Resources, Conservation & Recycling 179 (2022) 106073

Contents lists available at ScienceDirect

Resources, Conservation & Recycling

journal homepage: www.elsevier.com/locate/resconrec

An extended integrative model of behavioural prediction for examining households' food waste behaviour in Addis Ababa, Ethiopia

Assem Abu Hatab [a,b,*], Wondmagegn Tafesse Tirkaso [a], Elazar Tadesse [c], Carl-Johan Lagerkvist [a]

[a] Department of Economics, Swedish University of Agricultural Sciences, P.O. Box 7013, 750 07, Uppsala, Sweden
[b] Department of Economics & Rural Development, Arish University, Al-Arish, 45516, Egypt
[c] Department of Human Nutrition, Kotebe Metropolitan University, Addis Ababa, Ethiopia

ARTICLE INFO

Keywords:
Food waste
Consumer behaviour
Integrative model of behavioural prediction
Structural equation modelling
Binary logistic model

ABSTRACT

In developing countries, urbanization and demographic changes are increasing food waste generation at household levels. However, it remains unclear how behavioural and personal characteristics influence the behaviours of urban consumers in developing countries regarding food waste. In this study, we extended the integrative model of behavioural prediction to examine the determinants of food waste behaviour amongst a sample of 698 urban dwellers in Addis Ababa, Ethiopia. The empirical results revealed that attitudes and perceived behavioural control were the most important predictors of intention toward food waste reduction. With regard to food waste behaviours, the results showed that the more an individual feels obliged to discard less food, the higher the odds that the quantity of food that gets wasted by the household would be reduced. Likewise, knowledge about the negative impacts of wasting food and an ability to interpret information on labels of food products were associated with decreased quantities of household food waste. In addition, lower psychological distance to food waste was generally associated with lower quantities of wasted food. Finally, sociodemographic characteristics and food-shopping routines were found to be significant predictors of food waste behaviours. Overall, these findings constitute an entry point for more research and policy measures in order to understand determinants of household food waste behaviours in developing countries and to design effective interventions to reinforce their behaviours towards more sustainable food consumption patterns.

1. Introduction

Achieving the Sustainable Development Goals (SDGs) and the 1.5C goal of the Paris Agreement has been a major focus of research and policymaking in recent years. In this context, reducing or eliminating food waste (FW), i.e., raw or cooked food materials discarded before, during or after food preparation (Caldeira et al., 2017), has received considerable attention as an efficient means to accomplish these sustainability goals, in both developed and developing countries. The hypothesis is that FW compounds sustainability challenges, posed by natural-resource degradation, climatic and environmental changes, and population growth and associated demographic changes that current food systems face and that will accelerate in the coming decades (FAO, 2019; Lemaire and Limbourg, 2019). Particularly in developing countries, and especially Sub-Saharan African (SSA) countries, FW is closely linked to sustainability from two interrelated angles: food security and environmental change (Shukla et al., 2019).

With regard to food security, it is estimated that around 800 million people are chronically undernourished. At the same time, it is estimated that roughly one-third of food produced globally is lost or wasted along the food chain (Ivanova et al., 2020). In SSA, where almost one in every four people is undernourished and lacks adequate food for a healthy and productive life, it is estimated that close to 40% of food produced is lost or wasted ((Bremner, 2017); Sheahan and Barrett, 2017). Thus, such high prevalence of undernourishment on the one hand, and significant FW on the other suggest that reducing FW could decrease the pressures on food systems and contribute towards enhanced food and nutrition security (Li et al., 2021).

In relation to environmental change, several studies have established that a better management of FW has the potential to substantially lower greenhouse gas (GHG) emissions and reduce the environmental footprint of food systems (Shukla et al., 2019).This is supported by the fact that food supply chains are resource intensive, accounting for 20% of land resources, 70% of water withdrawals, and around 30% of energy

* Corresponding author.
E-mail address: assem.abuhatab@slu.se (A. Abu Hatab).

https://doi.org/10.1016/j.resconrec.2021.106073
Received 6 September 2021; Received in revised form 27 October 2021; Accepted 16 November 2021
Available online 25 November 2021

consumption (Godoy-Faúndez et al., 2021). In addition, food supply chains generate significant amounts pollutants, solid waste and GHG emissions (Poore and Nemecek, 2018) For instance, the share of developing countries in GHG emissions due to food loss and waste (FLW) has been growing remarkably in past few decades, adding around 70 Gt CO_2e to atmospheric GHG stock, an amount corresponding at current rates to 2 years' emissions from all anthropogenic sources (Porter et al., 2016; Scherhaufer et al., 2018). The IPCC estimates that reducing FLW in the food supply chain could decrease GHG emissions by 0.76–4.5 $GtCO_2$-eq yr^{-1} (Shukla et al., 2019). Therefore, the UN 2030 Agenda recognizes the links between reducing FLW and achieving the Sustainable Development Goals (SDGs), especially SDG 12 which sets a target of halving per capita global FW at the retail and consumer levels by 2030 and reducing losses along production and supply chains.

From a literature perspective, the last decade has witnessed an exponential growth in research related to FLW (Xue et al., 2017). However, existing evidence on questions related to the determinants of FW in the context of developing countries as well as policy options to reduce it are still under-researched (Spang et al., 2019). In this regard, Xue et al. (2017) and Li et al. (2021) point out that existing knowledge and quantitative assessments of FW in developing countries are insufficient to inform policymakers and to support interventions and actions on reducing FW. Furthermore, previous studies on FLW in developing countries are widely diverse with regard to context, methods and coverage of the stages of the value chain (Cattaneo et al., 2021). In particular, a significantly small number of these studies have empirically examined the role of the cognitive, emotional and behavioural aspects that share and influence consumers' food waste behaviour (FWB). This lack of studies on the behavioural aspects of FW, in developing countries especially, presents a major limitation in the literature given that understanding and then changing consumer behaviour through relevant interventions is a crucial step towards reducing FW and promoting a sustainable management of food chains (Aschemann-Witzel et al., 2018; FAO, 2019).

With this background, this study aims to address the above-mentioned gaps in the existing knowledge on FW in the context of developing countries. Specifically, taking Addis Ababa in Ethiopia as a case, this study extends a theoretically grounded framework, the "integrative model of behavioural prediction" (IMBP) (Fishbein, 2008; Fishbein and Ajzen, 2010), to explain and predict FWB of a sample of 698 households in Addis Ababa. The study adopted the European Commission's definition of FW, stating that household FW is waste composed of raw or cooked food materials, and includes food discarded before, during or after food preparation (Caldeira et al., 2017). While the literature traditionally categorizes FW at the consumer level into three main groups: unavoidable, possibly avoidable and avoidable (Beretta et al., 2013), we focus on the latter two categories. More specifically, our analysis focuses on edible food that households throw away because of being regarded unanimously inedible or being no longer wanted (van der Werf et al., 2018).

The remainder of this study is structured as follows. Section 2 reviews and positions the present study in the relevant academic literature. Section 3 presents the theoretical framework. Section 4 describes the study area and the survey design and presents the data analysis process. Section 5 reports and discusses the empirical results. Finally, Section 6 concludes the study and draws policy implications and the avenues of future work.

2. Prior literature and contribution

The design of the present study was based on a "scoping" review[1] of the theory-based empirical literature on households' intention and behaviours towards FW reduction published during the period between January 2010 and January 2021. Hence, for a study to be included in our review, it had to meet two criteria: (*i*) to have adopted a theoretical model including behavioural dimensions to empirically explain and predict households' intention and behaviour towards reducing FW; and, (*ii*) to have been published during the above-mentioned period. The focus on the period 2010–2021 is justified by the findings of Xue et al. (2017), which reveal that the empirical literature on FLW has proliferated since 2010, whereas earlier studies were dominated by technical and specialized publications with few contributions by economists (Cattaneoet al., 2021). The literature review was undertaken by searching Google Scholar, Scopus and Web of Science.

Table 1 summarizes the most relevant studies identified by our review of the literature based on their context, theoretical model adopted, the quantification method, the dependant variable and the measurements and predictors of intention and behaviours regarding FW. Upon a close look at these studies, five major characteristics/limitations in previous literature can be identified, which are briefly presented in the following paragraphs, together with a description of how the present study extends the current body of knowledge.

First, the initial results of our review of the literature identified 57 studies that addressed consumer and household FW (Table S1 in the supplementary material). Less than 20% of these studies investigated household FWB in the context of a developing country. In this respect, Nahman and de Lange (2013) note that there has been a rigid spatial division in FLW literature, where studies focusing on developing countries revolve primarily around "food loss" within upstream stages of the food chain and those focusing on developed countries tend to centre more on "FW" that occurs during the consumption stages (HLPE, 2014). This tendency in the literature has been ascribed to the argument that consumer FW in developing countries is much less than that in developed countries. However, Spang et al. (2019) point out that this argument remains under-explored and unproven. Therefore, many questions related to measuring and identifying where and why FW occurs in developing countries remain unanswered (Xue et al. (2017). This presents a major shortcoming in extant literature since the likely impacts of increased consumer FW in developing countries could be even severer and challenging because FW would co-exist with food insecurity and other sustainability challenges. Therefore, the present study makes its first contribution to the existing literature by examining the determinants of FW at the household-level in the context of a developing country, Ethiopia.

The second limitation of the reviewed literature is that many of the previous studies on developing countries were not guided by a theoretical framework. The lack of an overarching theoretical framework in these studies presents a concern as theoretical frameworks provide a basis to construct and empirically test relationships between conceptual ideas and variables. In many of these studies, the role of the 'behavioural' aspects in relation to consumers' FW practices was neglected, despite that fact that consumer behaviour is increasingly becoming a major cause of FW in developing and emerging countries (FAO, 2019). In this regard, Li et al. (2018) point out that several measures have been proposed to reduce FW in recent decades with 'technological' measures being the ones that have received most interest, whereas the role of the 'human factor' in reducing FW did not receive the same level of attention until very recently, despite the fact that evidence suggests that most FW during consumption stages in developing countries can be avoidable with more sustainable consumer behaviour (Farr-Wharton et al., 2014). Thus, Stöckli et al. (2018) argue that behavioural change can play a specially effective role in reducing FW because consumption is the stage where the natural resources invested and economic value accumulate throughout the food chain. The second contribution of this study is that it adopts a behavioural perspective on FWB and integrates behavioural factors together with environmental constraints and socioeconomic characteristics of households to understand the underlying process of

[1] Scoping reviews are "preliminary assessment of potential size and scope of available research literature" with the aim to identify nature and extent of research evidence (Grant and Booth, 2009)

Table 1
List of the reviewed theoretically-based empirical literature on households' intentions and behaviours towards FW reduction during the period January 2010- January 2021:.

Study	Context	theoretical model	dependant variable	Predictors of intention and behaviour*										
				ATT	SN	DN	PBC	INT	MN	PD	EC	SA	AR	SI	SE
Aydin & Yildirim (2021)	Turkey	Theory of self-concept maintenance Intrinsic moral attitudes	Self-reported FW behaviour			–			–			+			
Van der Werf et al. (2018)	UK, Canada	TPB**	Self-reported intention to reduce FW	+-	+ +	+-	+-	–							
Heidari et al. (2019)	Iran	ETPB***	Self-reported FW behaviour	+	+		+	+							
Soorani & Ahmadvand (2019)	Iran	ETPB	Self-reported FW behaviour	+ +	+ +		+	+							
Fami et al. (2019)	Iran	TPB**	Self-reported FW behaviour			–	+				+	+ -			
Abdelradi (2018)	Egypt	Consumer behaviour	Self-reported FW behaviour								+	+			
Achemann-Witzel et al. (2018)	Uruguay		Self-reported FW behaviour	+	+				–						
Aktas et al. (2018)	Qatar	TPB	Self-reported FW behaviour	+	+		–	–							
Mattar et al. (2018)	Lebanon	Consumers' behaviour	Self-reported FW behaviour						+						
Diaz-Ruiz et al. (2018)	Spain	Theoretical model considering FW related behavioural aspects and consumer values	Self-reported FW behaviour								+			+	
Romani et al. (2018)	Italy	TPB	Self-reported FW behaviour	+	+	+	+		–			+	–		
Karim-Ghani et al. (2013)	Malaysia	TPB	Self-reported FW separation behaviour	+	+		+								
Stefan et al. (2013)	Romania	TPB	Self-reported FW behaviour		–		–	–	+					+	
Poins et al. (2017)	Greece	Theoretical model considering FW related behavioural aspects	Self-reported FW behaviour											+	
Russell et al. (2017)	UK	TPB	Self-reported FW behaviour	+	–		–	–					–		
Visschers et al. (2016)	Switzerland	TPB	Self-reported FW behaviour	+ +	+		+	+	++						
Schmidt (2016)	Germany	Integrative influence model of pro-environmental behaviour	Self-reported FW behaviour				+				+			+	
Stancu et al. (2016)	Denmark	ETPB	Self-reported food waste:	+	+		+ -	–				–			
Mondéjar-Jiménez et al. (2016)	Spain and Italy	TPB	Self-reported FW behaviour	+-	++		+ +	+	+ +					--	
Graham-Rowe et al. (2015)	UK	TPB	Self-reported FW behaviour	+	+	+	+						+	+	
Langen et al. (2015)	Germany	TPB	Self-reported food waste									+	+		
Parizeau et al. (2015)	Canada	Theoretical model considering FW related behavioural and sociodemographic aspects	Self-reported FW behaviour combined with observations of organic, recyclable, and garbage waste production rates				+		+			+	+		

* ATT = Attitude, SN = Subjective norm, DN = Descriptive norm, PBC = Perceived behavioural control, INT =vIntention, MN = Moral norm, PD = Psychological distance, EC = Environmental constraints, SA = Skills and abilities, and SI = Self-identity. The green colour indicates that the predictor was used in the reviewed article as a determinant of intention towards FW reduction, whereas blue colour indicates that the predictor was used in the reviewed article to explain households' FW behaviour. A "+/-" sign indicates that the predictor has a positive/negative effect on households' intention and/or behaviours to reduce FW. A bold font indicates that the reviewed article found a statistically significant effect of the predictor on households' intention and/or behaviours to reduce FW, whilst a regular non-bold font indicates insignificant effect.

** Extended Theory of Planned Behaviour (ETPB).

*** Theory of Planned Behaviour (TPB).

FWB. Such a comprehensive approach for establishing the determinants of consumer FWB can inform the design of evidence-based interventions to change consumer behaviour and build sustainable FW management systems.

In connection with the previous limitation, the bulk of the thin literature that has investigated the influence of cognitive and behavioural factors on consumer FWB in developing countries (e.g. Abdelradi, 2018; Soorani & Ahmadvand, 2019; Fami et al., 2019), has predominantly been based on the Theory of Planned Behaviour (TPB). Although the TPB has been the workhorse of this literature for the past decade, it has been criticized for insufficiently addressing some moral considerations including 'anticipated regret', which are particularly

important in a morally relevant domain such as FW (Manstead, 2000). Anticipated regret plays an important role in shaping pro-environmental and conservation behaviours since it measures consumers' anticipated feelings of moral regret due to wasting food (Kaiser, 2006). Likewise, there have been criticisms that TPB does not adequately account for environmental factors that influence FWB (e.g. Li et al., 2018). Therefore, several studies have emphasized the importance of adding other moral and normative predictors of behaviour (e.g. Liao et al., 2018), and situational and conditional factors to broaden the scope of TPB use and improve its predictive power in different context (e.g. Ajzen, 1991; Donald et al., 2014). The third contribution of this study is the utilization of the IMBP (Fishbein, 2008; Fishbein and Ajzen, 2010), which combines elements of behavioural prediction from TPB and the most prominent theories for this purpose, such as the reasoned action theory, the health belief model, the social cognitive theory, and the normative conduct theory. None of the reviewed literature in Table 1 adopted the IMBP, except the attempt made by Schmidt (2016), who integrated perceptual, motivational and behavioural predictors within an integrative influence model for pro-environmental behaviour to explain FW-prevention behaviours of households. The IMBP developed in the present study integrates the above-mentioned morally relevant constructs (moral norm and anticipated regret), and added three additional constructs (environmental constraints, skills and abilities and psychological distance) to the traditional TPB model to explain and predict actual FWB of households.

As shown in Table 1 another obvious limitation of the reviewed literature is that previous studies relied mostly on self-reported information regarding the amount of food thrown away by households (e.g. Aktas et al., 2018; Aydin and Yildirim; 2021; Heidari et al., 2019), which may differ significantly from the actual amounts. Previous studies have adopted a range of methods, such as FW diaries (e.g. Katajajuuri et al., 2014) and waste composition analysis (e.g. Lebersorger and Schneider, 2011) and other questionnaire-based approaches (e.g. Abdelradi, 2018; Aktas et al., 2018). Several authors highlighted the need for further research using more direct measurements to estimate consumer FW (Spang et al., 2019; van der Werf et al., 2018). The fourth contribution of the present study is given by our measurement approach of FW that was envisaged to minimize the potential gap between reported and actual FW. That is, we followed a two-step approach, where the dimensions of the container that consumers use to dispose food items were measured, and then households were asked to indicate the number of times they empty the container per week. Based on this information, we were able to provide a refined estimate of the quantity of FW.

Last but not least, despite the fact that the literature on demographic change and sustainable development establishes a relationship between economic growth and the population percentage living in urban areas, as well as the production of FW, very little of the literature reviewed in Table 1 accounted for the role of spatial variances across and within the study areas in relation to consumers FWB. As noted by Seto and Ramankutty (2016), urbanization, which is happening most rapidly in developing countries in Africa and Asia, is not just about the growth in the percentage of urban population, but also involves multiple and broader dimensions (Abu Hatab et al., 2021), including changes in shopping patterns and eating habits and spatial re-arrangement of the retailing sector. In addition, urban growth in developing countries has been associated with increased consumer FW, which poses significant threats to food system sustainability and magnifies existing challenges in terms of poverty, food insecurity and malnutrition (Abu Hatab et al., 2019). These rapid urbanization processes together with the growing middle class and the changes in dietary preferences and food consumption patterns imply that developing countries may exhibit similar patterns of consumer FW to more developed countries. A better understanding of the determinants of consumer FWB in "urbanizing" environments in developing countries can help design effective urban planning policies to transform urban food systems towards sustainability. Therefore, another added value of the present study is the relatively large sample (698 urban households) on which the empirical analysis draws. That is, compared to previous similar studies concerning consumer FWB issues in the context of SSA countries (e.g. Cronjé et al., 2018; Gikuri, 2021), the sample size and response rate of this study is highest. In connection with this, our sampling strategy allowed us to account for variations in FWB amongst dwellers of different spatial areas of the city of Addis Ababa. This city-level analysis provides a more nuanced picture of the complexity and diversity of FWB and the underlying processes of food wasting by capturing the influence of and the interaction between cultural, socioeconomic and context-specific characteristics of local consumers in various spatial settings.

3. Conceptual underpinnings of the study

As shown in Fig. 1, our IMPB approach views consumer FWB as consisting of two main subsequent stages: intention and actual behaviour. In the 'intention' stage, we followed previous TPB-based studies on consumer FWB, which emphasize the roles of attitudes, norms (subjective and descriptive), perceived behavioural control (PBC) in shaping consumers' intention toward FWB (e.g. Graham-Rowe, 2015; Soorani and Ahmadvand, 2019). Elements within this literature have also supported including 'self-identity' as a causal antecedent to attitude and also support the fact that it exerts its effects on intentions through the constructs of the model (e.g. Booth et al., 2014).

In the second stage, and according to the premise of the IMBP, behavioural intentions are anticipated to predict actual FWB. The IMBP also recognizes that the intention-behaviour relationship may become distorted by factors that inhibit or constrain the individual from performing the intended action, even if the individual has positive intentions to reduce FW, or alternatively by factors that contribute to promote, push, or encourage actual behaviour. For instance, an individual intending to reduce FW might be constrained by a lack of skills and/or abilities, by unexpected environmental barriers and constraints in regards to the performance of the actual FWB.

Thus, to adapt the IMBP for the purpose of our analysis, we followed the five guidelines in Fishbein and Ajzen (2010, p.282) by adding predictors beyond the stage of intentions in operationalizing internal components of the model to influence consumers' actual FWB. As illustrated in Fig. 1, we propose the extension and deepening of the intention-behaviour relationship within the IMBP by introducing constructs related to ethical dissonance. First, actions performed by consumers to reduce FW waste may represent a private provision of a public good (i.e. reduction of negative environmental externalities), with the private utility part related to the act of contributing to this end. Although there is little existing research on the motivations underlying such behaviour, the work by Meier (2007) suggests that self-reward, guilt reduction and self-esteem contribute to activate such behaviours. The psychological phenomena of ethical dissonance is identified from the inconsistency between sustaining a moral self-image and the temptation of benefiting from deviating from what one should do (Barkan et al., 2015). Therefore, moral norms are introduced into the IMBP to represent the obligation and right behaviour to choose and act for a positive self-esteem (Stern, 2000).

Then, when acting against this norm, and following Thørgersen (2006), the individual may experience bad conscience and feelings of guilt. Thus, the construct of anticipated regret was introduced together with the moral norms construct to operationalize the trade-off between the behavioural obligation and its potential emotional cost. Furthermore, as both moral norms as well as anticipated regret are two-dimensional constructs weighing in a social distance (own-self vs. distant other) and a temporal distance (now vs. distant future) (Todorov et al., 2007), we also include the construct of psychological distance. A greater psychological distance, thus viewing the reduction of FW as more desirable than feasible and thus less own-and-now centred is then associated with a lower likelihood of actions taken to reduce FW. Finally, Fig. 1 shows that individual difference and background and

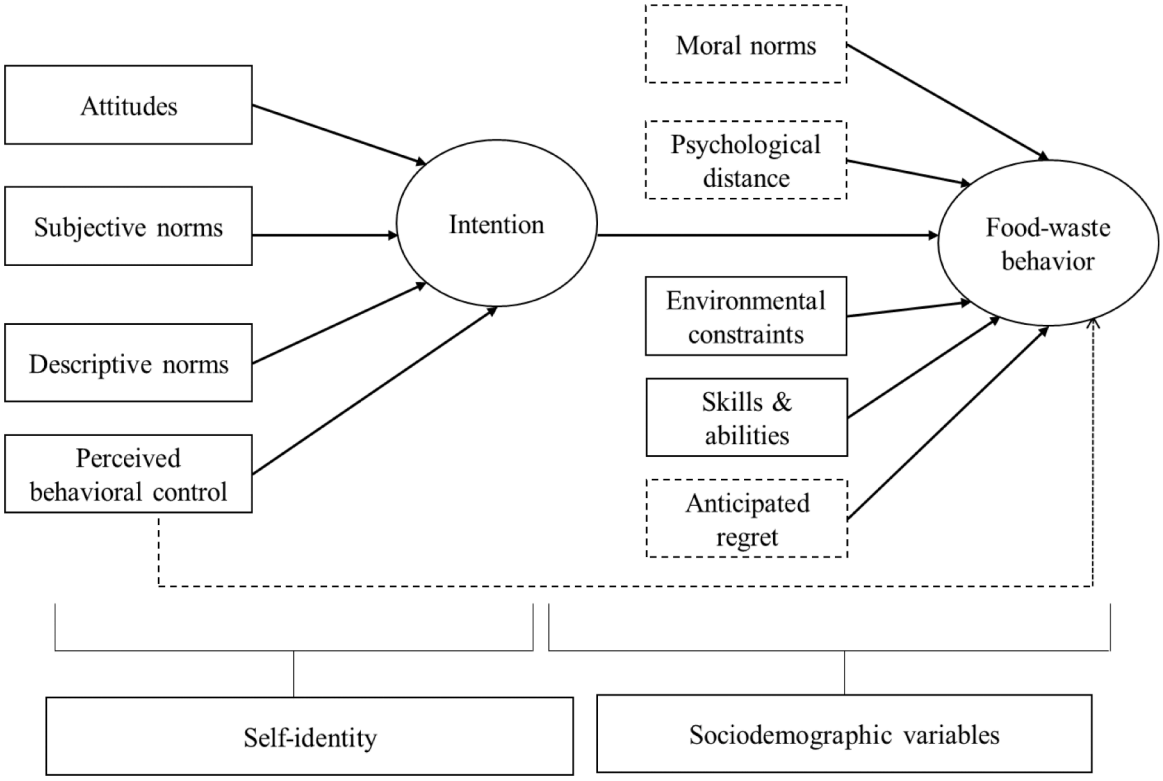

Fig. 1. The integrative model of behavioural prediction related to household food waste behaviour
Note: Partially adapted from Fishbein (2008), Fishbein and Ajzen (2010). Constructs introduced by the authors to the IMBP are in dash-dot line.

distal factors, such as household income, household size, age and education level (Song et al., 2018), may indirectly influence FWB.

4. Data and methods

4.1. Survey design

In accordance with our theoretical model in Fig. 1, a paper-based questionnaire was designed to investigate the determinants of FWB amongst urban and peri-urban consumers in Addis Ababa. The final questionnaire was translated into Amharic, and reviewed by three local researchers in the fields of waste management, environmental sustainability and agricultural economics. Then, the questionnaire was pretested with 20 dwellers randomly selected from the 10 districts of Addis Ababa to ensure the appropriateness and clarity of questions and to ascertain that respondents comprehended and answered the questions as intended. The final questionnaire contained informed consent and consisted of five main sections. A copy of the questionnaire is available in the Supplementary material of this paper. Section 1 contained questions related to the sociodemographic characteristics of the respondents and their households. Section 2 consisted of questions related to food buying and eating habits and Section 3 included questions related to reasons for discarding food. Finally, in Section 4, a set of statements and questions covering the behavioural constructs displayed in Fig. 1were included to investigate consumer FWB.

With regard to the assessment of consumer FWB (Section 4 of the questionnaire), questions were adapted mainly from previous studies cited in the introduction and the theoretical framework sections of this study. Except for the attitude and psychological distance constructs, a seven-point Likert-scale ranging from "strongly disagree" (1) to "strongly agree" (7) was used to collect answers to questions related to the behavioural constructs. Attitudes toward FW were assessed using five 7-point bipolar items, with higher scores indicating more positive attitudes toward FW. Psychological distance to FWB was measured using 3 items covering the social, temporal and spatial dimensions in relation to FWB. The exact questions and the response options are presented in the attached questionnaire in the supplementary material.

4.2. Study area and sampling strategy

With a population estimated at 4.7 million in 2020, Addis Ababa is the capital and largest city in Ethiopia, and one of the rapidly growing economic and political centres in Africa (World Bank, 2015). The city is home to around 40% of the total urban population in Ethiopia (Schmidt et al., 2018). With a rapid urbanization rate of around 19%, the population of Addis Ababa is projected to further grow by the year 2035 (OECD, 2020), which is expected to bring significant land use changes, to add pressures on the food system and to have major consequences on poverty and food security (Goshu et al., 2013). In this regard, the 2016 Demographic and Health Survey report already indicates that food security is a pressing issue, with nearly 15% of children under five years of age being chronically undernourished (Central Statistical Agency (CSA) [Ethiopia] and ICF 2016), and 13% and 18% of women and men (between 15 and 49 years), respectively, being underweight. In tandem with urban sprawl, rising incomes and rural-urban migration, Addis Ababa has been experiencing a surge in urban food demand and increased FW generation at the consumer level (Schmidt et al., 2018), which contributes at least 60–70% to the total waste generated in the city (Adebe, 2018). In this regard, Wubneh (2013) points out that growing levels of consumer FW in recent years represents one of the most challenging environmental issues for the local authorities of Addis Ababa, thus posing further social, economic and environmental challenges.

As shown in Figure S.1 in the supplementary material, Addis Ababa contains 10 sub-city administration (or districts). According to (Erena, 2017), these 10 districts can be categorized into four settlement areas. Historically, the development of these settlement area coincided with the economic development of Addis Ababa. Generally, districts within

each settlement area share common social, economic and environmental characteristics. However, the four settlement areas differ widely in terms of their socioeconomic and environmental conditions, which may influence household FWB. The first settlement area is referred to as the Early Settlement (1886–1935) and it consists of Addis Ketema and Arada, which are characterized by slums and very low-income levels compared to the other categories. The second settlement area was developed during the Italian (1935 - 1941) and Post-Italian (1941–1974) Periods and it consists of Kirkos, Lideta and Gulele. The third settlement area was developed during the Derg era (1974–1991) and it consists of Kolfe Keranio and Nifas Silk. The fourth settlement area was developed during the Post Derg Era since 1991, and it consists of Akaki Kaliti, Bole, and Yeka.

Each of 10 districts of Addis Ababa consists of an average of 12 *Woredas*[2] (AACA, 2020). Population data for each *Woreda* were obtained from the Addis Ababa City Administration (AACA). The study implemented a cluster sampling strategy to collect data from these Woredas based on their share of the total population of Addis Ababa. To randomize the distributions of the sample, we further randomly draw an average of four *Woredas* from each district (nearly 30% of the total *Woredas* in the corresponding sub-city administration). That is, we allocated a proportional number of the sample size (n) across the selected *Woredas* considering the population (N) weight in each sub-city administration. To minimize selection bias, we implemented the following strategy. First, the enumerator drew the first household from centre of each selected *Woreda*. Next, the enumerator picked the second household with a minimum distance of 200 m difference in the right direction until reaching the boundary of the Woreda. Later, the enumerator shifted direction to the left and kept the same distance interval to identify the remaining households. The administration of the selected *Woredas* helped the research team identify the centres of the *Woredas*. Finally, 698 respondents were sampled from the selected *Woredas*. Table S.2 in the supplementary material summarizes the sampling technique.

4.3. Study population

Data collection took place between December 2019 and January 2020 using a face-to-face household-level survey. At the beginning of the interviews, the enumerators provided the respondents with a brief introduction to the study and obtained their consent to participate in the survey. The selection of the respondents was based on two participation criteria, determined by their answers to two questions: whether they are responsible for planning and doing the shopping in their household and whether they are responsible for preparing and cooking food in their household.

If the answers to these questions were yes, then the person was regarded as eligible for participation in the survey, as these individuals are more likely to possess the knowledge and perspective needed to give accurate information concerning the determinants of FW within their corresponding households. The sample comprised 698 participants distributed across the four settlement areas encompassing the 10 districts of Addis Ababa. Sample characteristics are presented in Table 2.

Table 2
Characteristics of the participants surveyed ($N = 698$).

Characteristics	Percentage
Gender	
Female	78.51
Male	21.49
Age	
<35	28.80
35 to <44	33.24
44 to <55	20.92
>55	17.05
Marital Status	
Married	80.66
Non-married	19.34
Occupation	
Full time employed	48.42
Housewife	37.68
Retired	2.58
Student	1.29
Unemployed	10.03
Monthly income (ET birr)	
<3000	43.12
3000 to <5000	18.62
5000 to <8000	22.64
>8000	15.62
Educational attainment	
Below primary	33.52
Primary	16.33
Secondary	26.93
University or above	23.21
Household size	
≤ 3	29.60
4	20.78
5	22.12
>5	27.50
Settlement area	
Settlement Area 1 (Addis Ketema and Arada)	17.05
Settlement Area 2 (Kirkos, Lideta and Gulele)	24.64
Settlement Area 3 (Kolfe Keranio and Nifas Silk)	34.67
Settlement Area 4 (Akaki Kaliti and Bole, and Yeka)	23.64
Frequency of food shopping (per week)	
<3 times	26.93
3 to 5 times	30.37
≥6 times	42.69

4.4. Measures and covariates

4.4.1. The dependant variable

Theoretically, measures of behaviour should adhere to the "principle of correspondence". That is, a behaviour should have an action, target, time, and context. We specified the action as “throwing away food,” the target as “the quantity of food thrown away and number of times the household emptied the bin,” the context as “food that is appropriate for household consumption,” and the time as “the last seven days.”

Specifically, the quantity of good thrown away during the last seven days was measured with a reference to commonly used local plastic containers called “pestal”. Traditionally, households in Addis Ababa use these containers as a trash bin, which carry up to 5 kgs at full capacity. Each enumerator had this pestal during the interviews to compare the actual bag with the one households are using. If it was an identical pestal, they asked how many times per week they emptied it and then recorded the corresponding quantity of discarded food. In some cases, households use an open jar to store FW. This jar is usually labelled with the number of litres it holds (originally made to store liquid items such as water) and the enumerators converted the corresponding litre amount into kilograms (1kilogram = 1 litre).

4.4.2. Measures of the intention of households to reduce food waste[3]

Intention[4] refers to an individual’s willingness and readiness to commit himself or herself to engage in a FWB in the future (Visschers et al., 2016). In this study, intention towards FW was measured using five items (see the attached copy of the questionnaire in the

[2] Districts in Ethiopia are locally known as “*woreda*”, which represent the third level of the administrative division managed by a local government.

[3] The Cronbach’s Alpha test statistic was employed to check the internal consistency of all constructs related to the intention as well as FWB components of the conceptual model.

[4] In line with our IMBP in Figure 1, intention was included in the four estimated BLR models as a predictor of households’ actual food waste behavior. The construct has a Cronbach’s alpha of 0.78.

supplementary material). The following five measures were used to explain the intentions of households towards reducing the amount of FW:

- **Self-Identity** (Cronbach's alpha = 0.70) refers to salient and enduring aspects of an individual's self-perception and reflects the extent to which performing a certain behaviour is perceived as an important component of the individual's self-concept. The construct was measured using four items.
- **Attitudes** (Cronbach's alpha = 0.69) toward FW were measured using five bipolar items. Specifically, the question was asked as follows. For me to reduce the amount of food that gets thrown away from my household would be "bad vs. good", "useless vs. useful", "foolish vs. wise", "unenjoyable vs. enjoyable" and "worthless vs. worthwhile".
- **Subjective norms** (Cronbach's alpha = 0.67): The construct was measured using five items that reflect an individual's belief that an important person or group of people would support or approve a particular behaviour performed by the individual.
- **Descriptive norms** (Cronbach's alpha = 0.68): Five items were included in the questionnaire to measure this construct, which refers to the influence of what the majority of people often do in a given situation on an individual's decision to perform a certain behaviour or not (Graham-Rowe et al., 2015).
- **PBC**[5] (Cronbach's alpha = 0.81): The construct was measured using four items that reflect the extent to which an individual perceives the easiness or difficulty of engaging in a behaviour (Heidari et al., 2020).

4.4.3. Measures and predictors of households' FWB

The following set of IMBP predictors and sociodemographic variables were used in the empirical analysis to explain and predict households' actual FWB:

- **Moral norms** (Cronbach's alpha = 0.83): Five items were included in the survey to capture the morality rules that people ought to follow and that can influence their FWB.
- **Psychological distance** (Cronbach's alpha = 0.76): This refers to the extent to which an individual perceives events with the theorized dimensions of distance: temporal, social, geographical, and uncertainty (Spence et al., 2012). The effect of psychological distance on FWB was measured using 3 bipolar items with a 7-point scale covering temporal, social and geographical dimensions of distance.
- **Environmental constraints** (Cronbach's alpha = 0.78): We used 5 items to capture the influence of structures in the environment where the individual lives that affect FWB, such as food infrastructure, technical appliances and other factors that may facilitate or inhibit the individual from performing a certain behaviour (van Geffen et al., 2020). That is, consumers may consider food-waste behaviour to be under their control, but at the same time, they may perceive that behaviour as difficult to carry out.
- **Skills and abilities** (Cronbach's alpha = 0.81): Seven items were included in the survey to assess the role of skills and abilities on FWB, which refer to an individual's knowledge of how to perform the intended behaviour, to identify responsibility for the intended behaviour and to assess the perceived effectiveness of the behavioural act (Al-Sari et al., 2012).
- **Anticipated regret** (Cronbach's alpha = 0.86): This refers to the beliefs about the expected post-behavioural negative feeling that an individual would experience if a certain behaviour is or is not performed (Davidson et al., 2003). We measured this construct using four items.
- **Sociodemographic characteristics** of the respondents and their shopping habits were included in the empirical analysis as they were anticipated to influence the beliefs that an individual holds about a particular behaviour (e.g. Song et al., 2018).

4.5. Data treatment and analysis

4.5.1. Estimation procedures and analysis of intention towards reducing FW

In the first step of our empirical analysis, hypothesized relationships between constructs explaining intentions toward FW in Fig. 1 were investigated using a structural equation modelling (SEM). The model was developed and estimated using STATA (v. 16) software. Sample covariance matrix was used as input and a maximum likelihood method was employed to estimate the parameters. The comparison between different SEM specifications and the selection of the final model were based on the calculated absolute fit indices, the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI). Table S.4 in the supplementary material presents inter-correlations between the predictors of intention. All variables had positive and statistically significant correlations with intention. The only exception is the variable subjective norms, which is negatively correlated with intention; but the magnitude of the coefficient is too small and the coefficient is statistically insignificant.

4.5.2. Estimation procedures and analysis of the actual FWB of households

The next step of our empirical analysis focused on examining the behavioural prediction of actual FWB. First, descriptive analysis to explore the distribution of the dependant variable (actual FW) was performed. The histogram in Fig. 2 suggests that the distribution of the dependant variable is non-normal and positively skewed, where most amounts of FW reported by the respondents were clustered around the left tail of the distribution.

Second, a multiple linear regression (MLR) analysis was used to explore the association between the dependant variable and all explanatory variables listed in Table 1. In particular, the fact that our dataset contains several variables implies that there is a possibility that some of the explanatory variables might be inter-correlated causing multi-collinearity that could increase the standard errors of the coefficients, and thus make estimated coefficients less significant. The results of the MLR model showed values of the variance inflation factors (VIF) smaller than five, implying that there is no problem of multicollinearity between the predictive variables (Table S.5 in the supplementary material).

Third, for further regression analysis, the dependant variable was categorized into four clusters as follows: amounts of 0.5 Kg/week or smaller as very low food waste (VLFW), amounts greater than 0.5 and smaller than 1 Kg/week as low food waste (LFW), amounts greater than 1 and smaller than 2 Kg/week as moderate food waste (MFW), and amounts equal to or greater than 2 Kg/week as high food waste (HFW). From an analytical perspective, this categorization is interesting as it allows us to examine how our conceptual model explains and predicts the actual FW across the four clusters of FW that we observe in Fig. 2.

Fourth, the structure of our dependant variable (four ordinal categories) implies that an ordinal logistic regression approach using a maximum likelihood estimator should be adopted instead of the standard linear regression approach. To this end, an ordinal logistic regression (OLR) is appropriate if the proportional odds assumption, which assumes that the relationship between the predictors and the dependant variable does not differ across the varying categories of the

[5] In line with our IMBP in Figure 1, PBC was used both in the SEM to explain both intentions towards reducing food waste, and in the BLR models to explain actual food waste behaviour.

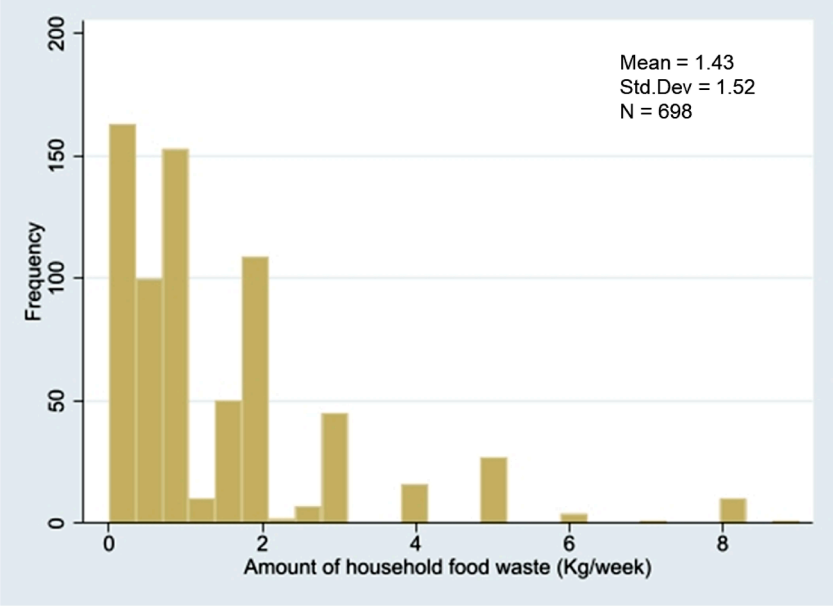

Fig. 2. Distribution of actual food waste in kg per household during the seven-day sampling period
Source: Survey results.

dependant variable (although the intercepts will change), cannot be rejected (Liang et al., 2020). A likelihood ratio test[6] performed between the OLR and a multinomial model, however, showed that the use of a proportional odds model was inappropriate.

The next step was then to test which IMBP model constructs contribute to this result. This was done using the R-package ordinal (Christensen, 2019). The results showed that several IMBP constructs significantly contributed to the rejection of the proportional odds model. Specifically, in order to examine the determinants of FW across the four sub-categories of the dependant variable, we followed Bender and Grouwen (1998) and Agresti et al. (2008) and fitted a binary logistic regression (BLR) model for each sub-category. Table 3 below provides operational definitions, categorization and descriptive statistics of the IMBP variables included in the binary logistic regressions. Indicator coding was applied based on the empirical distribution of each variable to facilitate interpretation of effects.

Finally, the IMBP variables as well as the sociodemographic variables used in predicting the FWB of households. To reduce the risk of overfitting, we used the stepwise approach to minimize the Aikaike Information Criterion (Venables and Ripley, 2002). In addition to the IMBP variables (Table 3), this analysis included the sociodemographic variables in Table 2, with the exception of gender, marital status and occupation, as these were seen as related more closely to whom we interviewed rather than to the amount of FW that the study aimed to explain and predict. The predictive accuracy of each model fitted was calculated as the sum of diagonal terms divided by the total sum of the terms in the confusion matrix (observed values (rows) vs. predicted classification (columns)). The analysis was done in R 4.0.5 (R Core Team, 2021).

Table 3
Definition, categories and summary statistics of the IMBP variables used as covariates.

Predictors Variable	Summary statistics Categories*	Mean	Std. Dev.	Obs.
Intention (INT)	• INT (*low*): INT<6 • INT (*medium*): 6< INT <6.9 • INT (*high*): INT=7	6.03	0.898	695
Perceived behavioural control (PBC)	• PBC (*low*): PBC <5.74 • PBC (*medium*): 5.75<PBC<6.25 • PBC (*high*): PBC≥6.5	5.93	0.926	697
Anticipated regret (AR)	• AR (*low*): AR<5.75 • AR (*medium*): 6.0<AR<6.5 • AR (*high*): AR≥6.5	6.06	0.853	689
Moral norm (MN)	• MN (*low*): MN<5.6 • MN (*moderate*): 5.8<MN<6.6 • MN (*high*): MN≥6.8	5.91	1.01	691
Skills and abilities (SA)	• SA (*low*): SA<5.13 • SA (*medium*): 5.25<SA<6 • SA (*high*): SA≥6	5.33	0.82	696
Environmental constraints (EC)	• EC (*very low*): EC<1.6 • EC (*low*): 1.8<EC<3 • EC (*moderate*): 3.2<EC≤4.6 • EC (*high*): EC≥4.8	3.63	1.66	695
Psychological distance (PD)	• PD (*low*): PD<3.33 • PD (*medium*): 3.67<PD<4.33 • PD (*high*): PD≥4.67	3.96	1.421	964

Note: the "*low*" category of all predictors, except for the EC, was used in the model estimations as a reference category. For the EC predictor, the "very low" category was used as the reference category.

[6] The (log) likelihood ratio statistic is often referred to as the deviance. The deviance for a logistic model can be likened to the residual sum of squares in ordinary least squares regression for the linear model (McCullagh and Nelder, 1989). The smaller the deviance the better the fit of the logistic model. The estimated residual deviance for the OLR model was 1657.979, whilst that for the MNL model was 1509.281 implying that there is no support for an ordinal model with proportional odds.

5. Results and discussion

In the following sub-sections, we first report SEM results for the determinants of households' intention towards FW. Then, we report the results of the binary logistic regression for the IMBP constructs explaining households' FWB. Finally, we report the parsimonious binary logistic regression of IMBP constructs as well as sociodemographic variables and food shopping habits predicting households' actual FW.

5.1. SEM results of intentions of households to reduce FW

The results indicated that SEM adequately fit the data, with CFI = 0.903, TLI = 0.975, the chi-square per degree of freedom is less than three (χ^2/df = 2.816), and the model has a reasonably accepted RMSEA = 0.074. The standardized SEM results displayed in Fig. 3 shows that self-identity is a positive and statistically highly significant antecedent of all predictors of intention. This comports with the findings of Booth et al. (2014) showing that self-identity exerts its effects on intention by influencing constructs of intention-predicting models.

We found that positive attitudes ($\beta = 0.17$; $p < 0.01$) towards FW reduction are positively correlated with stronger intentions to decrease FW, which corroborates the findings of recently published studies on consumer FWB (e.g. Heidari et al., 2020). PBC ($\beta = 0.31$; $p < 0.01$) was found to have a strong significant explanatory power of behavioural intention, which is in conformity with the findings of Heidari et al. (2018). The findings related to subjective norm ($\beta = -0.04$; $p > 0.1$) and descriptive norm ($\beta = 0.45$; $p < 0.1$) lend support to the findings of La Barbera and Ajzen (2020), which pointed out that these two constructs are less indicative of consumer's intention to perform a behaviour.

5.2. Binary logistic regression results of the extended IMBP constructs on households' FWB

Our descriptive analysis of the survey data showed that the amount of food thrown away by households averages 1.4 kg/week, with a standard deviation of 1.5 Kg. A breakdown of food commodities/categories that were listed by the respondents as the most thrown away by the household revealed that leftovers on plates come first (65.2%), followed by over-cooked foods (14.3%), stored foods that ended up unconsumed (13.2%), food bottles opened but were unused (6.6%) and other foods items such as fresh fruit and vegetables (0.7%).

Table 4 provides the estimated coefficients (in log odds) and the adjusted odds ratios (ORs) of the estimated BLR model for the influence of different categories of the IMBP predictors on households' actual FW. Following Greene and Hensher (2008), the ORs were calculated to facilitate the interpretation of the relevant size and magnitude of the effect of the IMBP predictors on households' actual FW. The ORs in each regression can be interpreted as the effect each IMBP predictor has on the odds of being in the corresponding FW category, adjusted for the effects of all the other predictor variables included in the model. Thus, the odds ratio reflects the increase (decrease) in the odds of being classified in a group when the predictor variable increases (decreases) by one unit.

With regard to the intention of households to reduce FW, most of the coefficients of the four estimated models were statistically insignificant. Counterintuitively, the results show that households with stronger intentions towards reducing FW are more likely to be high food wasters (2 Kg or more per week) compared to those who have weaker intentions to decrease FW. In this respect, Chao (2012) point out that self-reported intentions do not fully reflect the actual behaviour of individuals, but they only reflect their perceptions about their own behaviours. The results related to PBC tend to suggest that higher the extent to which an individual perceives the easiness of reducing household FW, the lower the probability that the household would throw away more food. Specifically, the results reveal that respondents who perceived high control over their FW behaviour were 0.64 times less likely than those who perceive low control to belong to the MFW category of the dependant variable (greater than 1 and less than 2 Kg/week). In contrast, they were more likely than those who perceive low control to throw away small amounts of food every week (greater than 0.5 and less than 1 Kg/week).

With only one exception, the estimated coefficients of "anticipated regret" in the four estimated models were statistically insignificant. The OR of this predictor in the VLFW Model was highly statistically significant, suggesting that those who would experience moderate levels of a prospective regret when imagining how they would feel if they waste food are more likely, than those who would experience low levels of regret, to belong to the VLFW category. Largely, the calculated ORs of this predictor across the four models imply an absence of anticipated regret amongst those who waste more food. The "regret regulation theory" provides a possible explanation for the insignificance and unexpected influence of this construct on the FWB of households, while it posits that some individuals are more inclined towards protecting themselves from regret feelings when making decisions, whereas others are less so (Nygren, 2000). Thus, the former type of individual is expected to perform behaviours that minimize regret or avoid performing behaviours due to the fear of subsequent regret feelings. In addition, Djulbegovic et al. (2015) find that individuals who report higher levels of regret are more indecisive and that they experience difficulties in making choices and express self-doubt about decision-making ability to perform a behaviour.

The ORs related to "moral norms" in Table 4 were statistically highly significant, relative to those related to intention and anticipated regret. The results reveal that the more an individual feels obliged to discard less food, the higher the odds that the quantity of food that gets wasted by the household would be reduced. Specifically, those who have moderate to higher levels of moral norms are around 2 times more likely than those who have low moral norms, to waste between "very low" and "low" amounts of food. At the same time, they are significantly less

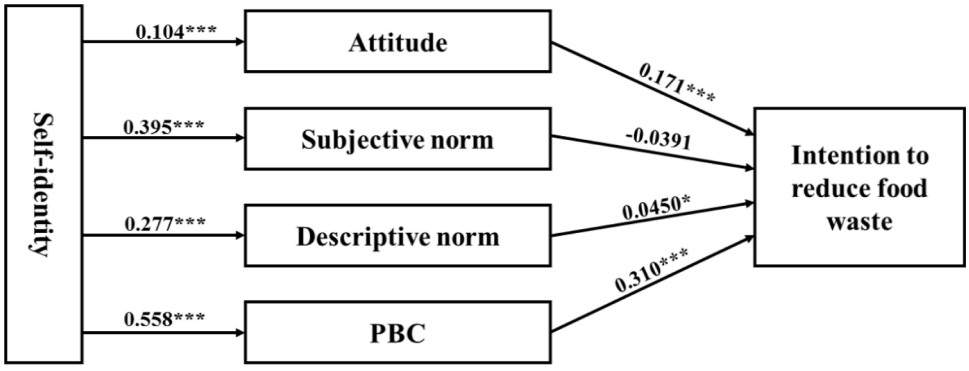

Fig. 3. Structural model estimates of determinants of respondents' intention to reduce food waste
Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 4
Binary logistic regression of IMBP constructs on households' actual food waste.

Variable [a, b,c]	Categories for actual food waste VLFW	LFW	MFW	HFW
Intercept	−2.47***	−2.71***	−1.17***	0.284
Intention (*medium*)	0.009	**−0.586****	0.252	0.281
	(1.009)	(0.557)	(1.287)	(1.324)
Intention (*high*)	−0.391	−0.268	0.255	**0.533***
	(0.676)	(0.765)	(1.290)	(1.704)
Perceived behavioural control (*medium*)	−0.061	**1.344*****	**−0.587****	−0.007
	(0.941)	(3.834)	(0.556)	(0.993)
Perceived behavioural control (*high*)	0.100	**0.696****	**−0.439***	−0.038
	(1.105)	(2.006)	(0.645)	0.963
Anticipated regret (*medium*)	**−0.893*****	0.221	0.006	0.312
	(0.409)	(1.247)	(1.006)	(1.366)
Anticipated regret (*high*)	−0.508	−0.434	0.255	0.103
	(0.602)	(0.648)	(1.290)	(1.108)
Moral norm (*medium*)	**0.667****	**0.797****	0.120	**−1.01*****
	(1.948)	(2.219)	(1.127)	(0.364)
Moral norm (*high*)	**0.787***	**0.830***	0.418	**−1.35*****
	(2.197)	(2.293)	(1.519)	(0.259)
Skills and abilities (*medium*)	0.464	−0.116	**0.453****	**−0.60*****
	(1.590)	(0.890)	(1.573)	(0.549)
Skills and abilities (*high*)	−0.054	−0.426	0.218	0.157
	(0.947)	(0.653)	(1.244)	(1.170)
Environmental constraints (*low*)	**1.31****	0.204	**0.549***	**−1.723*****
	(3.706)	(1.226)	(1.732)	(0.179)
Environmental constraints (*medium*)	**2.13*****	−0.012	**−0.483***	**−1.096*****
	(8.415)	(0.988)	(0.617)	(0.334)
Environmental constraints (*high*)	**−1.26****	0.546	**0.800*****	**−0.574***
	(0.284)	(1.726)	(2.226)	(0.563)
Psychological distance (*medium*)	**0.844*****	−0.102	**−0.844*****	−0.034
	(2.326)	(0.903)	(0.430)	(0.967)
Psychological distance (*high*)	**−2.27*****	**−0.614****	0.211	**1.148*****
	(0.103)	(0.541)	(1.235)	(3.152)
Deviance (null)	758.7	587.7	857.1	868.4
Deviance (residual)	510.6	548.3	774.3	748.4
AIC	542.6	580.3	806.3	780.4
McFadden	0.327	0.067	0.097	0.138
Proportion of observations	23.4%	14.9%	30.4%	31.4%

Note:.
[a] Indicator (dummy) variables with reference category set as follows (INT<6.0; PBC<5.75; AR<5.75; MN<5.6; SA<5.13; EC<1.6; PD <3.33).
[b] in log-odds.
[c] numbers between parentheses are odds ratios. Categories for the dependant variable are: very low food waste (VLFW), low food waste (LFW), moderate food waste (MFW) and high food waste (HFW). Significance: *** p(>?z? <0.01), ** $p < 0.05$, * $p < 0.1$" in Table 4 with * , ** and *** = significant at 1%, 5% and 10%, respectively

likely than those who have low moral norms to waste "high" amounts of food. Likewise, albeit the insignificance of the majority of the calculated ORs,

For those who perceive lower and medium levels of "environmental constraints", the results show that the odds of wasting very small amounts of food are highly statistically significant, being 3.7 and 8.4, respectively. In contrast, compared to those who belong to the reference category (perceivers of very low environmental constraints), the results reveal that households that perceive high levels of environmental constraints are more likely to waste greater amounts of food, as suggested by the statistically significant OR (2.2) in the MFW model. These findings imply that addressing both infrastructural challenges (e.g. improving households' access to stable electricity supply in the neighbourhood[7]) and promoting pro-environmental behavioural change interventions (e.g. providing access to information and building the capacity of households to handle, prepare and store food in order to reduce FW) can significantly help households reduce their FW. It is important to emphasise here that addressing infrastructural constraints and promoting pro-environmental behavioural change should go hand in hand. This is because income growth and economic development often stabilize electricity supply in developing countries and enable households to use larger storing facilities (e.g. fridge and freezer) that may motivate them to buy and cook more food than they need, which could then end up uneaten and finally be thrown away (Aschemann-Witzel et al., 2018); Farr-Wharton et al., 2014). Therefore, van Holsteijn and Kemna (2018) underline the importance of consumers' knowledge in relation to adequate and proper storage of food to reduce FW.

Linking the results of the four models regarding "environmental constraints" with those related to "skills and abilities", as expected we find that the two predictors tend to have an opposite effect on the amounts of food thrown away be the surveyed households. That is, a higher perception of environmental constraints was associated with more FW, whereas greater skills and abilities were associated with lower FW. In this respect, previous studies pointed out how there are certain factors that bridge and determine the extent of the "intention–behaviour" gap, which traditionally exists in sustainable consumption (e.g. Hassan et al., 2016). In the context of the present study, "skills and abilities" imply an intention to achieve some desired result (that is, reduce FW) through action. Given that an action-taking process entails some notions of cause and effect, "skills and abilities" bridge the gap between intention and behaviour and make the actual behaviour conform to the one that was intended. In contrast, "environmental constraints" have a negative impact on consumer FWB, but the construct similarly influences the gap between intention and actual behaviour, since these constraints present non-motivational factors that restrict the application of "skills and abilities", and therefore may cause a failure to enact an intended behaviour.

Finally, the ORs of the "psychological distance" construct generally indicate that those who reported greater psychological distance to FW are about 3 times more likely to waste high amounts of food, compare to others who reported low psychological distance. This finding suggests that an increase in psychological distance turns individuals' thoughts regarding FW to being more abstract and less concrete. Accordingly, this would decrease the likelihood that households would behave in a way that decreases FW and would make them less motivated to change their behaviours to minimize or prevent FW in the future. This finding accords with the findings of van Dam et al. (2016) calling for the need to integrate psychological constructs and theories into socioeconomic models of consumer behaviour in order to understand the discrepancy between sustainable "attitudes" and "actual behaviour" toward FW reduction.

5.3. *Predicting households' actual FWB*

Table 5 presents BLR model results including IMBP constructs, personal characteristics of the respondents and households' food shopping habits. A comparative look at the estimated models in Tables 4 and 5 shows that the results are generally similar in terms of the signs, magnitude and significance. Therefore, our discussion in this section will focus on the results related to respondents' sociodemographic characteristics and their food shopping habits.

With regards to the socioeconomic characteristics of the respondents, the calculated ORs show that compared to younger respondents (<35

[7] These examples of technological and behavioral changing interventions are based on the statements included in our survey.

Table 5
Parsimonious (stepwise to minimize the AIC measure) binary logistic regression of IMBP constructs and sociodemographic variables on households' actual FWB.

Variable[a, b]	Categories for actual food waste			
	VLFW	LFW	MFW	HFW
Intercept[c]	−0.184 (0.83)	−1.666*** (5.29)	−0.888** (0.411)	−3.19*** (0.041)
Intention (*medium*)		−0.645** (0.525)		
Intention (*high*)		1.470*** (4.349)	−0.432* (0.649)	
		0.654*(1.923)	−0.346 (0.707)	0.321(1.378)
Perceived behavioural control (*medium*)	−0.743***(0.48)			0.395* (1.484)
		−0.715**(0.489)	0.212* (0.489)	
Perceived behavioural control (*high*)		0.668**(1.950)		−0.697***(0.498)
		0.611(1.842)		−0.914**(0.400)
Anticipated regret (*medium*)	0.549**(1.731)		0.391**(1.478)	−0.659***(0.517)
Anticipated regret (*high*)	1.386***(3.998)		0.652**(1.919)	−1.432***(0.239)
	1.767***(5.853)	−0.403(0.668)		−0.412*(0.662)
Moral norm (*medium*)	−1.242**(0.289)		1.250***(3.490)	
		−0.590**(0.554)	−0.597**(0.550)	
Moral norm (*high*)	−2.156***(0.116)			0.901***(2.462)
Age				
35 to <44			−0.341(0.711)	
44 to <55		**0.650****(1.915)	**−0.510****(0.600)	**−0.547****(0.579)
≥55				**−0.734****(0.480)
Monthly income				
<3000	**0.575****(1.777)		**−0.684*****(0.505)	0.918*(**2.504**)
3000 to <5000		−0.516(0.597)		**1.254****(3.504)
5000 to <8000	**−0.784***(0.457)	**−1.322*****(0.267)	**0.473****(1.605)	**1.461****(4.310)
≥8000	**−1.920****(0.146)	**−2.325****(0.098)		**2.072*****(7.940)
Educational attainment				
Primary		**0.840****(2.316)		
Secondary	**0.631***(1.879)			
University or above			**−0.494****(0.610)	
Household size				
≤ 3				
4	−0.48(0.618)		−0.394(0.674)	**0.727****(2.068)
5		**−0.530****(0.589)	**−0.773*****(0.461)	**1.278*****(3.589)
Settlement area				
Settlement Area 3	**−1.582*****(0.206)			
Settlement Area 4	**−0.622***(0.537)	**−0.519***(0.595)	**−0.653*****(0.520)	**0.941*****(2.562)
Frequency of food shopping [d]				
3 to 5 times	**−1.747*****(0.174)		**0.605****(1.831)	**1.089*****(2.971)
≥6 times	**−1.546*****(0.213)		**1.06*****(2.88)	**0.667***(1.948)
Deviance (null)	758.7	587.7	857.1	868.4
Deviance (residual)	423.4	498.0	723.7	646.1
AIC	455.36	530.0	759.7	688.0
Predictive accuracy	87.8%	85.4%	73.4%	76.4%

Note:.
[a] Indicator (dummy) variables for the dependant variable are: very low food waste (VLFW), low food waste (LFW), moderate food waste (MFW) and high food waste (HFW).
[b] in log-odds.
[c] numbers between parentheses are odds ratios.
[d] the reference category for the frequency of shopping is "< 3 times/week". Significance: *** p(>?z? <0.01), ** $p < 0.05$, * $p < 0.1$" in Table 5 with * , ** and *** = significant at 1%, 5% and 10%, respectively

years old), older respondents who belong to the age groups 44 years old or older are significantly less likely to waste high amounts of food. This finding, that age has a positive effect on FW reduction is in keeping with previous studies, which suggested that older consumers generally generate lower amounts of FW than younger consumers (e.g. Wakefield and Axon, 2020). In the context of Addis Ababa, this can be attributed to two main reasons. First, previous experiences of the 1983–1985 famine in Ethiopia and austerity may have shaped negative attitudes towards food wastage (Arage et al., 2021). Second, older people are significantly less prone to stockpiling and making excessive and unnecessary purchases because they generally have more free time to buy and prepare fresh foods.

Interestingly, the results show that the level of income is positively associated with an increased FW. For instance, the ORs for the HFW model climb from 2.5 for individuals with less than 3000 ETB per month to 3.5 for individuals with incomes ranging between 3000 and 5000 ETB per month, 4.3 for individuals with incomes ranging between 5000 and 8000 ETB per month, and 7.9 for individuals with incomes higher than 8000 ETB per month. In connection with this finding, the results reveal that households dwelling in more economically and socially developed areas of Addis Ababa (e.g. Akaki Kaliti, Bole and Yeka) are more likely to waste higher amount of food than those residing in poorer and less urbanized settlement areas (settlement areas 1 and 2). In this vein, previous studies show that growing urbanization trends in developing countries are causing substantial shifts in the organization of food supply chains and major changes in shopping patterns and food consumption habits that have been associated with increased FW generation at household levels (Abu Hatab et al., 2019).

In addition, previous studies reveal that higher incomes are positively related with increased grocery expenditure, increased consumption of more perishable items (e.g. fruits and livestock-source products) and thus increased generation of FW (e.g. Parizeau et al., 2015; Wakefield and Axon, 2020). In contrast, lower earnings are associated with less FW because the diets of poorer households in Ethiopia, like in other developing countries, predominantly consist of staple foods that are less likely to spoil, and poor households cannot afford to discard food, which

represents a significant share of household expenditure (Ilakovac et al., 2020). These findings regarding the influence of income on households' FW generation confirm our findings discussed above concerning the likely consequences of economic development and income growth in developing countries on consumer FW.

The influence of education on consumers' FWB is generally consistent with the results of Schanes et al. (2018), which show that there is no strong relation between the level of an individual's education and household FW practices. However, the ORs of the primary (2.3), secondary (1.9) and university level education (0.6) in the LFW, VLFW and MFW models, respectively, suggest that higher levels of education are associated with lower amounts of household FW. In this regard, Visschers et al. (2016) note that education and knowledge may have an indirect impact on consumers' intention and FWB through, for example, PBC. Thus, integrating FW issues into the education systems in developing countries could be an effective intervention to raise awareness of the implications of unsustainable food practices and to motivate people to carry out sustainable food purchasing, preparing, cooking practices and sustainable FW management in the household.

Expectedly, the results show that larger-sized households tend to waste more food. This coincides with the findings of previous studies on household FW suggesting that larger-sized households discard greater amounts of food because of their higher grocery expenditures and tendency to patronize big-box stores for cheaper prices (e.g. Ilakovac, 2020). Although larger-sized households may produce more total FW, they tend to produce less total per capita FW as they generally have more awareness and express more guilt about producing high volumes of FW (Parizeau et al., 2015).

Finally, the results show that the effect of the frequency of weekly grocery-shopping is different between the VLFW category of the dependant variable compared to the MFW and HFW categories. However, the frequency of grocery-shopping trips tends to be associated with higher amounts of FW. Specifically, compared to households that conduct such trips less than three times per week, more frequent shoppers (3–5 times/week or more than 6 times/week) are significantly more likely to waste high volumes of food. As shown in Table 1, more than 70% of the respondents indicated that they conduct at least three grocery-shopping trips per week. This can be attributed to lack of adequate cooling and storing facilities (e.g. fridge and freezer), proximity to food retailers or attraction to special offers by food stores and groceries. According to Dobernig and Schanes (2019), physical proximity to food retailers allows households to purchase more frequently and rather low quantities per shopping occasion, which decreases the likelihood that these food items were spoiled and discarded. However, inadequate storage facilities and poor handling and cooking practices and poor management of refrigerator temperature can increase household FW. In addition, many respondents indicated during the interviews that they live close to a food store and did not need to use transportation means to get to food stores and thus they shop food very frequently. Frequent grocery shoppers, especially those with higher incomes, are more likely to buy more food than what they actually need, which could then ended up uneaten and finally thrown away (Aschemann-Witzel et al., 2018). In conjunction with this, frequent grocery shoppers are more likely to be attracted to special offers by local food stores and groceries, such as discounts and buy one get one free offers, which subsequently increases the amount of food thrown away by the households. In this regard, Aschemann-Witzel et al. (2016) show that marketing activities by food retailers steer consumer purchasing practices through offers and promotions, and that consumers often lose control over the quantities of food products that were needed or intended. Therefore, policy interventions pertaining to decrease consumer FW should address the roles of retailer and marketing practices in FW generated by the consumers.

6. Conclusion and implications

This study aimed to contribute to an understanding of the determinants of FWB amongst urban consumers in developing countries. The study extended the IMBP to examine the determinants of FW behaviour amongst a sample of 698 urban dwellers in Addis Ababa, Ethiopia. The results showed that intentions of households to reduce FW showed that self-identity, attitudes, and PBC are the most important predictors of intention toward FW reduction. With regard to the determinants of actual FWB, the results however revealed that the intention of households to reduce FW had a statistically insignificant effect on FWB. In addition, respondents who perceived high control over their FW behaviour were less likely than those who perceive low control to belong to throw away larger amounts of food. Largely, the results suggested that those who would experience higher levels of a prospective regret when imagining how they would feel if they waste food are more likely to waste less food. Moreover, the more an individual feels obliged to discard less food, the higher the odds that the quantity of food that gets wasted by the household would be reduced. Likewise, knowledge about the negative impacts of wasting food and an ability to understand and interpret information on labels of food products would likely decrease the quantity of FW by households. In contrast, households that perceived high levels of environmental constraints were more likely to waste greater amounts of food. Lower psychological distance to FW was generally associated with lower quantities of wasted food. Finally, sociodemographic characteristics and food-shopping routines were found to be significant predictors of FWB.

Overall, our empirical results make a methodological contribution to the literature on FW behaviours amongst urban dwellers in developing countries. In particular, the results imply that FW is not a behaviour *per se*; rather it is the outcome of the interaction of multiple behaviours relating to psychological and sociodemographic characteristics of consumers as well as the environmental and institutional contexts where they dwell. In this respect, our theoretical model contributed to an improvement in the measurement and prediction of consumer FWB. Specifically, the results revealed that accounting for psychological factors as well as consumers' skills and abilities and food purchasing routines in IMBP can improve our understanding of significant factors that influence the FWB of consumers. Therefore, these findings should be a strong motivation for future research in this field.

In relation to policy implications, the results provide empirical evidence to inform the design of more effective initiatives to reduce consumer FW in developing countries. First, while a growing literature is increasingly suggesting that reducing FW should be integral to strategies conducive to promoting food security and mitigating climate change effects in developing countries (e.g. van Geffen et al., 2020), our results show that these strategies should include behavioural changing interventions, which have a potential for reducing FW levels. In particular, our findings emphasize the importance of consumers' attitude and PBC that can enhance their knowledge and understanding of the adverse consequences of FW and make them comprehend that they have both the responsibility and ability to reduce household-level FW. Second, the weak predictive power of subjective and descriptive norms of intentions to reduce FW implies that policy interventions should be implemented to promote FWB within the community and to nurture a culture of sustainability and resource conservation. In particular, interventions for reducing household FW should be more comprehensive so that they not only focus on consumers but also on other actors along the food chain, including food retailers who influence the food purchasing decisions of consumers through advertisements, marketing, packaging and special offers, and subsequently influence their FWB. Municipalities and policymakers should engage food retailers and companies in designing and implementing interventions aiming at reducing FW and changing consumer behaviour.

Third, and in connection with the previous point, our findings suggest that if the consequences of wasting food are perceived to be

psychologically close to consumers, they will be construed more concretely by the consumers who would be more willing to engage in behaviours that reduce FW to avoid the adverse impacts that wasting food poses. Therefore, a deeper understanding of this aspect of consumers' perceptions of FW issues is essential in order to formulate effective strategies that engage the public and promote sustainable food consumption patterns. Fourth, respondents' skills and abilities were closely associated with decreased household FW. Therefore, education and skill-building interventions to change consumers' FWB should target the perceived skills and abilities of households in relation to FW, together with promoting intention through information campaigns that place emphasis on norms and changing attitudes towards FW.

CRediT authorship contribution statement

Assem Abu Hatab: Conceptualization, Methodology, Software, Validation, Formal analysis, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization, Project administration, Funding acquisition. **Wondmagegn Tafesse Tirkaso:** Software, Formal analysis, Investigation, Data curation. **Elazar Tadesse:** Investigation. **Carl-Johan Lagerkvist:** Conceptualization, Methodology, Software, Validation, Formal analysis, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

This study was supported by a research grant from SLU Urban Futures at the Swedish University of Agricultural Sciences. The authors would like to thank Birhanu Addisu for his inputs to the survey design.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.resconrec.2021.106073.

References

AACA (2020). The sub city level population size and land area in city of Addis Ababa. The Addis Ababa city Government. Available at: http://www.addisababa.gov.et/de/web/guest/sub-cities. Accessed on 2019-112-2019).

Abdelradi, F. (2018). Food waste behaviour at the household level: a conceptual framework. Waste Manag., pp. 485–493.

Abu Hatab, A., Cavinato, M.E.R., Lindemer, A., Lagerkvist, C.J., 2019. Urban sprawl, food security and agricultural systems in developing countries: a systematic review of the literature. Cities 94, 129–142.

Abu Hatab, A., Ravula, P., Nedumaran, S., et al., 2021. Perceptions of the impacts of urban sprawl among urban and peri-urban dwellers of Hyderabad, India: a Latent class clustering analysis. Environ Dev Sustain. https://doi.org/10.1007/s10668-021-01964-2.

Adebe, M.A., 2018. Challenges of waste to energy facility in Reppi (Koshe), Addis Ababa City. Int. J. Pharm. Res. And Medical Sci. 1, 9–16.

Agresti, A., Bini, M., Bertaccini, B., Ryu, E., 2008. Simultaneous confidence intervals for comparing binomial parameters. Biometrics 64, 1270–1275.

Ajzen, I., 1991. The theory of planned behavior. Organ. Behav. Hum. Decis. Process. 50 (2), 179–211.

Aktas, E., Sahin, H., Topaloglu, Z., Oledinma, A., Huda, A.K.S., Irani, Z., Kamrava, M., 2018. A consumer behavioural approach to food waste. J. Enterp. Inf. Manag. 21 (5).

Al-Sari, M.I., Al-Khatib, I.A., Avraamides, M., Fatta-Kassinos, D, 2012. A study on the attitudes and behavioural influence of construction waste management in occupied Palestinian territory. Waste Manag. Res. 30 (2), 122–136.

Arage, G., Belachew, T., Hajmahmud, K., Abera, M., Abdulhay, F., Abdulahi, M., Abate, K.H., 2021. Impact of early life famine exposure on adulthood anthropometry among survivors of the 1983–1985 Ethiopian great famine: a historical cohort study. BMC Public Health 21 (1), 1–16.

Aschemann-Witzel, J., de Hooge, I., Normann, A., 2016. Consumer-related food waste: role of food marketing and retailers and potential for action. J. Int. Food Agribusiness Mark. 28 (3), 271–285.

Aschemann-Witzel, J., Gimenez, A., Ares, G., 2018. Convenience or price orientation? Consumer characteristics influencing food waste behaviour in the context of an emerging country and the impact on future sustainability of the global food sector. Glob. Environ. Change 49, 85–94.

Aydin, A.E., Yildirim, P., 2021. Understanding food waste behavior: the role of morals, habits and knowledge. J. Clean. Prod. 280, 124–250.

Barkan, R., Ayal, S., Ariely, D, 2015. Ethical dissonance, justifications, and moral behavior. Curr. Opin. Psychol. 6, 157–161.

Bender, R., Grouwen, U., 1998. Using binary logistic regression models for ordinal data with non-proportional odds. J. Clin. Epidemiol. 51 (10), 809–816.

Beretta, C., Stoessel, F., Baier, U., Hellweg, S., 2013. Quantifying food losses and the potential for reduction in Switzerland. Waste Manag. 33 (3), 764–773.

Booth, A.R., Norman, P., Harris, P.R., Goyder, E., 2014. Using the theory of planned behaviour and self-identity to explain chlamydia testing intentions in young people living in deprived areas. Br. J. Health Psychol. 19 (1), 101–112.

Bremner, J., 2017. Population, Food Security, and Climate Change: africa's Challenges. Africa's Population: In Search of a Demographic Dividend. Springer, Cham, pp. 403–414. ,.

Caldeira, C., Corrado, S., Sala, S., 2017. Food Waste accounting: Methodologies, Challenges and opportunities, Luxembourg (Luxembourg), 2017. Publications Office of the European Union, JRC109202.

Cattaneo, A., Marco, V., Sánchez, M.T., Rob, V, 2021. Reducing food loss and waste: five challenges for policy and research. Food Policy 98, 101974.

Central Statistical Agency (CSA) [Ethiopia] and ICF, 2016. Ethiopia Demographic and Health Survey 2016. CSA and ICF, Addis Ababa, Ethiopia, and Rockville, Maryland, USA.

Chao, Y.L., 2012. Predicting people's environmental behaviour: theory of planned behaviour and model of responsible environmental behaviour. Environ. Educ. Res. 18 (4), 437–461.

Christensen, R.H.B. (2019). Ordinal—regression models for ordinal data. R package version 2019.12-10. https://CRAN.R-project.org/package=ordinal.

Cronjé, N., Van der Merwe, I., Müller, I.M., 2018. Household food waste: a case study in Kimberley, South Africa. J. Consum. Sci. 46, 1–9.

Davidson, R.J., Scherer, K.R., Goldsmith, H.H., 2003. The role of affect in decision-making. Handbook of Affective Sciences 3, 619–642.

Diaz-Ruiz, R., Costa-Font, M., Gil, J.M., 2018. Moving ahead from food-related behaviours: an alternative approach to understand household food waste generation. J. Clean. Prod. 172, 1140–1151.

Djulbegovic, M., Beckstead, J., Elqayam, S., Reljic, T., Kumar, A., Paidas, C., Djulbegovic, B., 2015. Thinking styles and regret in physicians. PLoS ONE 10 (8), e0134038.

Dobernig, K., Schanes, K., 2019. Domestic spaces and beyond: consumer food waste in the context of shopping and storing routines. Int. J. Consum. Stud. 43 (5), 480–489.

Donald, I.J., Cooper, S.R., Conchie, S.M., 2014. An extended theory of planned behaviour model of the psychological factors affecting commuters' transport mode use. J. Environ. Psychol. 40, 39–48.

Erena D. et.al. (2017). City profile: addis Ababa. Report prepared in the SES (Social Inclusion and Energy).

Fami, H.S., Aramyan, L.H., Sijtsema, S.J., Alambaigi, A, 2019. Determinants of household food waste behavior in Tehran city: a structural model. Resour. Conserv. Recycl. 143, 154–166.

FAO, 2019. The State of Food and Agriculture 2019. Moving forward on food loss and waste reduction. Rome. Licence: CC BY-NC-SA 3.0 IGO.

Farr-Wharton, G., Choi, J.H.J., Foth, M., 2014. December. Food talks back: exploring the role of mobile applications in reducing domestic food wastage. In: Proceedings of the 26th Australian computer-human interaction conference on designing futures: The future of design, pp. 352–361.

Fishbein, M., Ajzen, I., 2010. Predicting and Changing behavior: The reasoned Action Approach. Psychology Press, New York, NY.

Fishbein, M., 2008. A reasoned action approach to health promotion. Med. Decis. Making 28 (6), 834–844.

Ghani, W.A.W.A.K., Rusli, I.F., Biak, D.R.A., Idris, A., 2013. An application of the theory of planned behaviour to study the influencing factors of participation in source separation of food waste. Waste Manage. (Oxford) 33 (5), 1276–1281.

Gikuri, A., 2021. Wedding and wasting: exploring food plate waste in Tanzania. J. Soc. Sci. Bus. Technol. 2, 33–41.

Godoy-Faúndez, A., Rivera, D., Aitken, D., Herrera, M. and El Youssfi. L. (2021) Circular economy in a water-energy-food security nexus associate to an SDGs framework: understanding complexities. An Introduction to Circular Economy, pp. 219–239. Springer, Singapore.

Goshu, D., Kassa, B., Ketema, M., 2013. Measuring diet quantity and quality dimensions of food security in rural Ethiopia. J Dev Agric Econ 5 (5), 174–185.

Graham-Rowe, E., Jessop, D.C., Sparks, P., 2015. Predicting household food waste reduction using an extended theory of planned behaviour. Resour. Conserv. Recycl. 101, 194–202.

Greene, W.H. and Hensher, D.A. (2008). Modeling Ordered Choices: a Primer and Recent Developments. Working Paper No 08–26. Department of Economics, Leonard, N. Stern School of Business, New York University: New York, NY, USA.

Hassan, L.M., Shiu, E., Shaw, D., 2016. Who says there is an intention–behaviour gap? Assessing the empirical evidence of an intention–behaviour gap in ethical consumption. J. Bus. Ethics 136, 219–236.

Heidari, A., Kolahi, M., Behravesh, N., Ghorbanyon, M., Ehsanmansh, F., Hashemolhosini, N., Zanganeh, F., 2018. Youth and sustainable waste management: a SEM approach and extended theory of planned behavior. J. Mater. Cycles Waste Manage. 20, 2041–2053.

Heidari, A., Mirzaii, F., Rahnama, M., Alidoost, F., 2020. A theoretical framework for explaining the determinants of food waste reduction in residential households: a case study of Mashhad, Iran. Environmental Science and Pollution Research 27 (7), 6774–6784.
Heidari, A., Mirzaii, F., Rahnama, M, Alidoost, F., 2019. A theoretical framework for explaining the determinants of food waste reduction in residential households: a case study of Mashhad, Iran. Environ Sci Pollut Res 27, 6774–6784.
HLPE, 2014. Aquaculture For Food Security and Nutrition: A report By the High Level Panel Experts On Food Security and Nutrition of the Committee On World Food Security. Committee on World Food Security, HLPE, Rome.
Ilakovac, B., Voca, N., Pezo, L., Cerjak, M., 2020. Quantification and determination of household food waste and its relation to sociodemographic characteristics in Croatia. Waste Manage. (Oxford) 102, 231–240.
Ivanova, D., Barrett, J., Wiedenhofer, D., Macura, B., Callaghan, M., Creutzig, F., 2020. Quantifying the potential for climate change mitigation of consumption options. Environ. Res. Lett. 15 (9), 093001.
Kaiser, F.G., 2006. A moral extension of the theory of planned behavior: norms and anticipated feelings of regret in conservationism. Pers Individ Dif 41 (1), 71–81.
Katajajuuri, J.M., Silvennoinen, K., Hartikainen, H., Heikkilä, L., Reinikainen, A., 2014. Food waste in the Finnish food chain. J Clean Prod 73, 322–329.
La Barbera, F., Ajzen, I., 2020. Control interactions in the theory of planned behavior: rethinking the role of subjective norm. Europe's Journal of Psychology 16 (3), 401–417.
Langen, N., Göbel, C., Waskow, F., 2015. The effectiveness of advice and actions in reducing food waste. Waste and Resource Management 168 (2), 72–86.
Lebersorger, S., Schneider, F., 2011. Discussion on the methodology for determining food waste in household waste composition studies. Waste Manage. (Oxford) 31 (9–10), 1924–1933.
Lemaire, A., Limbourg, S., 2019. How can food loss and waste management achieve sustainable development goals? J Clean Prod 234, 1221–1234.
Li, J., Zuo, J., Cai, H., Zillante, G., 2018. Construction waste reduction behavior of contractor employees: an extended theory of planned behavior model approach. J Clean Prod 172, 1399–1408.
Li, Y., Wang, L.E., Liu, G., Cheng, S., 2021. Rural household food waste characteristics and driving factors in China. Resour. Conserv. Recycl. 164, 105–209.
Liang, J., Bi, G., Zhan, C., 2020. Multinomial and ordinal Logistic regression analyses with multi-categorical variables using R. Ann Transl Med 8 (16).
Liao, C., Zhao, D., Zhang, S., 2018. Psychological and conditional factors influencing staff's takeaway waste separation intention: an application of the extended theory of planned behavior. Sustainable cities and society 41, 186–194.
Manstead, A.S.R. (2000). The role of moral norm in the attitude-behavior relation. Attitudes, behavior, and social context, pp. 11–30. Psychology Press.
Meier, S. (2007). A survey of economic theories and field evidence on pro-social behavior. In: Frey, B., Stutzer, A. (Eds.), Economics and Psychology: A Promising New Cross-Disciplinary Field. MIT Press, Cambridge, MA, pp. 51–88.
Mondéjar-Jiménez, J.A., Ferrari, G., Secondi, L., Principato, L., 2016. From the table to waste: an exploratory study on behaviour towards food waste of Spanish and Italian youths. J Clean Prod 138, 8–18.
Nahman, A., de Lange, W., 2013. Costs of food waste along the value chain: evidence from South Africa. Waste Manage. (Oxford) 33 (11), 2493–2500.
Nygren, T.E., 2000. Development of a measure of decision making styles to predict performance in a dynamic J/DM task. In: Paper presented at the 41st Psychonomic Society Meeting. New Orleans, LA.
OECD, 2020. Rural Development Strategy Review of Ethiopia: Reaping the Benefits of Urbanisation. OECD Development Centre. OECD and Policy Studies Institute.
Parizeau, K., von Massow, M., Martin, R., 2015. Household-level dynamics of food waste production and related beliefs, attitudes, and behaviours in Guelph, Ontario. Waste Manage. (Oxford) 35, 207–217.
Poore, Joseph, Nemecek, Thomas, 2018. Reducing food's environmental impacts through producers and consumers. ScienceScience 360 (6392), 987–992.
Porter, S.D., Reay, D.S., Higgins, P., Bomberg, E., 2016. A half-century of production-phase greenhouse gas emissions from food loss & waste in the global food supply chain. Sci. Total Environ. 571, 721–729.
R Core Team (2021). R: a language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.
Romani, S., Grappi, S., Bagozzi, R.P., Barone, A.M., 2018. Domestic food practices: a study of food management behaviors and the role of food preparation planning in reducing waste. Appetite 121, 215–227.
Russell, S.V., Young, C.W., Unsworth, K.L., Robinson, C., 2017. Bringing habits and emotions into food waste behaviour. Resour. Conserv. Recycl. 125, 107–114.
Schanes, K., Dobernig, K., Gözet, B., 2018. Food waste matters-A systematic review of household food waste practices and their policy implications. J. Clean. Prod. 182, 978–991.
Scherhaufer, S., Moates, G., Hartikainen, H., Waldron, K., Obersteiner, G., 2018. Environmental impacts of food waste in Europe. Waste Manage. (Oxford) 77, 98–113.
Schmidt, E., Dorosh, P.A., KedirJemal, M. and Smart, J. (2018). Ethiopia's spatial and structural transformation: puvblic policy and drivers of change. s.l.:Intl. Food Policy Res. Inst.
Schmidt, K., 2016. Explaining and promoting household food waste-prevention by an environmental psychological based intervention study. Resour. Conserv. Recycl. 111, 53–66.
Seto, K.C., Ramankutty, N., 2016. Hidden linkages between urbanization and food systems. Science 352 (6288), 943–945.
Sheahan, M., Barrett, C.B., 2017. Food loss and waste in Sub-Saharan Africa. Food Policy 70, 1–12.
Shukla, P.R., Skea, J., Calvo Buendia, E., Masson-Delmotte, V., Pörtner, H.-.O., Roberts, D.C., Zhai, P., Slade, R., Connors, S., andvan Diemen, R., 2019. Climate Change and Land: An IPCC Special Report On Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems. IPCC, Geneva, Switzerland.
Song, G., Semakula, H.M., Fullana-i-Palmer, P., 2018. Chinese houshold food waste and its climate burden driven by urbanization: a Bayesian Belief Network modelling for reduction possibilities in the context of global efforts. J. Clean. Prod. 202, 916–924.
Soorani, F., Ahmadvand, M., 2019. Determinants of consumers' food management behavior: applying and extending the theory of planned behavior. Waste Manage. (Oxford) 98, 151–159.
Spang, E.S., Moreno, L.C., Pace, S.A., Achmon, Y., Donis-Gonzalez, I., Gosliner, W.A., 2019. Food Loss and Waste: measurement, Drivers, and Solutions. Annu. Rev. Environ. Resour. 44, 117–156.
Spence, A., Poortinga, W., Pidgeon, N., 2012. The psychological distance of climate change. Risk Anal. 32 (6), 957–972.
Stancu, V., Haugaard, P., Lähteenmäki, L., 2016. Determinants of consumer food waste behaviour: Two routes to food waste. Appetite 96, 7–17.
Stefan, V., van Herpen, E., Tudoran, A.A., Lähteenmäki, L., 2013. Avoiding food waste by Romanian consumers: the importance of planning and shopping routines. Food Qualirt and Preference 28 (1), 375–381.
Stern, P.C., 2000. New environmental theories: towards a coherent theory of environmentally significant behaviour. J. Soc. Issues 56 (3), 407–424.
Stöckli, S., Niklaus, E., Dorn, M., 2018. Call for testing interventions to prevent consumer food waste. Resour. Conserv. Recycl. 136, 445–462.
Thørgersen, J., 2006. Norms for environmentally responsible behaviour: an extended taxonomy. J. Environ. Psychol. 26 (4), 247–261.
Todorov, A., Goren, A., Trope, Y., 2007. Probability as a pyschological distance: construal and preferences. J. Exp. Soc. Psychol. 43 (3), 473–482.
van Dam, Ynte, K., van Trijp, J.C.M., 2016. Interventions to encourage sustainable consumption. APSTRACT: Applied Studies in Agribusiness and Commerce 10 (2–3), 51–58.
van der Werf, P., Seabrook, J.A., Gilliland, J.A., 2018. The quantity of food waste in the garbage stream of southern Ontario, Canada households. PLoS ONE 13 (6), e0198470.
van Geffen, L., van Herpen, E., Sijtsema, S., van Trip, H., 2020. Food waste as the consequence of competing motivations, lack of opportunities, and insufficient abilities. Resour. Conserv. Recycl. X 5, 100026.
van Holsteijn, F., Kemna, R., 2018. Minimizing food waste by improving storage conditions in household refrigeration. Resour. Conserv. Recycl. 128, 25–31.
Venables, W.N., Ripley, B.D., 2002. Modern Applied Statistics With S, 4th edition. Springer.
Visschers, V.H., Wickli, N., Siegrist, M., 2016. Sorting out food waste behaviour: a survey on the motivators and barriers of self-reported amounts of food waste in households. J. Environ. Psychol. 45, 66–78.
Wakefield, A., Axon, S., 2020. I'm bit of a waster: identifying the enablers of, and barriers to, sustainable food waste practices. J. Clean. Prod. 275, 122803.
Wubneh, M., 2013. Addis Ababa, Ethiopia-Africa's diplomatic capital. Cities 35, 255–269.
Xue, L., Liu, G., Parfitt, J., Liu, X., Van Herpen, E., Stenmarck, 2017. Missing food, missing data? A critical review of global food losses and food waste data. Environ. Sci. Technol. 51 (12), 6618–6633.