore, in the current study, cooking skills of a consumer are used to represent how well he can estimate the right amounts of food needed for a meal and how well he can reuse the leftovers.

When eating instant food, cooking skills play little or no role in the cooking process (Brunner et al., 2010). The preparation of instant food often consists of only a single action such as warming up the meal. Moreover, the products needed for instant food are often just one or two products that are already prepared or ready-to-eat. Cooking skills will therefore have little or no influence on food waste when eating instant food. However, cooking skills do affect food waste when eating a meal-kit. When cooking with a meal-kit, more actions are needed from the consumer to create the meal. He needs to buy more different products and estimate their quantities in preparation for the meal. The more capable the consumer is in doing so, the

less food will be wasted. Because traditional cooking consists of even more different products than a meal-kit, the effect of cooking skills on food waste will be strongest in traditional cooking. In the current study, the difference in effect of instant food, meal-kits, and traditional cooking on food waste is central. Since the effect of cooking skills on food waste gets greater as the meal gets more complicated to prepare, cooking skills moderate the main effect. That is, the difference in effect of the forms of cooking gets smaller if cooking skills get higher. Thus, cooking skills weaken the main effect. Based on these arguments, the following hypotheses are proposed:

H2a: *Higher cooking skills weaken the difference in effect of cooking with a meal-kit and instant food on food waste.*

H2b: *Higher cooking skills weaken the difference in effect of cooking with a meal-kit and traditional cooking on food waste.*

3.4 Purchase manner (online vs. physical)

Today, food products can be purchased both online and physically (Yoon et al., 2022). One of the main differences between online and physical purchasing of meals is that a consumer can check what he still has in stock. If a consumer physically goes to the grocery store, there is a chance of misjudging the stock at home and therefore buying more food than is needed (Chandon & Wansink, 2006). However, regarding groceries in general, Ilyuk (2018) finds that buying groceries online, as opposed to physically shopping, leads to higher intentions of discarding purchased food items. Next to the papers of Chandon and Wansink (2006) and Ilyuk (2018), research on food waste when it comes to the purchase manner (online vs. physical) is very limited (Rodrigues et al., 2021).

When buying groceries online, it is easy for consumers to check whether they still have certain products in stock. If a smaller number of different products is needed for a meal, a consumer will therefore experience less benefit in terms of food waste from buying his meal online. Cooking instant food does not require a large variety of groceries. As mentioned before, with instant food, only one or two different products are needed for the meal. The effect of purchase manner (online vs. physical) on food waste will therefore be little for instant food. In the case of a meal-kit, individual products may need to be purchased in addition to the meal-kit to make the meal. The effect of purchase manner (online vs. physical) on food waste will therefore be stronger for meal-kits than it will be for instant food. With traditional cooking, the majority of purchased products will be different. Checking which products are in storage is therefore the most beneficial for traditional cooking. Additionally, when a consumer physically

goes to the grocery store, he runs the risk of making impulse purchases (Porpino et al., 2015). However, Ilyuk (2018) states that while shopping online, less regard is given to which products are being bought as opposed to shopping physically, which can also lead to impulse purchases. Impulse purchases lead to food waste because they are often unnecessary. Furthermore, ordering online in advance does entail the risk that consumers may not be in the mood for the specific meal on the day of delivery. If the consumer does not eat that specific meal, he eats something else on the day of delivery which he reports in the food waste diary. The bought products that are not eaten are not regarded in the food waste diary. Therefore, this form of food waste is not included in the current study.

Summarising, the purchase manner (online vs. physical) has the least influence on food waste for instant food. It has more influence on food waste for a meal-kit and the most influence on food waste for traditional cooking. Since the effect of purchase manner online on food waste gets greater as the meal gets more complicated to prepare, purchase manner (online vs. physical) moderates the main effect. That is, the difference in effect of forms of cooking on food waste gets smaller if purchase manner is online. Thus, purchase manner online weakens the main effect. Based on these arguments, the following hypotheses are proposed:

H3a: *Purchase manner online weakens the difference in effect of cooking with a meal-kit and instant food on food waste.*

H3b: *Purchase manner online weakens the difference in effect of cooking with a meal-kit and traditional cooking on food waste.*

3.5 Pre-cut ingredients

There are different types of meal-kits available. There are meal-kits in which the contents like vegetables are just bundled together in a box, but there are also meal-kits in which the contents are already pre-cut. Consumers prefer buying a meal-kit with pre-cut ingredients (Yoon et al., 2022). Meals in which ingredients are pre-cut are more likely to be eaten completely compared to meals in which ingredients still have to be cut by the consumer (Wansink et al., 2013). In addition, shops only sell products with the right appearance, weight, size, and shape, causing farmers to waste large parts of their harvest (Gustavsson, 2011). If there are pre-cut ingredients in a meal, the less perfect vegetables, for example, could also be processed in the product. On the contrary, pre-cut ingredients are generally more perishable and may therefore contribute more to food waste (De Laurentiis et al., 2018). So, pre-cut ingredients have an influence on food waste. If the ingredients are not pre-cut, unnecessary parts of the products will be thrown away because some consumers simply do not know how to prepare these products (Yoon et al.,

2022). Thus, when it comes to meal-kits, cooking with a meal-kit with pre-cut ingredients leads to less food waste than cooking with a meal-kit in which ingredients are not pre-cut. In the set-up of the current study, it is not possible for the respondent to use pre-cut ingredients when he cooks instant food or traditionally. As explained in the definitions in the food waste diary (Appendix II), only the meal-kit can have pre-cut ingredients. The choice to exclude the option of pre-cut ingredients for instant food is made because none of the four forms of instant food can contain pre-cut ingredients (Brunner et al., 2010). Additionally, in the current study, traditional cooking is defined as cooking a meal from scratch (Moisio et al., 2004). Thus, also for traditional cooking, no pre-cut ingredients can be used.

Pre-cut ingredients in a meal-kit imply a smaller difference between instant food and meal-kits and a bigger difference between meal-kits and traditional cooking. A smaller difference between instant food and meal-kits implies a smaller difference in their effect on food waste. That is, the difference in effect of meal-kits and instant food on food waste is weakened when the meal-kit has pre-cut ingredients. Moreover, a bigger difference between meal-kits and traditional cooking implies a bigger difference in the effect on food waste. Thus, the difference in effect of meal-kits and traditional cooking on food waste is strengthened when the meal-kit has pre-cut ingredients. Based on these arguments, the following hypotheses are proposed:

H4a: *Pre-cut ingredients weaken the difference in effect of cooking with a meal-kit and instant food on food waste.*

H4b: *Pre-cut ingredients strengthen the difference in effect of cooking with a meal-kit and traditional cooking on food waste.*

3.6 Control variables

To control for other factors that may influence food waste, several control variables are added. Age is added as a control variable because young people are more likely to produce more food waste than older people (Stefan et al., 2013; Visschers et al., 2016). Gender is also controlled for as men tend to waste more food than women (Visschers et al., 2016). Moreover, household size is added as a control variable because households with children on average waste more food than households without children (Parfitt et al., 2010). Finally, education is controlled for as a lower level of education leads to a lower amount of wasted food (Secondi et al., 2015).

4. Methodology

In this chapter, the methodological choices made during the research are explained. First, the research design is explained in 4.1. Then, in 4.2 the sampling design is addressed. After that, in 4.3, the operationalization is elaborated on. In 4.4 the pre-test is explained, after which the data analysis strategy is addressed in 4.5. Finally, how the ethical requirements for the research are met, is described in 4.6.

4.1 Research design

The aim of the study is to investigate the difference in effect of cooking with a meal-kit, instant food, and traditional cooking on food waste. A quantitative research approach is chosen because the collected data is numerical in nature (Field, 2018). For the study, respondents keep a food waste diary for a period of seven days. In a food waste diary, the respondent can keep track of how much food they waste (Williams et al., 2012). By using a food waste diary, one can get closer to the actual food waste than by using a questionnaire (Giordano, Alboni & Falasconi, 2019). This is because the intensity of the reporting method is higher in a food waste diary than in a questionnaire. The average value of food waste is significantly higher when data is collected through diaries while a questionnaire catches less than one-third of food waste determinants (Giordano et al., 2019). The food waste diary method of data collection has previously been successfully consulted in a study by Williams et al. (2012) on food waste in households.

4.2 Sampling design

For respondents to participate in the study, they must meet the following four requirements. First, it is important that a respondent has cooked with a meal-kit before. If people have never cooked with a meal-kit, this can lead to confusion and bias in the data, which could reduce the validity. Second, respondents participating in the study must cook instant food at least once, at least once with a meal-kit, and at least once traditionally during the measurement week. By setting this requirement, there is no longer a natural experiment where pure behaviour is measured. However, collecting enough data in all three cooking ways is more important than maintaining a natural experiment in which pure behaviour is measured. Third, the respondent must be at least 18 years old because from this age onwards, people are able to take responsibility for preparing a meal themselves. Fourth and last, since the food waste diary is in Dutch, the respondent must speak Dutch sufficiently to understand the questions. Next to these

four requirements, respondents do not have to meet any other thresholds or requirements to participate in the current study.

Before the respondents start the food waste diary, they are given a short introduction to food waste. It is important for the reliability of the food waste diary that respondents are informed about what is covered by food waste in the food waste diary (Van Herpen et al., 2019). However, this advance notice also has disadvantages. Respondents may adapt their food-wasting behaviour, even when they are explicitly asked not to do so (Van Herpen et al., 2019). To minimise the chances of behavioural change, the preliminary announcement by Van Herpen et al. (2019) is included in the introduction.

In the current study, a convenience sample is chosen as the method of selecting participants. A convenience sample is a form of selective sampling. In a selective sample, not every member of the population has an equal chance of ending up in the sample (Vennix, 2016). First, a selective sample is chosen because the results of the current study do not need to be generalised to the entire population. Second, a selective sample is chosen because there is insufficient time available for the current study to draw a random sample.

The food waste diary is distributed through the researchers' own network. The choice is made to distribute the food waste diary online because it offers several appropriate advantages for the research, such as low costs and access to a wider audience (Wright, 2005). Another advantage of online distribution is that the anonymity of the respondent can be guaranteed. Because the subject focuses on both amoral and personal behaviour, respondents are more likely to react reluctantly or give socially desirable answers if anonymity is not guaranteed. However, socially desirable answers cannot completely be excluded in the current study. As a result, a slightly distorted picture may be created, which will reduce validity and reliability. It is therefore important to consider the consequences in terms of validity and reliability when drawing conclusions.

Based on previous research with a food waste diary by Williams et al. (2012), it is argued in the current study that a sample size of minimum 30 respondents is found to be sufficient. In the study by Williams et al. (2012), there were 61 households that completed a food waste diary about food waste, divided into two groups. In the study by Mueller-Sierlin et al. (2021), which also uses a food diary, feasible, acceptable, and preliminary valid results are obtained from 63 respondents divided into two groups. In the current study, the respondents can fall into all three cooking categories as there are several measuring moments per respondent. Therefore, there is just one group of respondents in the current study. The choice is made to have seven measuring moments per respondent. This choice is made because

Williams et al. (2012) indicate in their research that it is difficult to motivate people to keep track of their food waste for longer than seven days if they do not care about it anyway. These measurement points need not be consecutive given that not all dining options, such as eating out, were included in the study. In the study by Williams et al. (2012), respondents were given a period of two months to complete the food waste diary. Given the limited time for the current study, respondents are given a two-week time frame (from week 17 to week 18). In these two weeks, the participants can decide for themselves which days will be chosen as measuring days.

4.3 Operationalization

Before the respondents start the food waste diary, there will, as already mentioned, be a preliminary announcement about food waste to avoid any misconceptions. Food waste includes all food bought for dinner during the measurement week that has expired, is wasted, or thrown on the compost pile. Unavoidable waste, as defined by Williams et al. (2013), such as bones, peelings, and food given to pets is not categorised as food waste in the current study. Also, food that gets frozen is not included in the current study as food waste. In the preliminary announcement, the email addresses and telephone numbers of the researchers will be listed in case respondents have questions. In addition, respondents will be able to request the results of the study. After the preliminary announcement, the first thing to follow will be the questions that need to be answered only once. After that, the food waste diary will contain the questions that need to be answered on each measuring day. Finally, the respondents will be warmly thanked for their participation.

For the operationalisation, the choice is made to take the scales from prior research where possible (Appendix I). By taking scales from prior research, validity and reliability are secured (Vennix, 2016). Where possible, scales with a Cronbach's Alpha higher than .8 are used because this indicates a high degree of reliability (Field, 2018).

The food waste diary also contains questions for the research of a colleague. The questions of that colleague are not relevant to the current study and are therefore not included in the analysis. The research of my colleague focuses only on grocery store meal-kits, whereas in the current study, both forms of meal-kits are included (i.e., online and physically bought). Thus, for the study of my colleague, a distinction is made in the food waste diary between grocery store meal-kits and delivery meal-kits. For the analysis in the current study, both forms of meal-kits are combined and treated as one answer option: meal-kit.

The food waste diary was conducted in Dutch because the target group of respondents speaks Dutch. The questions are taken from English-language literature, so back translation is used to guarantee validity.

The food waste diary, including the preliminary announcement, can be found in Appendix II.

Food waste

In the current study, food waste is measured by perceived food waste. Measuring food waste by perceived food waste is done because it is difficult to measure the exact amount of food waste. Previous studies by Stefan et al. (2013) and Stancu, Haugaard and Lähteenmäki (2016) have shown that perceived food waste can be used to give an indication of consumer food waste behaviour. Perceived food waste can be measured by the percentage of the entire meal (Stancu et al., 2016; Stefan et al., 2013). In this item, the percentage is then linked to a 5-point scale. The values for food waste are as follows: 1) 'not at all', 2) 'less than a tenth', 3) 'more than a tenth but less than a quarter', 4) 'more than a quarter but less than a half', and 5) 'more than a half'. Given that not all households have kitchen scales, and that respondents are more likely to fill in a scale than to weigh the leftover food every day, this 5-point scale is a good way of measuring the respondent's perceived food waste.

The scale used by Stefan et al. (2013) for measuring perceived food waste is ordinal in nature. However, the dependent variable in a multiple regression analysis should be an interval or ratio measurement level in nature (Field, 2018). For this reason, perceived food waste is considered a continuous variable.

Cooking manner

Cooking manner is measured by means of a categorical variable. Respondents are asked which of the four main ways they use for cooking that evening (i.e., traditional cooking, meal-kit via a delivery service, grocery store meal-kit, instant food). As the cooking method may vary from one measurement day to another, the respondent is asked to fill out his cooking method every day of the food waste diary. If a consumer adds ingredients to instant food or a meal-kit, they still have to fill out the main cooking method as instant food or meal-kit, respectively. Then comes the question of whether the meal was purchased online or physically in a grocery store. If the answer to this question is 'grocery store meal-kit' or 'meal-kit via a delivery service' a follow-up question is proposed that deals with the meal characteristic 'pre-cut ingredients'.

Cooking skills

The first moderator is cooking skills. Hartmann et al. (2013) measure this variable using 7 items on a 6-point Likert scale. The respondent is asked to rate his own cooking skills. In the current study, the 6-point Likert scale is converted to a 7-point Likert scale because in this way, the scale is closer to the objective reality of the respondent (Joshi et al., 2015). The 7-point Likert scale is ranging from 1 = do not agree at all to 7 = totally agree. The scale Joshi et al. (2015) constructed is based on the items from Brunner et al. (2010) and Van der Horst, Brunner and Siegrist (2011) with the addition of their own corresponding cooking skills items. In the study by Hartmann et al. (2013), two additional cooking skills items were added because the preparation of special foods or meals can vary greatly depending on the cultural context and could therefore influence the assessment of cooking skills. The Cronbach's alpha is sufficient ($\alpha = .91$) from the study by Hartmann et al. (2013). This question is asked once, at the beginning of the food waste diary.

Purchase manner (online vs. physical)

The second moderator is purchase manner (online vs. physical). This moderator represents the way in which groceries needed for a meal are bought. This can be for instant food as well as for cooking with a meal-kit, and traditional cooking. Purchase manner can either be online, via the internet, or physical, in a grocery store. In the current study, the time of purchase of a meal (e.g., a few days before or on the day of consuming) is not regarded. That is, no distinction is made between the times of purchase of a meal. Yoon et al. (2022) measure this variable using one item with the following two answer options 'purchase at the grocery store' and 'purchase online'. Since the question has two answer options, the variable is made into a dummy variable in the current study: 0 = purchase online and 1 = purchase at the grocery store. The respondent has to fill in this question every day of the food waste diary.

Pre-cut ingredients

The third moderator is pre-cut ingredients. Yoon et al. (2022) measure pre-cut ingredients using one item with the following two answer options 'preparation effort high' and 'preparation effort low'. Respondents were informed in the study of Yoon et al. (2022) that 'low' meant that ingredients were pre-cut, while 'high' meant more time and effort spent on cutting and chopping. In the current study, respondents are given the same information with the question, as the same variable is measured as in the study by Yoon et al (2022). Since the question has two options, the variable is made into a dummy variable in the current study: 0 = preparation effort high and

1 = preparation effort low. The respondent has to fill in this question every time he has filled in 'grocery store meal-kit' or 'meal-kit via a delivery service' for the way of cooking.

4.4 Pre-test

To increase validity, four consumers that were not in the research sample have given feedback on the food waste diary. These test persons were asked to pay particular attention to the interpretability of the questions. Based on the feedback, a different background was chosen for the questionnaire to increase the contrast between background and text. In addition, extra explanations have been added to clarify what the measuring days mean. Furthermore, some grammatical adjustments have been made.

4.5 Data analysis strategy

First, the empirical data will be retrieved from Qualtrics, after which an analysis will be carried out using the IBM SPSS Statistics 28.0.1.0. (SPSS) statistical program. Multiple regression analysis is used to analyse the collected data. Multiple regression analysis is used to test whether multiple independent variables influence a dependent variable (Field, 2018). Given that this analysis cannot include categorical variables (Field, 2018), dummy variables of the variables cooking manner, purchase manner (online vs. physical), pre-cut ingredients, gender, household size, and education were created. The remaining variables are metric in nature as the dependent variable food waste is considered a continuous variable and the independent variable cooking skills is measured on a 7-point scale. The reason for applying multiple regression analysis in the current study is to be able to determine whether food waste can be predicted when cooking with a meal-kit, compared to cooking instant food or traditionally. The equation below represents the estimated model for food waste.

$$\begin{aligned}
Food\ waste_{it} = & \beta_0 + \beta_1 Instant\ Food_{it} + \beta_2 Traditional\ cooking_{it} + \beta_3 Cooking\ Skill_i \\
& + \beta_4 Purchase\ Manner\ (physical)_{it} + \beta_5 Pre - Cut\ Ingredients_{it} \\
& + \beta_6 Cooking\ Skills * Instant\ Food_{it} + \beta_7 Cooking\ Skills \\
& * Traditional\ Cooking_{it} + \beta_8 Purchase\ Manner\ (physical) \\
& * Instant\ Food_{it} + \beta_9 Age_i + \beta_{10} Gender\ (male)_i \\
& + \beta_{11} Household\ Size\ (2\ persons)_i + \beta_{12} Household\ Size\ (3\ persons)_i \\
& + \beta_{13} Household\ Size\ (4\ persons\ +)_i \\
& + \beta_{14} Education\ Level\ (Intermediate\ Vocational\ Education)_i \\
& + \beta_{15} Educational\ Level\ (Higher\ Vocational\ Education)_i \\
& + \beta_{16} Educational\ Level\ (Bachelor's,\ university)_i \\
& + \beta_{17} Educational\ Level\ (Master's,\ university)_i \\
& + \beta_{18} Educational\ Level\ (Doctorate\ degree,\ university)_i + \epsilon_{it}
\end{aligned}$$

4.6 Research ethics

The data in this study will be collected in an ethical manner. Before people participate, the purpose and subject of the study will be clearly stated in the introduction to ensure the transparency of the study. However, the introduction will consider that too much information about food-wasting behaviour can change the regular behaviour of consumers (Van Herpen et al., 2019). In addition, the anonymity of the respondents is guaranteed by not collecting identifiable data. Afterwards, it is impossible to find out which person belongs to which food waste diary. Moreover, participation in the study is completely voluntary. Respondents can stop at any time during the period that they keep the food waste diary. Furthermore, the data collected will only be used for research purposes and will not be made available to people not directly connected with the study. Finally, the APA guidelines will be used in the study to respect the copyrights of other authors when referenced.

5. Results

This chapter discusses the results of the analysis that is conducted based on the hypotheses set out in chapter three. First, in 5.1, the sample design is discussed. In 5.2, the multiple regression analysis is discussed, including assumptions and model fit.

5.1 Sample design

In the current study, a total of 65 respondents started the food waste diary. 23 Respondents started the food waste diary without completing it. These 23 respondents dropped out before filling in the seventh day of the food waste diary. Because the respondents were all in the personal circle of the researchers, knowledge was available about the way some of the respondents filled in the food waste diary. One issue was the fact that there were respondents who had completed the first day(s) of the food waste diary in incognito mode on the internet. When incognito mode is switched on, the browser does not remember previous activity in its cookies. Therefore, if a respondent fills in the first day of the food waste diary while the browser is in incognito mode, the browser does not remember that. When that same respondent then tries to fill in the second day, the browser does not remember the respondent and the food waste diary registers him as a new respondent. The respondent then has to start the food waste diary again. This leads to the same respondent being in the dataset twice. To avoid the same respondents being in the dataset twice, all unfinished questionnaires were deleted. In addition, some remarkable activity was registered concerning the five multiple-choice questions regarding time that the respondent had on the day of the food waste diary. One respondent filled in the first option of the five multiple-choice questions every day from measurement day five onwards. Since some of those five questions (Appendix II) should give opposing answers, an indication is given that the respondent did not correctly fill out the last three days of the diary. Therefore, that respondent was also dropped. Furthermore, to collect enough data in all three cooking ways, every respondent was asked to cook instant food at least once, at least once with a meal-kit, and at least once traditionally. For the final sample, the choice was made to remove all five respondents that did not meet the requirement of cooking in each of the three cooking manners at least once. The final sample consisted of 36 respondents who together completed a total of 252 reported days of food waste.

The descriptive statistics show that 5 men (14%) and 31 women (86%) participated in the study, the majority of whom live in two to three-person households. More than 50% of the respondents are aged 25 years or younger. In addition, 50.1% of the people indicated university

as their most senior education. These high percentages in women, people in their early twenties, and people with university education can be attributed to the fact that the food waste diary was distributed within the network of the researchers. Furthermore, the mean in food waste of 1.740 can be explained by the fact that the fourth category was between 25% and 50% food waste. Very few observations had food waste in the 25% to 50% category. Most observations had no food waste, less than 10%, or between 10% and 25%.

Table 1 shows the descriptive statistics for all the variables.

	N	Minimum	Maximum	Mean	Std. Deviation
Food waste	252	1	4	1.740	0.814
Traditional cooking	252	0	1	0.564	0.497
Meal-kit	252	0	1	0.206	0.405
Instant food	252	0	1	0.230	0.422
Cooking skills	252	4.17	7.00	5.741	0.688
Purchase manner (physical)	252	0	1	0.920	0.270
Pre-cut ingredients	252	0	1	0.052	0.222
Age	252	20	86	33.390	16.383
Gender (male)	252	0	1	0.140	0.347
Household size (1 person)	252	0	1	0.194	0.397
Household size (2 persons)	252	0	1	0.361	0.481
Household size (3 persons)	252	0	1	0.278	0.449

Household size (4+ persons)	252	0	1	0.167	0.373
Education level (Elementary and Secondary School)	252	0	1	0.056	0.230
Education level (Intermediate Vocational Education)	252	0	1	0.222	0.417
Education level (Higher Vocational Education)	252	0	1	0.222	0.417
Education level (Bachelor's degree, University)	252	0	1	0.167	0.373
Education level (Master's degree, University)	252	0	1	0.306	0.462
Education level (Doctorate degree, University)	252	0	1	0.028	0.165

Table 1: Descriptive Statistics

5.2 Multiple regression analysis

5.2.1 Reliability analysis

To test the assumptions and hypotheses, it is important to assess the internal consistency of the item cooking skills first. Internal consistency is an assessment of whether the variable, or a set of variables, is consistent with what it intends to measure (Hair et al., 2019). The lower limit for an acceptable value of the Cronbach's alpha is .70 (Hair et al., 2019). Cooking skills has a Cronbach's alpha of .728 (Appendix III, table 3) allowing the analysis to continue with internal consistency of cooking skills being covered.

5.2.2 Assumptions & model fit

Before performing a multiple regression analysis, the variable cooking skills must first be re-coded. The variable cooking skills is measured on a 7-point Likert scale. To reduce the multicollinearity risk between single correlations and coefficients, this variable is re-coded (Field, 2018). In addition to re-coding, five assumptions need to be tested (Field, 2018). The assumptions of linearity, homoscedasticity, independence of error terms, no multicollinearity, and multivariate normality are addressed.

First, the assumptions of linearity and constant variance of the residuals (homoscedasticity) are tested using a scatterplot of the residuals (Hair et al., 2019). The scatterplot shows that the residuals are randomly and evenly distributed (Appendix III, figure 3). The error terms are not significantly higher or lower for certain values of the predicted dependent variable. So, the scatterplot shows no clear pattern in terms of nonlinearity or heteroskedasticity. Thus, the first two assumptions are met.

Second, the assumption that the error terms are independent of each other is tested using the Durbin-Watson test (Field, 2018). The Durbin-Watson statistic value in the current study is 2.013 (Appendix III, table 4), which is within the acceptable range of 1.5 to 2.5 (Field, 2018). It can be concluded that, based on this statistic, the observations are independent of each other. However, since for each respondent, the current study has seven observations, it can intuitively be argued that the observations are not in reality independent. The third assumption is therefore solely statistically met.

Third, the assumption that none of the predictor variables are highly correlated with each other is checked. The VIF-score should be below 10 (Hair et al., 2019). In the current study the VIF-scores are all below 10 so the predictor variables are not highly correlated with each other (Appendix III, table 5). Next to the VIF scores, a correlation table is added to check for individual correlations between variables (Appendix III, table 6). None of the variables are highly correlated with each other, that is, in absolute terms higher than 0.7 (Hair et al., 2019). Thus, the assumption of no multicollinearity is met.

Fourth, the assumption of normally distributed residuals of the model is checked (Field, 2018; Hair et al., 2019). This is done by plotting a histogram of the residuals (Appendix III, figure 4). According to that plot, the distribution of the residuals is a little right skewed. However, since the skewness is not staggering, the influence of it on the reliability, model fit, and stability of the model is not great. To investigate the normality further, a P-P plot of the residuals is created (Appendix III, figure 5). The P-P plot also indicates that, given the increasing straight diagonal line, the assumption of normality is met. From this P-P plot, it can also be concluded that no significant outliers are present in the data. Lastly, the Kolmogorov-Smirnov's and the Shapiro-Wilk's test statistics are calculated. They are equal to 0.291 (<0.001) and 0.789 (<0.001), respectively. With a p-value of 5%, the null-hypothesis of normality of the dependent variable is rejected.

The R-squared for the model is equal to 0.201. With 20.1% of the variance in the dependent variable being explained by the independent variables, the model does not score high in terms of explanation power (Hair et al., 2019). Furthermore, the F-test statistic is equal to

3.064 (<0.001). With a p-value of 5%, the F-test statistic is significant here. That is, the null hypothesis of the F-test, that all estimated coefficients are equal to zero, is rejected.

5.2.3 Statistical results

As the current study is about meal-kits, in the estimation of the model, that form of cooking is the baseline. The estimated coefficients for the variables in the model in the current study are given in Table 2. In contrast to H1a, no effect is found for instant food on food waste as opposed to meal-kits. Cooking with a meal-kit does not lead to higher food waste than cooking instant food. In line with H1b, traditional cooking has a significant positive effect on food waste as opposed to meal-kits ($\beta = 2.679$, $p < .05$). When the cooking method is traditional, food waste is 2.679 points higher on the scale of food waste compared to when the cooking method is meal-kit. While food waste is measured on a 5-point scale, an estimated coefficient of 2.679 for traditional cooking might seem high. However, the moderating effect of the interaction term between cooking skills and traditional cooking is significant on the 90% significance level ($\beta = -0.319$, $p < .1$). While in the current study a significance level of 95% is maintained, the 90% significance of the estimated coefficient of the interaction term between cooking skills and traditional cooking indicates that it does to some level affect the relationship between food waste and cooking traditionally. As stated in Table 1, the average cooking skill of the respondents in the current study is 5.741. Thus, when the cooking manner is traditional, 1.831 ($=5.741 \times 0.319$) points on the food waste scale are deducted from that 2.679, on average. Cooking traditionally adds, on average, 0.848 ($=2.679 - 1.831$) points to the food waste scale.

Hypotheses H2a and H2b consider the estimated interaction terms between the forms of cooking and cooking skills. In contrast to H2a, higher cooking skills do not weaken the difference in effect of cooking with a meal-kit and instant food on food waste. No effect of cooking skills when cooking instant food on food waste is found in the current study ($\beta = -0.052$, $p > .05$). Furthermore, in contrast to H2b, higher cooking skills do not weaken the difference in effect of cooking with a meal-kit and traditional cooking on food waste. In the current study, no effect of cooking skills when cooking traditionally on food waste is found on the 95% significance level ($\beta = -0.319$, $p > .05$).

Hypotheses H3a and H3b regard the estimated interaction term between the forms of cooking and the purchase manner (online vs. physical). In contrast to H3a, purchase manner online does not weaken the difference in effect of cooking with a meal-kit and instant food on food waste. No effect of purchase manner (online vs. physical) when cooking instant food on food waste is found in the current study ($\beta = -0.580$, $p > .05$). Additionally, in contrast to H3b,

purchase manner online does not weaken the difference in effect of cooking with a meal-kit and cooking traditionally on food waste. No effect of purchase manner (online vs. physical) when cooking traditionally on food waste is found in the current study ($\beta = -0.698$, $p > .05$).

Lastly, hypotheses H4a and H4b are about the estimated coefficient of pre-cut ingredients. Since the variable pre-cut ingredients is by design of the current study 0 for instant food and traditional cooking, the effect of the interaction terms of pre-cut ingredients with instant food and traditional cooking cannot be estimated. Therefore, only the main effect of pre-cut ingredients on food waste is estimated. In contrast to H4a, pre-cut ingredients do not weaken the difference in effect of cooking with a meal-kit and instant food on food waste. Furthermore, in contrast to H4b, pre-cut ingredients do not strengthen the difference in effect of cooking with a meal-kit and traditional cooking on food waste. Both hypotheses are rejected because no effect of pre-cut ingredients on food waste is found in the current study ($\beta = 0.425$, $p > .05$).

Additionally, of the control variables, only the size of the household significantly influences food waste. When households get bigger, more food is wasted in the cooking and eating process.

	β	Std. Error	Hypothesis	Hypothesis supported
<i>Main effects</i>				
Constant	1.431	0.621		
Instant food	0.371	1.447	H1a	No
Traditional cooking	2.679**	1.272	H1b	Yes
Cooking skills	0.262	0.179		
Purchase manner	0.164	0.509		
Pre-cut ingredients	0.425	0.285	H4a, H4b	No, No (resp.)
<i>Moderating effects</i>				
Cooking skills_instant food	-0.052	0.232	H2a	No
Cooking skills_traditional	-0.319*	0.191	H2b	No

Purchase manner_instant food	-0.580	0.571	H3a	No
Purchase manner_traditional	-0.698	0.619	H3b	No
<i>Control variables</i>				
Age	-0.005	0.004		
Gender (male)	0.072	0.166		
Household size (2 persons)	0.276*	0.165		
Household size (3 persons)	0.418**	0.169		
Household size (4+ persons)	0.425**	0.178		
Education level (Intermediate Vocational Education)	-0.069	0.260		
Education level (Higher Vocational Education)	-0.044	0.292		
Education level (Bachelor's degree, university)	0.381	0.303		
Education level (Master's degree, university)	-0.111	0.278		
Education level (Doctorate degree, university)	-0.036	0.447		

*** significant on $\alpha = 0.01$, ** significant on $\alpha = 0.05$, * significant on $\alpha = 0.1$

Table 2: Estimated Coefficients (Unstandardized)

6. Discussion

In this chapter, first the theoretical and managerial implications of the research are discussed in 6.1 and 6.2. Then, the chapter concludes with the limitations of the research, which in turn lead to suggestions for further research in 6.3.

6.1 Theoretical implications

The aim of the current study is to contribute to the literature in several ways. The current study aims to contribute to a gap in the literature regarding the difference in effect of instant food and meal-kits on food waste. Additionally, by performing a replication of the difference in effect of meal-kits and traditional cooking on food waste. Furthermore, by resolving two contradictions in the literature by adding the variables purchase manner (online vs. physical) and pre-cut ingredients as moderators. And finally, by examining to what extent the moderators (cooking skills, purchase manner, and pre-cut ingredients) affect the main relationships.

In the current study, a negative effect of meal-kits on food waste is found in comparison to traditional cooking. The results are in line with Heard et al. (2019), increasing the reliability of the current literature. The current study found no difference between instant food and meal-kits and their effect on food waste, which is not in line with Wansink et al. (2013). In the study of Wansink et al. (2013), it is stated that food that is ready-to-eat is more likely to be eaten completely. Since instant food is more ready-to-eat than a meal-kit, instant food is more likely to be eaten completely, leading to less food waste than a meal-kit. A reason for the current study to contradict Wansink et al. (2013) could be that instant food and meal-kits have too many similarities. While the current study regards meal-kits and instant food as two separate meal forms, they are both part of the same category: convenience food (Hertz & Halkier, 2017). When two independent variables in a model have similar traits, the estimated effect that they have on the dependent variable is likely to be similar as well. When the estimated effects of instant food and meal-kits on food waste are similar, the difference in their effects is not likely to be found. Another explanation may lie in the design of the study. In the current study, there are 58 instant food observations, and 52 meal-kit observations. It could be that more observations are needed to find an effect.

Furthermore, in the current study, no difference in the effect of cooking skills on the relationship between cooking manner and food waste is found. While Van Doorn (2016) and Evans (2011) state that people with less cooking skills waste more food, that statement is not found to be supported in the current study. Cherry (2019) states that the Dunning-Kruger effect,

creating cognitive bias regarding one's own personal skills, could be the reason that people overestimate how well they can perform tasks. The inability of some respondents to correctly estimate their own cooking skills could lead to the wrong conclusions regarding cooking skills and their relationship with the main effect.

In the current study, no difference in the effect of purchase manner (online vs. physical) on the relationship between cooking manner and food waste is found. In contrast to Chandon and Wansink (2006) and Ilyuk (2018), the current study finds that it does not matter for food waste in what way a meal is cooked and thus how many different products are needed for a meal. Chandon and Wansink (2006) state that shopping physically results in the stock at home being mis estimated, superfluous products to be bought and thus more food being wasted. However, Ilyuk (2018) states that shopping online leads to more food being wasted. Thomas and Garland (1996) examined in their paper the effect of a shopping list on consumer behaviour while grocery shopping. None of the respondents in the paper of Thomas and Garland (1996) stuck to that list while grocery shopping. The reason that the current study contradicts both Chandon and Wansink (2006) and Ilyuk (2018) could be that people are not as concerned with buying exactly what they need according to the plan they made (Thomas & Garland, 1996).

Lastly, the current study found no difference in effect of pre-cut ingredients on the relationship between cooking manner and food waste, which is in contrast to Wansink et al. (2013) and Yoon et al. (2022). A reason could be that in The Netherlands, not many meal-kits have pre-cut ingredients in them. The reason for this is that meal-kits with pre-cut ingredients involve more use of plastic, making them less popular (Van Hooijdonk, 2022). As opposed to for example the USA where the phenomenon of pre-cut ingredients in a meal-kit is much more common (Yoon et al., 2022). Another reason for the contradiction between the current study and the findings of Yoon et al. (2022) could be that the paper of Yoon et al. (2022) is written from the health literature perspective. From that perspective, it could be that people from the USA eat less vegetables, are generally less familiar with cutting vegetables and do not know how to correctly cut vegetables as well as Dutch people. Therefore, it could be that consumers cutting vegetables themselves will lead to more food waste in the USA than in the Netherlands. Thus, pre-cut ingredients could have a bigger impact on food waste in the USA than in the Netherlands.

6.2 Managerial and policy implications

The current study provides management of grocery stores and providers of meal-kits with an initial insight into which cooking method can help combat food waste. Grocery stores are an important link between food production and consumers. In addition, for grocery stores, the creation of a sustainable image is an increasingly important topic. The current study shows that cooking with a meal-kit prevents food waste more than traditional cooking methods. With this knowledge, grocery store marketing managers, for example from Albert Heijn and Lidl, can respond both consciously and unconsciously to the amount of food wasted by consumers. For example, grocery store marketing managers can incorporate the finding that cooking with a meal-kit reduces food waste more than traditional cooking into their advertising strategy. In advertising, they can promote the meal-kit as a more sustainable product in terms of food waste than traditional cooking. In this way, grocery store marketing managers make consumers aware of the fact that they themselves can reduce food waste. In addition, by selling more types of meal-kits, consumers are more likely to see and buy a meal-kit they like. A greater variety of meal-kits in the grocery store prevents consumers from having to choose a meal-kit that contains ingredients they do not like or are allergic to. If there are ingredients in the meal-kit that the consumer does not use, they are wasted. In this way, a grocery store marketing manager influences the consumer in a more subconscious way. By offering a wide range of meal-kits and selling them in larger quantities, grocery stores can boost their own image by projecting sustainability. Furthermore, it is important to leave other forms of cooking such as instant food out of the promotions as no evidence is found in the current study that they prevent food waste more than meal-kits.

In addition, this outcome is useful for marketers of meal-kit providers such as Hellofresh but also for grocery store meal-kits. They can advertise with concrete figures that meal-kits are more sustainable in terms of food waste than traditional cooking. Marketing managers of meal-kit providers should not emphasise in their advertisements the cooking skills needed to prepare a meal-kit, the purchase manner (online vs. physical), and whether there are pre-cut ingredients in the meal-kit. These aspects have no effect on the relationship between cooking with a meal-kit and food waste.

For both grocery store managers and marketers of meal-kit providers, it is important that companies continue to conduct research to find out where green initiatives can be developed.

The United Nations' goal is to reduce food waste by 50% by 2030 (Government of the Netherlands, n.d.). To achieve this goal, the Dutch government can intervene by, for example,

imposing lower taxes on meals that prevent food waste better than other meal options. Based on the current study, lower taxes could be implemented on meal-kits compared to meals cooked in a traditional way. In addition, the government can also oblige grocery stores to offer a minimum quantity of different meal-kits or to display them in a more prominent place in the grocery store. In both cases, consumers will be more likely to buy a meal-kit and less food will be wasted than with traditional cooking. However, the government must be careful not to overemphasise the fact that meal-kits prevent food waste. Chandon and Wansink (2012) argue that by putting little effort into preparing the meal, people are more inclined to eat their entire meal. If food waste is over-promoted, people may overeat, which can also have unhealthy side effects. Additionally, since there is no effect on food waste found for instant food, cooking skills, purchase manner (online vs. physical), and whether there are pre-cut ingredients in the meal-kit, these aspects should not be focussed on in creating government policy to reduce food waste.

The managerial and policy implications mentioned above serve as a basis for the development of a model to combat food waste.

6.3 Limitations and future research

Despite the careful attention paid to the design and implementation of the study, some limitations arise. These limitations are discussed and in turn provide openings for further research.

First, it can be questioned whether letting respondents fill in more than one measurement day, and treating those measurements as independent, is a reliable method. Consequently, it could be argued that the current study does not really represent a normal week of food preparation. A requirement imposed on the respondents was that they had to prepare a meal-kit at least once, instant food at least once, and cook at least once traditionally during the seven days of measurement. This could influence the results because if respondents, for example, normally never cook with a meal-kit, they may want to perform the cooking process as well as possible, something that is likely to receive less attention if the respondent cooks with a meal-kit more often. With instant food, for example, people may be inclined to want to eat the whole meal because they have paid more for the meal than they would otherwise do on average (Brunner et al., 2010). In both cases, this can lead to less food being wasted than would be the case if no requirements had been imposed on the cooking week. In addition, one of the five assumptions of multiple regression is not met intuitively, only statistically, because the same respondent represents seven measurement moments. Because the assumption of

independence of the errors is intuitively not met, this has the consequence of reducing the power of the study (Hair et al., 2019). In future research, more respondents would have to be collected to meet the assumption not only statistically, but also intuitively. Moreover, the longer measurement period can then ensure that there is no minimum requirement for cooking methods. Also, more insight can be provided into the food leftovers that are put in the freezer.

Second, the representativeness of the sample must be discussed. Research shows that there is a difference in food waste between different countries (Thi, Kumar & Lin, 2015). The food waste diary in the current study was only available in Dutch, which automatically excluded other possible respondents from countries that do not speak Dutch. In addition, most respondents were women (86%). This can be explained by the still existing division of roles within households in which the woman cooks more often than the man (Wolfson et al., 2021). As men tend to waste more food than women (Visschers et al., 2016), the over-representation of women in the dataset may cause bias in the estimation of the coefficients. Furthermore, more than half of the respondents are 25 years of age or younger. As stated before, young people are more likely to produce more food waste than older people (Stefan et al., 2013; Visschers et al., 2016). This can also lead to bias in the estimation of the coefficients. It can be stated that the current study does not give a representative picture of the entire population and that therefore, the method of the current study is suboptimal. A suggestion for future research would be to draw a random sample. By drawing a random sample, it can be ensured that certain groups of respondents are not over-represented (Vennix, 2016).

Third, the respondents themselves estimated the percentage of food that was wasted. An own estimate of food waste can be seen as a limitation (Stancu et al., 2016; Stefan et al., 2013). The subject in the current study focuses on both amoral and personal behaviour. Therefore, despite the study being anonymous, it could be that respondents still filled in socially desirable answers. This could lead to a slightly distorted picture which will reduce reliability and validity of the results. In future research, respondents can be provided with a kitchen scale to get absolute figures on the amount of food wasted. It will then be possible to make a distinction, and with that a comparison, between perceived food waste and actual food waste. To date, there are no studies on how good consumers are at self-reflection on how much food waste they think they have compared to the actual amount of food waste. Thus, the comparison of perceived food waste and actual food waste. The disadvantage of measuring the actual food waste is that respondents have to go through more actions before they can write down an answer. In that way, they are even more conscious of food waste which could influence the data. In addition,

in future research, perhaps as in Stefan et al.'s (2013) research, the reason behind wasting food can also be named to get a more complete picture of food waste.

Fourth, some parts of the dataset may be not sufficiently evenly distributed to draw reliable conclusions about the results. Almost all participants consider themselves to be a good chef. The dataset has little variation and is not evenly distributed in terms of cooking skills. Thus, the conclusions that are drawn for the effect of cooking skills only hold for people that regard themselves to be a good chef. Therefore, it could be that the conclusions drawn in the current study for cooking skills are less reliable. It might be that if the dataset were more evenly distributed, a different conclusion would be drawn. The same holds for the results based on the online purchase of the meal. For a great part of the observations, the meal is bought physically in the store. This leads to a not evenly distributed dataset in terms of purchase manner. Therefore, it might be that the conclusions drawn in the current study regarding the effect of purchase manner (online vs. physical) on the main effect, only hold for when the purchase manner is physical. Thus, the results regarding purchase manner (online vs. physical) may be less reliable than when the dataset were more evenly distributed. In future research, more and a broader scale of questions could be asked to assess cooking skills. If the cooking objectives in the asked questions differ more in complexity, a more accurate assessment of cooking skills could be realised. Furthermore, to solve the unevenly distributed data in purchase manner, more data is needed so that an even distribution in the dataset can be obtained.

Fifth, in the current study, the choice factor effort is central in choosing the moderators. In the current study, by connecting "what" to the choice factor effort, pre-cut ingredients are connected to the preparation part of effort. The moderator pre-cut ingredients is created by combining the theory of Jaeger and Mieselman (2004), Wales (2009), and Yuan et al. (2013). In the current study, no difference in effect on food waste between the three forms of cooking is found, irrespective of the meal having pre-cut ingredients or not. In future research, the "what" could be connected to the type of meal-kit and two different meal-kits could be examined: delivery service or grocery store meal-kit. Furthermore, the parts of effort that the current study focuses on are planning, purchasing, and preparation. For future research, the other two aspects of effort, consuming and cleaning, and their effect on food waste could be regarded.

Despite the limitations mentioned, the current study is a first step in investigating the difference in effect of meal-kits and instant food on food waste. Furthermore, it replicates the difference in effect of meal-kits and traditional cooking on food waste. Additionally, the current

study takes the first step in researching the impact of the moderators on the main effect of cooking manner on food waste.

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Appendix I: Variables, definitions, items, scales, and Cronbach's alpha in prior research

Variable	Definition	Item	Scale
<i>Perceived food waste (Stefan et al., 2013) - daily measuring</i>	Perceived food waste refers to excess ingredients that are not used for the prepared meal or subsequent meals, as well as uneaten portions of the meal that are discarded (Heard et al., 2019, p. 191)	We would like you to write down the amount of food you have (possibly) thrown away as a percentage of what you bought to prepare the meal. How much food would you say you threw away of what you bought to prepare the meal?	“Not at all (1), less than a tenth (2), more than a tenth but less than a quarter (3), more than a quarter but less than a half (4) and more than a half (5)” (Stefan et al., 2013, p. 377)
<i>Cooking manner - daily measuring</i>		The meal you ate today, how did you prepare it?	Traditional (1), Meal-kit via a delivery service (e.g., Hello Fresh) (2), grocery store meal-kit (3), instant food (e.g., warm-up meals or ready-made salads) (4).
<i>Cooking skills (Hartmann, Dohle & Siegrist, 2013) - measured once (0.91*)</i>	The ability to prepare different foods	<p>“I consider my cooking skills as sufficient.</p> <p>I am able to prepare a hot meal without a recipe.</p> <p>I am able to prepare gratin.</p>	Likert-scale: ‘strongly disagree’ (1) to ‘strongly agree’ (7).

I am able to prepare
soup.

I am able to bake cake.

I am able to bake bread.”
(Hartmann et al., 2013,
p. 126)

<i>Purchases manner (online vs. physical) (Yoon et al., 2022) - daily measuring</i>	The difference between buying groceries online and physically in a grocery store	How did you purchase the meal?	“Purchase online (1), purchase at grocery store (2)” (Yoon et al., 2022)
<i>Pre-cut ingredients (Yoon et al., 2022) - measuring when cooking manner is meal-kit</i>	If the ingredients in the meal- kit are pre-cut or not	How much effort was needed to prepare the meal-kit?	“Low, all ingredients were pre-chopped (1), high, the ingredients still had to be chopped (2)” (Yoon et al., 2022)

* Cronbach’s alpha in prior research

Appendix II: Food waste diary (Dutch)

Beste deelnemer,

Hartelijk dank voor uw deelname aan dit onderzoek. Wij zijn Evelien Rosmalen en Elise van Drie, masterstudenten Marketing aan de Radboud Universiteit Nijmegen. Dit onderzoek wordt uitgevoerd in het kader van onze master thesis. Uw deelname is volledig anoniem. Daarnaast gebruiken wij de gegevens uitsluitend voor dit onderzoek en is deelname geheel vrijwillig.

Dit onderzoek zal gaan kijken naar hoe u omgaat met uw avondeten, wat door u thuis is bereid en geconsumeerd. Het bereiden van een maaltijd kan voor dit onderzoek op de volgende vier manieren:

- **Traditioneel:** koken met losse ingrediënten.
- **Maaltijdpakket via een bezorgservicedienst (bijvoorbeeld Hellofresh):** een doos (voorgesneden) rauwe ingrediënten, gebundeld met een receptkaart voor een complete zelfbereide maaltijd aan huis geleverd, vaak geabonneerd.
- **Verspakket van de supermarkt:** een doos (voorgesneden) rauwe ingrediënten, gebundeld met een receptkaart voor een complete zelfbereide maaltijd online of fysiek bij een supermarkt gekocht.
- **Kant-en-klaar maaltijd (bijvoorbeeld opwarmmaaltijden of kant-en-klare salades):** gemaksvoeding waarbij de kookactiviteit afwezig is.

U moet voor dit onderzoek gedurende zeven dagen, goed in de gaten houden of u avondeten (of gedeelten daarvan) weggooit. Elke avond willen we u vragen een vragenlijst in te vullen. Als u restjes overhoudt van het avondeten, die u bewaart, vult u de vragenlijst in na het later opeten of het weggooien van de restjes. U bent vrij om tussen 25 april tot 9 mei zelf zeven dagen uit te kiezen waarop u de vragenlijst invult. Deze dagen hoeven niet achtereenvolgend te zijn. Een dag buiten de deur eten telt bijvoorbeeld niet mee voor dit onderzoek. U kunt dan de dag erna kiezen voor het volgende meetmoment als u kookt met één van de vier bovenstaande manieren. U kunt dan via dezelfde link in de vragenlijst komen. De vragenlijst bestaat uit twee delen. Eén gedeelte bestaat uit vragen die eenmaal beantwoord dienen te worden (± 5 min). Het andere deel zijn dagelijkse vragen over het (gedeeltelijke) weggegooid avondeten zelf (\pm zeven keer 3 min).

In dit onderzoek gaat het om al het avondeten wat u uiteindelijk weggooit.

Wat valt er wel onder het weggooien van voedsel? Alle voeding die tijdens de meetweek gekocht is waarvan de houdbaarheidsdatum is verstreken, verspild of weggegooid wordt of op de composthoop wordt gegooid.

Wat valt er niet onder het weggooien van voedsel? Onvermijdelijk afval zoals botten, schillen en voedsel dat aan huisdieren wordt gegeven of ingevroren wordt.

Voor dit onderzoek is het belangrijk dat u de kassabon van uw gekochte producten bewaart, minimaal één keer traditioneel kookt, minimaal één keer met een maaltijdpakket via een bezorgservicedienst of verspakket van de supermarkt kookt en minimaal één keer een kant-en-klaar maaltijd consumeert.

Mocht u nog vragen hebben over het onderzoek kunt u bellen of een mail sturen naar: elise.vandrie@ru.nl (+31612767954) of evelien.rosmalen@ru.nl (+31642343927). Na afronding van het onderzoek zullen de resultaten naar u toegestuurd worden.

Nogmaals hartelijk dank voor uw deelname.

Vriendelijke groet,

Evelien Rosmalen

Elise van Drie

Allereerst zal nu het deel volgen met vragen die slechts éénmaal beantwoord hoeven te worden.

Wat is uw leeftijd?

.....

Wat is uw hoogst genoten opleiding?

- Basisschool en middelbare school
- Middelbaar beroepsonderwijs (MBO)
- Hoger beroepsonderwijs (HBO)
- Bachelor (Universiteit)
- Master (Universiteit)
- Doctoraat (Universiteit)
- Overig

Wat is de grootte van uw huishouden?

- 1 persoon
- 2 personen
- 3 personen
- 4 of meer personen

Wat is uw geslacht?

- Vrouw
- Man
- Anders

In hoeverre bent u het eens met de volgende stellingen? (1 = helemaal mee oneens, 7= helemaal mee eens)

1. Ik beschouw mijn kookvaardigheden als voldoende.
2. Ik heb de vaardigheden om een warme maaltijd te bereiden zonder een recept.
3. Ik heb de vaardigheden om een gratin (aardappel ovenschotel) te bereiden.
4. Ik heb de vaardigheden om een soep te bereiden.
5. Ik heb de vaardigheden om een cake te bakken.
6. Ik heb de vaardigheden om een brood te bakken.

Tot zover de vragen die slechts éénmaal beantwoord hoefden te worden. Klik op het pijltje om verder te gaan naar de vragen over meetdag 1.

Meetdag X: dag X van de 7 dat u de vragenlijst na het avondeten invult.

De maaltijd die u vandaag heeft gegeten, hoe heeft u deze klaargemaakt?

- Traditioneel
- Maaltijdpakket via een bezorgservicedienst (bijvoorbeeld Hello Fresh)
- Verspakket van de supermarkt
- Kant-en-klaar maaltijd

→ Als er maaltijdpakket via een bezorgservicedienst of verspakket van de supermarkt wordt aangevinkt: *Hoeveel inspanning was er nodig om het maaltijdpakket of verspakket te bereiden?*

- Laag, alle ingrediënten waren voorgesneden
- Hoog, de ingrediënten moesten zelf nog worden gesneden

Hoe heeft u de maaltijd aangeschaft?

- Online
- Fysiek, in een winkel

De volgende vraag staat in het kader van promoties. Hierbij gaat het erom of de maaltijd die u vandaag gekookt en gegeten heeft in promotie was op het moment dat u de product(en) kocht. U kunt op uw bewaarde kassabon kijken of er sprake was van een promotie op het moment van kopen als u dit zelf niet meer weet. Welke promotie was van toepassing op de product(en) die u vandaag gebruikt heeft voor uw maaltijd?

- 'Koop een product, en krijg er een gratis' (bijvoorbeeld 1+1 of 2+1 gratis)
- Prijsverlaging (...% korting)
- Een combinatie van verschillende promoties, namelijk...
- Anders, namelijk...
- Niet van toepassing, de producten die ik vandaag voor mijn maaltijd heb gebruikt, waren niet in promotie op het moment van kopen.

In hoeverre bent u het eens met de volgende stellingen? (1 = helemaal mee oneens, 7= helemaal mee eens)

1. “Zo veel te doen, zo weinig tijd”; deze uitspraak is vandaag van toepassing op mij.
2. Ik heb vandaag meer uren in de dag nodig om mijn werk gedaan te krijgen.
3. Ik heb vandaag veel tijd beschikbaar, maar ik weet niet wat te doen.
4. Ik heb vandaag het gevoel dat hoe hard ik ook werk, al mijn werk niet afkomt.
5. Ik heb vandaag haast.

De volgende vraag staat in het kader van voedselverspilling. We willen u vragen om de hoeveelheid voedsel die u (mogelijk) heeft weggegooid te noteren als een percentage van wat u heeft gekocht om de maaltijd te bereiden. Hoeveel voedsel zou u zeggen dat u heeft weggegooid van wat u heeft gekocht om de maaltijd te bereiden?

- Helemaal geen
- Minder dan 10%
- Tussen de 10% en 25%
- Tussen de 25% en 50%
- Meer dan 50%

Tot zover de vragen voor meetdag X. Klik op het pijltje om uw antwoorden op te slaan. U kunt dan de vragenlijst afsluiten. Op uw volgende meetdag kunt u via dezelfde link weer in de vragenlijst komen. Hartelijk bedankt.

Afsluitende tekst meetdag 7

Tot zover de vragen voor meetdag 7. Klik op het pijltje om uw antwoorden op te slaan. U kunt dan de vragenlijst afsluiten. Dit was uw laatste meetdag. Hartelijk bedankt voor uw bijdrage aan het onderzoek.

Appendix III: Assumptions regression analysis

Cronbach's Alpha	N of Items
0.728	6

Table 3: Reliability Statistics

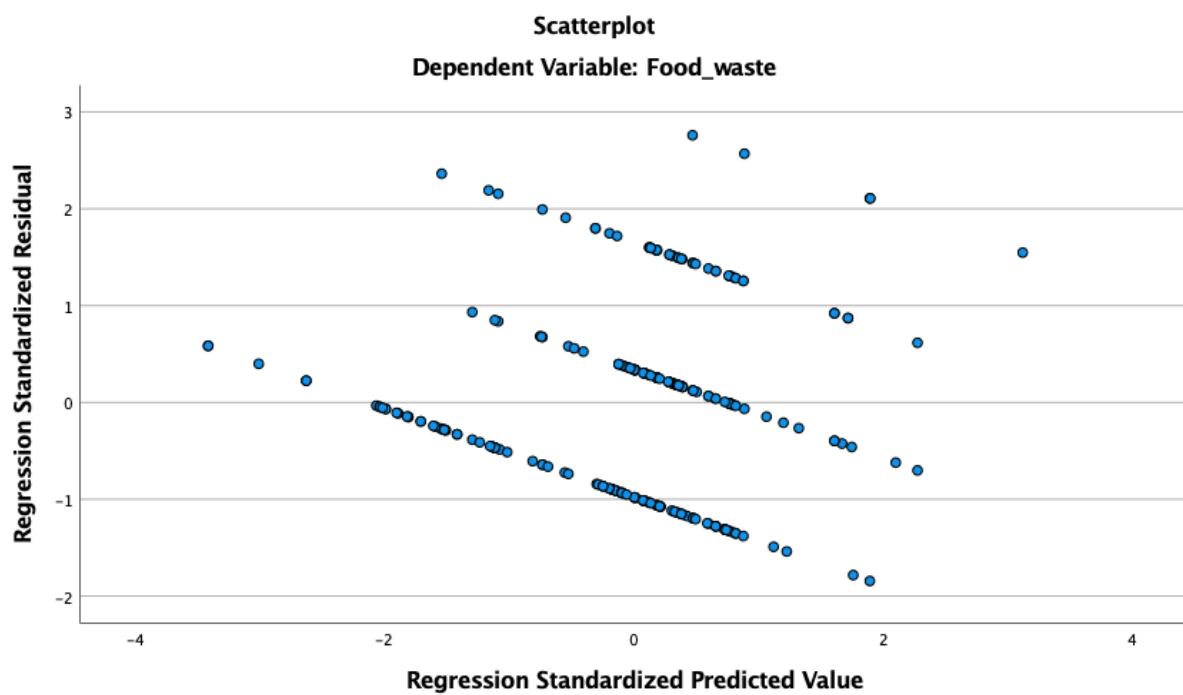


Figure 3: Scatterplot

<i>R</i>	<i>R Square</i>	<i>Adjusted R Square</i>	<i>Kolmogorov-Smirnov</i>	<i>Shapiro-Wilk</i>	<i>Durbin-Watson</i>
.448	.201	.135	0.291***	.789***	2.013

*** significant on $\alpha = 0.01$

Table 4: *R Square*, *Kolmogorov-Smirnov*, *Shapiro-Wilk* and *Durbin-Watson*

	Tolerance	VIF
Traditional cooking	.602	1.662
Meal-kit	.240	4.171
Cooking skills	.623	1.604
Purchase manner (online)	.853	1.173
Pre-cut ingredients (low)	.264	3.792
Age	.506	1.974
Gender (male)	.695	1.439
Household size (2 persons)	.363	2.752
Household size (3 persons)	.398	2.510
Household size (4+ persons)	.518	1.930
Education level (Intermediate Vocational Education)	.200	4.998
Education level (Higher Vocational Education)	.160	6.238
Education level (Bachelor's degree, university)	.181	5.532
Education level (Master's degree, university)	.141	7.097
Education level (Doctorate degree, university)	.428	2.336

Table 5: Tolerance and VIF-score

	Food_waste	Cooking_skills	Cooking_manner	Pre_cut_ingredients	Purchase_manner	Age	Education	Household size	Gender
Food_waste	1	.070	-.246	.067	-.060	-.161	.077	.150	-.042
Cooking_skills	.070	1	.007	-.244	.074	.049	.199	.153	-.043
Cooking_manner	-.246	.007	1	. ^c	-.261	-.028	-.035	.068	.037
Pre_cut_ingredients	.067	-.244	. ^c	1	-.429	.418	-.320	-.047	.209
Purchase_manner	-.060	.074	-.261	-.429	1	.023	.086	-.047	-.086
Age	-.161	.049	-.028	.418	.023	1	-.570	-.164	.103
Education	.077	.199	-.035	-.320	.086	-.570	1	.149	-.158
Household size	.150	.153	.068	-.047	-.047	-.164	.149	1	-.089
Gender	-.042	-.043	.037	.209	-.086	.103	-.158	-.089	1

Table 6: Correlation Matrix

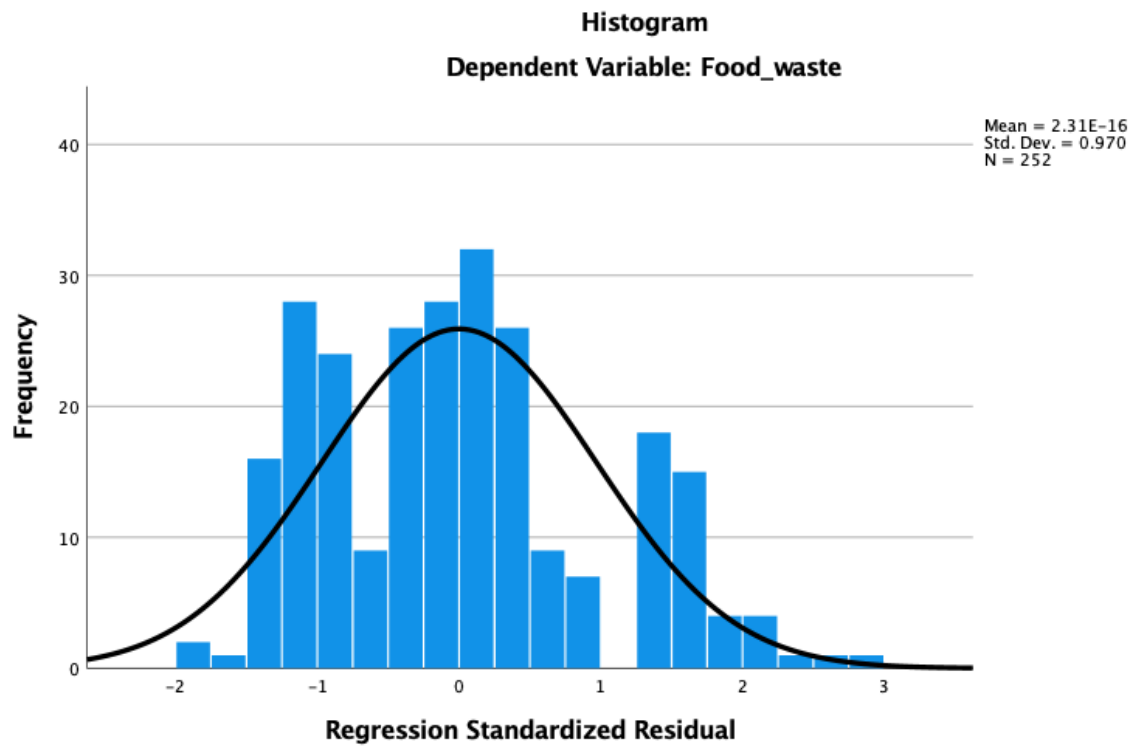


Figure 4: Histogram

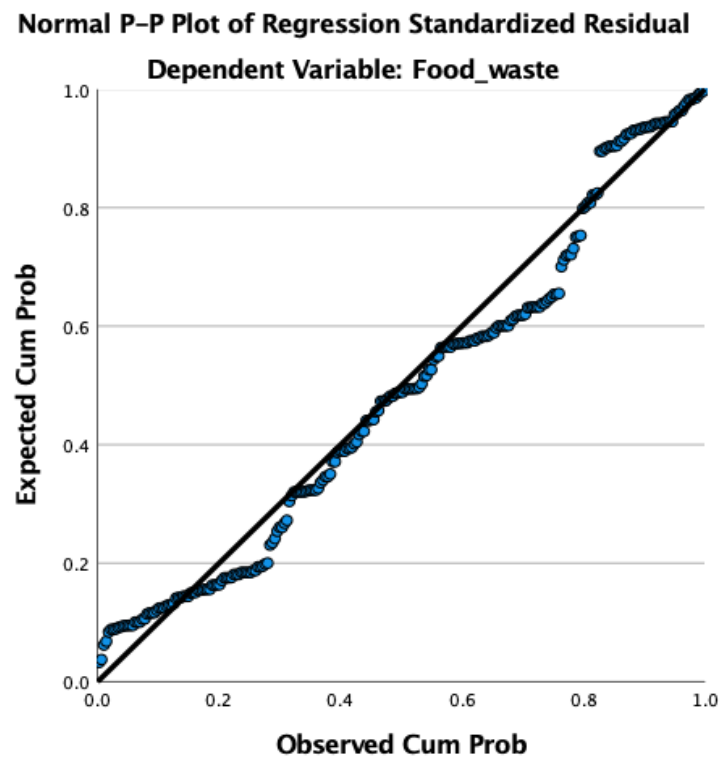


Figure 5: P-P Plot