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Review

Putting together the puzzle of consumer food waste: Towards an integral perspective

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ABSTRACT

Background: Although consumer food waste has increasingly received attention in both the public and the scientific domain, its complex nature is far from unravelled.
Scope and approach: This study aimed to contribute to an integral understanding of possible causal pathways of consumer food waste, by means of a configurative systematic literature review of potential factors of consumer food waste. Insights from 59 scientific articles have been systematically analysed and synthesised.
Key findings and conclusions: Consumer food waste research is characterised by fragmentation, lack of differentiation, and a relative scarcity of explanatory research into causal mechanisms. Potential factors of consumer food waste have been identified and categorised into behavioural, personal, product and societal factors and subclusters of these categories. On the basis of a synthesised overview of 116 factors, a framework has been developed that conceptualises the generation of consumer food waste in relation to stages of the household food chain. This review sheds light on the context-dependent ways in which proposed factors may be related to food waste and the possibility of parallel causal routes. Food waste factors might exert their influence in unexpected, indirect or multiple ways, possibly explaining contradictory findings. They might interact with other factors or form a condition for other factors to play a role, or might be correlated with food waste without playing a causal role. The framework may facilitate an integral and context-sensitive systems perspective, thereby promoting studies that account for the complexity of consumer food waste and intervention programmes that are better targeted.
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1. Introduction

Addressing food waste is increasingly considered a key priority in the context of a growing world population, augmenting pressures on our natural environment, shifting dietary patterns, and rising food security concerns (e.g. Buzby & Hyman, 2012; European Parliament, 2011; Gustavsson, Cederberg, Sonesson, Van Otterdijk, & Meybeck, 2011; HLPE, 2014). Various studies have exposed the magnitude of food waste on the globe, pointing out the staggering amounts of food intended for human consumption that get lost throughout the food supply chain (e.g. Gustavsson et al., 2011; Lundqvist, De Fraiture, & Molden, 2008; Monier et al., 2011). According to the FAO, approximately one-third of the food produced for human consumption, corresponding to around 1.3 billion tons yearly, is wasted or lost worldwide (Gustavsson et al., 2011). Lundqvist et al. (2008) even argued that half of the food produced does not end up being consumed by humans. In 2010, a study commissioned by the European Commission estimated that in the EU around 89 billion kg of food is wasted yearly, equalling to 179 kg per capita (excluding agricultural food waste) (Monier et al., 2011). The sheer magnitude of the figure is worrying, as food waste has been associated with a number of adverse societal impacts of ecological, economic and social nature (e.g. Graham-Rowe, Jessop, & Sparks, 2014; HLPE, 2014; Monier et al., 2011; Parizeau, von Massow, & Martin, 2015; Principato, Secondi, & Pratesi, 2015). Environmental impacts include the resources that have been used in vain for the production of food, as well as the greenhouse gas emissions associated with food waste disposal. Adverse economic consequences do not only include the economic cost of food waste itself, but also encompass inefficiencies in the supply chain, upward

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pressure on prices, and reduced profits, among other consequences. Social implications, finally, entail issues such as reduced labour productivity, lower wages, and difficulties in access to food (HLPE, 2014).

Although all supply chain stages and all regions are affected by food waste (e.g. Gustavsson et al., 2011; HLPE, 2014; Parfitt, Barthel, & MacNaughton, 2010), the scope and nature of food waste differ substantially both between regions and stages. Total per capita food waste in Europe and North-America is considerably higher than in Sub-Saharan Africa and South/Southeast Asia (Gustavsson et al., 2011). While food waste in developing or low-income countries is particularly associated with the earlier stages of the food supply chain, food waste in medium- and high-income countries for a major part takes place at the consumption stage (Gustavsson et al., 2011; HLPE, 2014). This is in line with other studies suggesting that consumers and specifically households are responsible for the majority of food waste in high-income countries (e.g. Beretta, Stoessel, Baier, & Hellweg, 2013; Griffin, Sobal, & Lyson, 2009; Jörissen, Priefer, & Bräutigam, 2015; Koivupuro et al., 2012; Monier et al., 2011; Parfitt et al., 2010; Silvennoinen, Katajajuuri, Hartikainen, Heikkilä, & Reinikainen, 2014). Vanham, Bouraoui, Leip, Grizzetti, and Bidoglio (2015) estimated, based on statistics from EU member states, that total EU consumer food waste amounts to 123 (min 55–max 190) kg per person per year, which corresponds to 16 (min 7–max 24) per cent of all food reaching the consumption stage. Furthermore, they concluded that almost 80 per cent of this food waste, i.e. 97 (min 45–max 153) kg per person per year, is avoidable food waste (edible food not consumed). This corresponds to 12 per cent of all food reaching consumers. Likewise, households in the UK were found to waste 12 per cent of the edible food they purchased (Quested, Ingle, & Parry, 2013), while this figure was found to be 14 per cent in the Netherlands (Van Westerhoven, 2013).

Food waste at the consumption level has particularly severe societal implications, as both environmental costs (HLPE, 2014; Monier et al., 2011; Williams & Wikström, 2011) and the economic value (HLPE, 2014; Koester, 2014; Nahman & de Lange, 2013) of food accumulate along the food chain. As food waste implies a waste in ecological, social and economic terms, the societal relevance of finding ways in which it can be used as a valuable resource rather than just being discarded is evident. Much research has been conducted on strategies to recover and reuse food waste, which contribute to the valorisation of food waste and to a certain extent mitigate the impact of food waste (e.g. Galanakis, Cvejic, Verardo, & Segura-Carretero, 2016, pp. 211–236; Lin et al., 2013). However, in line with the waste hierarchy endorsed by EU legislation (Lin et al., 2013), these efforts should be paralleled by initiatives to prevent the generation of food waste in the first place and to ensure that as much food as possible is being used as originally intended. The societal relevance of tackling the consumer food waste problem will become increasingly pressing, as various trends are likely to increase worldwide consumer food waste substantially. These include population growth, income growth, dietary change (Buzby & Hyman, 2012; HLPE, 2014; Parfitt et al., 2010), and the rise of single-person households (Monier et al., 2011; Parfitt et al., 2010).

From the foregoing becomes clear that its scope, severity and anticipated growth make the generation of consumer food waste a societal challenge that needs addressing. Designing effective interventions to reduce consumer food waste is however thwarted by the complexity and uncertainty surrounding it. Studies suggest that consumer food waste is a product of complex interrelationships between activities, attitudes and values (Parfitt et al., 2010; Quested, Marsh, Stunell, & Parry, 2013). Moreover, consumers do not act in isolation, but in a social, economic, and technical context (e.g. Evans, 2011; Groot-Marcus, Terpstra, Steenbekkers, & Butijn, 2006, pp. 33–42), and these behaviour-context interactions contribute to the complexity of consumer food waste (Quested, Marsh et al., 2013). While multiple studies have enhanced insight into amounts and compositions of food waste (e.g. Bernstad Saraiva Schott & Andersson, 2015; Katajajuuri, Silvennoinen, Hartikainen, Heikkilä, & Reinikainen, 2014; Kummu et al., 2012; Oelofse & Nahman, 2013; Reynolds et al., 2014), research into the drivers of household food waste is relatively limited (Graham-Rowe et al., 2014; Koivupuro et al., 2012; Parfitt et al., 2010; Parizeau et al., 2015; Principato et al., 2015; Stefan, Van Herpen, Tudoran, & Lähteenmäki, 2013). Parizeau et al. (2015, p. 208) noted that, considering the societal relevance of addressing food waste, strikingly little research exists that 'systematically assesses the factors that influence food wasting and waste disposal at the household/consumer level'.

This study aimed to contribute to an integral understanding of possible causal pathways of consumer food waste, by means of a configurative systematic literature review of potential factors of consumer food waste. On the basis of a systematic identification and synthesis of potential factors, a framework has been developed that conceptualises the generation of consumer food waste.

The set-up of the paper is as follows. The next section presents the approach guiding this systematic literature review. Subsequently, the review findings are presented and analysed in sections 3 and 4. The final section formulates conclusions on the basis of the review findings, and looks ahead by pointing at possible future research directions that might help to fill knowledge gaps.

2. Systematic literature review approach

2.1. Data collection

A systematic literature review was performed along the guidelines for a configurative review as described by Gough, Oliver, and Thomas (2012). A configurative review is aimed at organising (configuring) data with the purpose of exploring and developing concepts and theories, which contrasts with aggregative reviews which intend to add up (aggregate) data in order to test theories or hypotheses (Gough et al., 2012). Fig. 1 visualises the data collection process. The following key concepts were used to guide the data collection: 1) food waste, and 2) consumer level.

Only scientific articles presenting primary or secondary research originating from peer-reviewed journals were included. Supplementary Material I describes the detailed search strategy followed, including the databases selected and the exact search terms and search strings used. Various multidisciplinary bibliographic databases have been consulted to account for the multidimensional nature of consumer food waste.

The execution of the search string resulted in a large initial collection of literature (via Scopus, Web of Science, and CAB Abstracts respectively 659, 558, and 489 publications were found, making a total of 1706 publications). After merging the publications of the different databases, removing duplicates and applying the exclusion criteria (steps 4–8, in detail described in Supplementary Material I), a final body of literature of 59 scientific articles was generated that reported or reviewed empirical research on consumer food waste. Of these, 26 specifically dealt with consumer or household food waste. Another 27 articles were considered potentially useful as they dealt with food waste in a broader sense, i.e. not explicitly related to a specific stage of the food supply chain. As these publications could hold relevant insights for

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