University of Natural Resources
and Applied Life Sciences, Vienna
and
Cranfield University

Robert Glanz

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Department of Water, Atmosphere and Environment
and
School of Applied Sciences

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University of Natural Resources
and Applied Life Sciences, Vienna
and
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Institute of Waste Management
and
School of Applied Sciences

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Robert Glanz

Causes of food waste generation in households – an empirical analysis

Supervisors: PhD Stefan Salhofer, MSc Felicitas Schneider
and
PhD Phil Longhurst

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Abstract

Food waste accounts for around 18% of municipal solid waste in Austria but is a comparatively new topic for waste prevention initiatives. This thesis aims to give a variety of possible causes why food is discarded in households.

The literature review discusses all types of food waste and its relation to households in an international context. Food consumption patterns and factors influencing the amount shall give background information about the social context of food waste. Reasons found in literature are described and results from a UK food waste study presented.

The research section of this thesis focuses on Austria and two specific types of food waste that account for 6-12% of municipal solid waste: unopened food in original packaging and opened, partially used food. This study was based on 21 face-to-face interviews with households from Vienna and Lower Austria. A category system, derived via content analysis, summarized 43 different reasons into 6 main and 27 subcategories by content structuring. Results show that households are not always to blame for the arising food waste. Furthermore personal attitudes towards edibles, cooking and eating habits, shopping behaviour and storage of edibles have been identified as relevant factors which were then compared to international literature.

Qualitative interviews were supported by a quantitative analysis of expired products found in the households and a questionnaire about the socio-demographic background of participants. A total of 212 expired products with a net mass of 30.2 kg were recorded. Food in original packaging was found more frequent and was twice as long stored after its expiry date than partially used food. In general non-perishable products were kept longer in the storage after they expired than perishable edibles. In eight households none or just one expired item was found which could be traced back to place of residence and age of participants.

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I. INTRODUCTION

Food waste occurs in nearly every household throughout the year and is a highly emotional topic as it is an expression of personal lifestyle. Food prices or availability and socio-economic backgrounds of households have changed dramatically in the last decades for European countries and go along with a decreasing valuation for food. The amount of edibles discarded is dependent on several interlinked factors with varying importance for each household. Socio-demographic backgrounds as well as consumption patterns or cooking habits are likely to influence the magnitude of food discarded.

Even though composition analysis report a significant amount of food waste in municipal solid waste, many people do not see the direct linkage to environmental damage and the waste of resources. However, food waste causes several problems in the whole waste management chain including odour, contamination of bins and vehicles, vermin or liquid and gaseous emissions.

Households often restrict the term ‘food waste’ to inedible parts of food and leftovers. But there are two more types of food waste which are equally important: unopened, discarded food in original packaging and opened, partially used food thrown away. Little research has been conducted to understand the underlying causes of food waste arising in households which are important to implement effective prevention strategies. This thesis aims to give a variety of reasons for the disposal of unopened and opened food in its original packaging to support prevention initiatives in the future.

II. LITERATURE REVIEW

1. Food consumption

'Food' is defined by the European Parliament and Council (2002) as "any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans". But in fact it is a very complex issue as it is not only the ingestion of nutrients but, according to Brunner et al. (2007), food is associated with four main social and cultural functions:

a) Physiological function: metabolism, provision of nutrients and energy
b) Social function: identification, communication
c) Cultural function: customs, religion, national cuisines, taboos
d) Psychological function: consumption, emotional security, self-esteem

All these functions are differently important to an individual and will influence any statements when talking about food.

1.1 Changes in food supply and prices

During and after the Second World War, individual food choice was largely restricted by availability. In the 1950s, households came back to 'normal' diets constrained by income and prices. A rise in living standards and growing salaries gradually lifted the income constraint for many households in the 1960s. This imposed a change in food demand and caused a rise (e.g. coffee, cheese, rice) or a fall (e.g. tea, canned meat, potatoes) in average levels of food consumption for some products. During the 1970s, the volatility of retail prices became more important for influencing food consumption patterns. This price instability had several reasons under which the world commodities price boom, the adoption of the EEC's Common Agricultural Policy in the UK and food subsidy programmes were most important. During the 1980s prices fell gently and the pace of income growth slackened (Ritson and Hutchins, 1995). Different influences on food consumption between 1940 and 1990 are demonstrated in Figure 1. Until the end of the 1990s prices continued to fall mainly as a result of cheaper transportation and higher production rates.

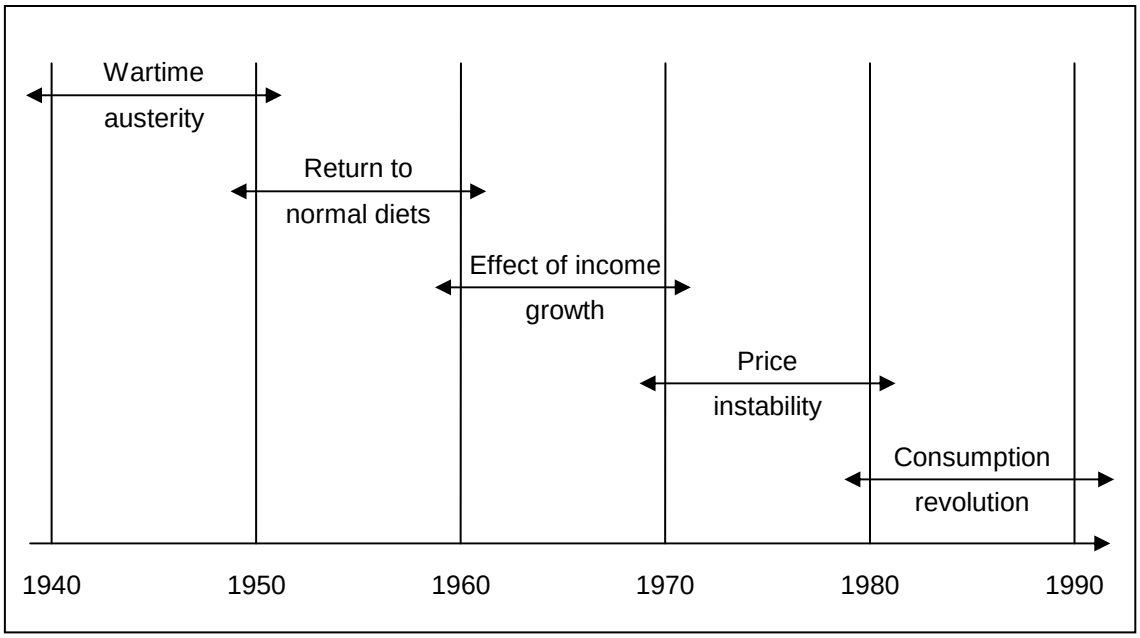

Figure 1: Key influences for UK food consumption between 1940 and 1990 (Ritson C. and Hutchins R., 1995)

In Austria the general price level increased by 54% between 1986 and 2006, but prices for food only rose 33%. After food prices followed three decades of decline in real terms, they have begun to rise in 2006 and are still a considerable reason for a high inflation rate in 2008. Within one year, starting in April 2007, wholesale prices for cereal went up 54.2%, for fruits and vegetables 15.0% and for diary products and eggs 12.6% (Die Presse, 2008). According to the Department for Agriculture and Rural Development of the European Commission (Fischer Boel, 2008), the huge increase in cereal prices is mainly caused by:

- a rising demand from emerging countries
- the surge in energy prices
- bad weather conditions (e.g. draughts in Australia)
- slowing-down of growth in cereal yields
- the depreciation of the US dollar
- strong movements in financial markets
- export restrictions or bans
- bio-fuel production (especially the US bio-fuel programme)

As a reaction to the food price surges, European Commission raised the milk quota by 2% and lifted the compulsory arable set-aside policy in 2008 (Fischer Boel, 2008).

1.2 Household expenditure on food

In the EU27 countries, private households spent 19.4% of their expenditure for food, (non- and alcoholic) drinks and tobacco in 2005. But there are huge differences on a macro and micro scale within the European Union. UK

households for example spent just 12.3% of their expenditures (compared to 13.4% ten years earlier) for food in 2005 whereas people in Romania spent 50.0%. According to the disposable income, the lowest quintile (i.e. 20% of households with the lowest disposable income equivalent[1]) of EU27 households spent 25% for food, drinks and tobacco whereas the highest quintile spent just 15% in 2005 (Eurostat, 2008). Within the European Union, people living in the EU10 (new member states in the eastern part of the European Union) and those households with lower incomes spent more money on food than others.

Austrian households spent 12.8% of their average monthly expenditure of 2,540 € for food and non-alcoholic drinks in 2004 (Lebensministerium, 2006). This all time low (compare Figure 2) was caused by falling prices and a stagnating food demand which can be traced back to over aging and a slow population growth.

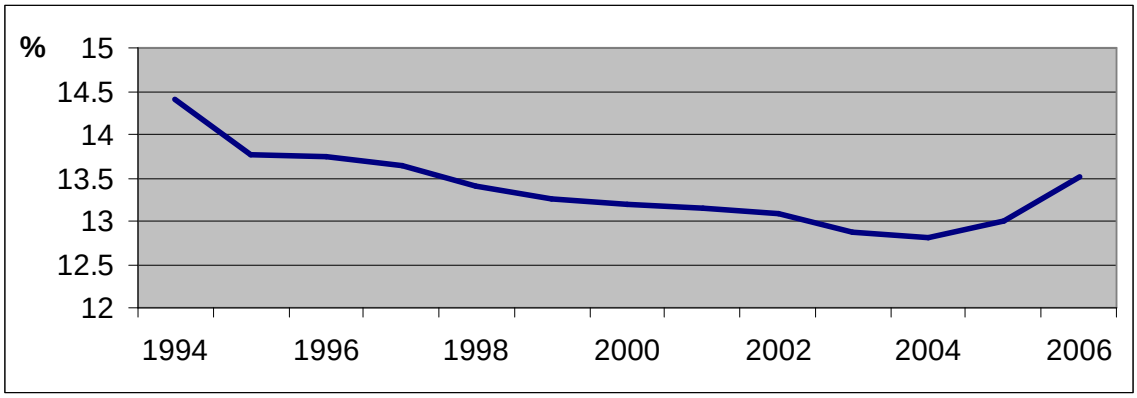

Figure 2: Percentage of average Austrian household expenditure on food and non-alcoholic drinks between 1994 and 2006 (Statistik Austria, 2008 and own calculations)

1.3 Food psychology

For most Europeans nowadays, the main problem of food intake is not a limited supply or high retail prices but the choice which product to buy. This principal change in the relationship to edibles went along with social and socio-demographic alterations during the last decades. From a psychological point of view, Pudel and Westenhöfer (1998) characterised four tendencies that link food supply and public perception:

a) Loss of food valuation: People born after 1950 did not experience any food shortages and therefore do not see the same strong emotional linkage between food and survival other generations did before.

[1] 'Disposable income equivalent' means the disposable household income divided by a weighted adult equivalent which is 1.0 for the first adult, 0.5 for persons aged over 14 and 0.3 for persons under 14 (Eurostat, 2008).

b) Loss of food identity: Modern supermarkets offer a variety of products. Flour is bought together with washing powder which appears the same in terms of packaging, product variety, pricing or special offers. Everything is available for consumption at any time until the last minute of the opening hours and therefore consumers lose the link to the producers of their food.

c) Loss of origin: The original source of food is lost which gives food a product character. A package of milk for example is hard to associate with a cow or pre-crumbed fish sticks with a fish. Modern convenience products like frozen pizza even more emphasize that food is a consumer item like anything else.

d) Loss of social and emotional linkage: Traditional family recipes or special dishes on a specific day of the week are disappearing. Eating together is a social event which will weaken the family bonds if everybody chooses to eat alone or outside the household. Within ten years the number of people eating alone in the UK increased from 34% in 1994 to 54% in 2004 (WRAP, 2007a).

These tendencies lead to an emotional neutralisation and give consumers the perception that edibles are products instead of something vital for life. Due to globalisation tendencies, enlarged shelf-life and cheap transportation of food, consumption patterns have been adapted between industrialised countries (Huber et al., 2001). Marketing strategies support this acculturation when promoting special recipes (e.g. Coca Cola) or standardised taste like fast food restaurants. But there is also a trend to more individual eating habits like vegetarianism and regional food supply. Branding of products in supermarkets shall re-emotionalise products as ‘quality you can trust’ and in fact it is hard to find any no-name-products on the shelves nowadays (Pudel and Westenhöfer, 1998).

1.4 Food shopping

In Austria most food is bought in one of the 6,204 supermarkets of which 85% have a self-service strategy. Retail concentration is very high as the two largest supermarket chains have a market share of 57% and the five largest together of over 88% (Lebensministerium, 2008). Companies use a crowding out strategy and so the retail area per person exceeds the European average by 20%. Apart from supermarkets, popularity of convenience shops (e.g. at petrol stations) and online food services is increasing.

According to Ederer (2001) advantages of online shopping are not carrying heavy things, save time and being not dependent on opening hours. As the major disadvantage, consumers can not check the quality and freshness of products themselves and are therefore more likely to shop longer lasting products like drinks or tinned food. A global study of Nielsen (2008) in 2007 investigated online consumer behaviour and found that the most frequent online shoppers come from South Korea, followed by the UK on second and Austria on eighth place. Since 2005 the number of worldwide shoppers who bought groceries online at least once within three month has increased from 6%

to 14% in 2007. Customised supermarket homepages and convenient door step delivery may cause a further increase in online food shopping.

The consumption process of food in households (neglecting food storage) is divided by Litwinschuh (2005) into four different stages:

a) Information stage

It is characterised by active (e.g. looking for advertisements) and passive (e.g. talking with relatives) gathering of information before going to a shop. It also includes the control of the storage in order to know which products will be needed. Most information on food and health topics is gathered through mass media or food labels. On-package-information becomes more important as the number of people with intolerances and allergies to certain ingredients is rising. 50% of Austrians feel that information on food packaging is hard to understand and only one out of ten is fully satisfied with the information provided (Lebensministerium, 2003). For 63% of UK consumers however, information provided on food labels is ‘about right’ (Food Standards Agency, 2008a).

b) Shopping stage

Decisions at the point of sale are influenced by a variety of things like the individual mood, packaging, choice of supermarket, shopping interval, hungry feeling etc. Time pressure usually lowers the propensity to consume and the probability to try new products. Accompanying persons will distract from shopping and social pressure can block or boost a consuming frenzy. Shopping behaviour also differs according to daily (e.g. fresh bakery in the morning) and yearly (e.g. ice-cream in summer) influences. Decisions made directly at the point of sale account for more than half of all food shopping (Lebensministerium, 2006).

c) Stage of use

Time is one of the main factors, not only while shopping, but also during food preparation. The average time spent for cooking a warm meal in the UK fell from 30 minutes in 1994 to 19 minutes ten years later (WRAP, 2007a). Time shortage on weekdays causes households to cook easy and fast dishes like rice, pasta, salads or convenience products. Employed persons are likely to change their cooking patterns on weekends when time is not a limiting factor.

d) Disposal

The correct disposal of unconsumed food depends on the local collection scheme (e.g. separate kitchen waste collection). If no extra bin for biodegradable waste is available, households are forced to dispose food waste together with municipal waste. Other options used are home composting, feeding to pets or wild animals and use the sink or toilet as ‘sewer disposal’. These other options are the disposal route for approximately 800,000 tonnes of food waste per year in the UK (WRAP, 2008).

1.5 Food patterns and cooking habits of households

A change in lifestyles over the last decades has forced individuals to optimise their time management in terms of career or social life. Eating was not important to every third Austrian in 1994 if there was a lack of time (Brunner et al., 2007).

The standard model of a three-meal-day (breakfast – lunch – dinner) which has been common in Europe since the 19th century is disappearing. Albeit it is still common to have at least one warm dish a day which half of the population (47%) will have for lunch (Brunner et al., 2007). Dinner is becoming increasingly important as it is more likely that all household members are at home in the evening. The division of the main dish into soup – dish – dessert is prevalent in traditional oriented households or for good eaters. Other and especially younger households celebrate this division on weekends, public holidays or when cooking for invited people.

Several factors influence food patterns and cooking habits of households:

a) Work

Two out of three Austrians (especially farmers) have fixed eating times and the majority among those people has a regular working day as well (Lebensministerium, 2003). Self employed persons, students or people with unusual working hours tend to eat more convenience products, have their main dish for dinner and do not have specified eating times. Differences in food patterns between self-employed persons and workers are most significant, but in general these class-related differences are diminishing (Brunner et al., 2007).

b) Gender

In 1988 married women were responsible for 72% of cooking and 49% of food shopping in a typical German household. Only 20% of cooking and 40% of food shopping were done together from both partners in marriage (Diedrichsen, 1995). In 76% of UK households, women take all or most responsibility for household food shopping (Food Standards Agency, 2008a). Women are still primarily responsible for cooking in many societies and husbands are most likely to take some strain off the housekeeping by going shopping. In households with younger, unmarried partners or working women, men are participating significantly more in both, cooking and shopping. In many cases a lack of cooking competency or interest forces single men to prepare easy dishes or convenience products. They have a limited cooking variety and are more likely to use take-away services (Bayer et al., 1999).

c) Household size

The number of households has increased to around 3.5 million in Austria, but the average household size decreased to 2.33 persons over the last decades due to other forms of living together and a higher life expectancy. Single or one-person-households are an urban phenomenon and account for 35% of all households in Austria (Lebensministerium, 2008). According to the 2001 UK

census, 40% of households in London and 30% in England and Wales are single-person households (compared to 26.3% in 1991). They are mainly occupied by young adults or older, widowed women and are very variable in eating habits, times and food choice (WRAP, 2006). Families with children tend to have more regular eating times and child specific food which depends on the age of the children and their taste preferences. When both parents are working, cooking at lunch time is often transferred to other parties like grandparents or the kindergarten (Brunner et al., 2007).

d) Age

Younger households usually have their main dish for dinner whereas 80% of people aged over sixty have it for lunch (Bayer et al., 1999). Older persons prefer small shops near their accommodation and are used to inform themselves before shopping about special offers mainly from the newspapers. Furthermore they hardly ever buy foreign or newfangled products.

e) Eating out

In the year 2000, 28% of all household food expenditure in Austria was spent for eating out, compared to 25% six years earlier. This tendency is caused by an increasing professional, spatial and social mobility and a growing distance from home to the place of work. Single households of young adults are most likely to eat out (Lebensministerium, 2003).

f) Storage

Households have to keep storage because packaging sizes are often too big to use food products at once. Storage of food can cause a reduction in quality and therefore a decline in value because of a limited shelf life. Quality considerations will influence the product choice at the point of sale (Schmalen et al., 1996). Some food like fruits or milk is bought demand driven to maximise freshness. According to Lebensministerium (2003) the average storage time for edibles has risen slightly to 3-4 days. It is 4.4 days for fruits, 3.4 days for vegetables and salad, 3.3 days for diary products and 3.0 days for meat.

The amount of things stored is dependent on the storage space available. The average floor space in Austrian flats is 65 m² compared to 101 m² in single and semidetached houses (Bruckner, 2004). Hence the availability of additional storage capacities like separate freezers or cellars is constrained in smaller accommodations. A limited storage space can cause ‘psychological pressure’ if products have to be stapled conspicuously or usual places like the fridge run out of capacity (Schmalen et al., 1996).

The experience of a food shortage among older people may have another psychological impact on storage habits. It is said to be the reason why older people tend to have “a long lasting storage of basic food” which some refer to as the ‘war mentality’ (WRAP, 2006).

1.6 Quality and durability of food

In a survey from Lebensministerium (2003), consumers were asked to rank the importance of several criteria when buying food. Freshness was ranked highest with 69% followed by untreated food (22%) and place of origin (19%). Meat was judged in terms of appearance (17%), taste (6%) and smell (2%). For dairy products the date of expiry was the main quality criterion at the point of sale. Two out of three consumers always read information provided about price and durability before buying food products.

According to Austrian law ('Lebensmittelkennzeichnungsverordnung' from 1993), food packaging is legally required to inform about the name of the product, ingredients, amount of food, address of producer and an appropriate durability indication (Lebensmittelnet, 2007). Two labels with different meanings are marking the durability and only one of them has to be used:

'best before' ('mindestens haltbar bis') indicates the time until the product keeps it's quality if accordingly stored. After this date food will not necessarily be harmful, but it might begin to lose its flavour and texture. Food with an expired 'best before' date is allowed to be sold in shops if obviously marked. 'Best before dates' have to include:

- Day and month of expiry if the durability of the product is less than 3 month
- Month and year if the durability is between 3 and 18 month
- Only the year of expiry if the product lasts longer than 18 month

Products with a 'use by' ('zu verbrauchen bis') label should not be used after expiry as it could put consumer's health at risk. This labelling is statutory for food that goes off quickly such as raw milk, raw meat products and fresh fish. It is against the law to sell food or drinks after this date. However food can be frozen within households which would extend its life beyond the 'use by' date without health concerns.

'display until' or 'sell by' instructions are often placed next to the durability indications for some products. They shall help supermarket staff with stock control but are not important for shoppers. As it "adds clutter to the pack and is irritating if it makes the more important 'use by' date more difficult to identify" (Food Standards Agency, 2006), consumers would like to remove this information.

In the UK additional statutory information about any special storage conditions (e.g. 'keep refrigerated'), the manufacturing process and instructions for use of the food have to be imprinted on the packaging according to the 'food labelling regulations' from 1996 (Food Standards Agency, 2008b).

2. Food waste

Food waste research has been linked to landfill methane gas emissions for a long time and in fact, landfills and agriculture each account for 30% of methane gas emissions in the European Union (Lechner and Huber-Humer, 2004). Food waste however is a comparatively new topic for waste prevention initiatives which were focussed on beverage and packaging before. Increasing prices for food on an international level and the discussion about using arable land for energy crops have lead to a growing media attention in the last years. Furthermore public awareness was raised through concerns about hunger, national food safety, resource conservation, environmental issues and the economic costs of food waste for households and communities.

2.1 Food losses

Food losses occur throughout the food system and have been divided by Kantor et al. (1997) into four main stages:

a) Farm and post-harvest

Severe weather conditions like droughts and floods or pest infestations can reduce expected harvests. Another reason that hinders the production of food in the first place is quality standards that might prompt farmers to selectively harvest those fruits and crops, which will be accepted in the processing plant.

b) Processing and wholesaling

After food left the farm, the main reason for food loss is improper storage. Pests, mould, deterioration or improper transportation and handling are the major threats at this stage. Inadequate packaging or simply too much time passed in the storage can lead to shrinkage (loss in amount or volume). Food safety regulations are especially targeting perishable foods like meat or milk and therefore divert those products which do not meet quality or hygiene standards. Thogersen (1996) describes a waste shift from household food waste to the processing plant due to modern consumption patterns. Industrially processed pineapples for example are bought pre-cut in cans and so the non-edible parts will pile up in the processing plant where they will be categorized as industrial waste.

c) Retail

A case study from Schneider and Wassermann (Salhofer et al., 2007) showed that 45 kg of food (50% vegetables, 30% fruits and 9% grain products) was wasted every day in each one of the two investigated discount supermarkets in Vienna. According to Jones (2004) around 0.8% of all food products, offered by US supermarkets were lost at this stage. Overstocking, damaged packaging,

products past its 'sell by date' or post holiday discard of seasonal items (e.g. at Christmas or Halloween) were the main reasons for food losses at this stage. The comparatively low figure of 0.8% can be traced back to better logistics and storage rotation practices where supermarkets sell food going out of date cheaper (Jones, 2004).

d) Consumers and food services

At this stage around one fourth of US American edible food supply is lost in 1995 due to over preparation, expanded menu choices, unexpected flotation and leftovers (Kantor et al., 1997). As a proportion of total food used in commercial food service industries, convenience stores (e.g. at petrol stations) account for 26.3% of food loss and fast food restaurants for 9.6% in the USA (Jones, 2004).

2.2 Types and amounts of food waste from households

Amounts and types of food waste vary according to different nations, regions or households and are influenced by numerous factors (compare chapter 2.4). Food waste accounts for around 17.6% of municipal waste in Austria and 27.4% in Vienna (Schneider and Obersteiner, 2007). The four food waste types described in Table 1 were derived from Austrian composition analysis and the amounts mentioned are valid for Viennese households in 2003 (Wassermann and Schneider, 2005):

Table 1: Types of food waste and amounts in kg per capita per year for Vienna

	Types of food waste and examples		Amount in kg/cap/ year	Picture for illustration
1	**Unopened food in original packaging** (food in its original packaging, discarded past or before the expiry date)	**'wasted food'**	34	
	e.g. unopened yogurt; unopened sausages			
2	**Opened, partially used food** (food that was partially used but discarded)		33	
	e.g. half a package of spread; half of a sausage			
3	**Inedibles** (mainly consist of preparation residues)		50	

	e.g. onion peelings; egg shells		
4	**Leftovers** (food scraps from plates because it was cooked too much)	20	
	e.g. boiled rice; sandwiches		

The first two categories are henceforth called ‘wasted food’ and account for 12% of residual waste in Vienna and 6.6% in the more rural area of Lower Austria (Salhofer et al., 2007). Higher amounts of inedibles are found in households that are cooking from scratch and therefore use more fresh fruits and vegetables.

2.3 Public awareness of food waste

Households have different perceptions when talking about food waste. For most of them, food waste is something they have control over like leftovers or food that has been allowed to go off and so inedibles are usually not included in their thoughts (WRAP, 2007b). Throughout the year everybody wastes at least some amount of food that could have been eaten.

During a kitchen waste diary research (see chapter 2.8.1) by WRAP (2007b), participants had to list the amount of food waste they produce and were asked before and after the study if they call themselves high – medium – or low food wasters. After the event, the percentage of persons feeling that they personally waste a ‘high’ amount of food increased considerably by 11.5% (compare Table 2). Another study asked the same question but was carried out on a UK national scale. It shows that on average 30% of people in the UK said that they are high food wasters, which is significantly lower than the post-diary figure of 52.6%. According to the UK national survey, 43% of people asked self-assessed themselves as low food wasters. This shows that households tend to underestimate the amount of food waste they create if they do not concern themselves with this topic and are not aware about the scale of the problem.

Table 2: Types of food wasters in the UK (WRAP, 2007b)

Types of food waster	Pre-diary	Post-diary	UK national survey
High throws away quite a lot or reasonable amount	41.1%	52.6%	30%
Medium throws away a small amount	40.8%	28.7%	27%
Low throws away a little or none	18.2%	18.1%	43%

At a qualitative study about consumer food management behaviour, especially older, low-income and participants that experienced hunger in other countries, felt that “food waste is something to be avoided” (WRAP, 2006).

Consumers however are more environmentally concerned about food packaging, even though higher amounts of food then packaging waste are arising (WRAP, 2006). Food waste is often associated with methane produced in landfills but the whole food supply chain alone (production, processing, transportation and storage), accounts for 20% of UK’s greenhouse gas emission (WRAP, 2007a). Environmental caring households and those committed to recycling produce less amounts of food waste than others whereas single people and students are more willing to throw edibles away (WRAP, 2006).

2.4 Factors influencing the amount of food waste generated in households

The amount of food waste generated is influenced by a variety of interlinked factors. They have been summarized in three main categories as follows:

2.4.1 Demographics

- Household size and composition

The more persons living in a household, the more food waste they produce. Due to economies of scale, larger households waste less on a per capita basis. Therefore single households waste most food per person (WRAP, 2008). Even though adults waste more than children (Wenlock et al., 1979), the highest amount of food waste can be found in family households with children aged under 16 (WRAP, 2008).

- Age

Younger working people aged between 16 and 34 tend to be higher food wasters (WRAP, 2007a). According to Wassermann and Schneider (2005) older people (over 50 years) waste less food because they are more into saving and recycling (‘war mentality’), spend more time at home and are financially restricted.

- Education

Higher educated people tend to throw away more (Wassermann and Schneider, 2005). But this might go along with higher income and more often eating out which may influence storage management.

- Housing

Households who rent their property privately waste most compared to own outright, mortgage and social rented accommodations (WRAP, 2008).

- Income

The impact of income on the amount of food waste is assessed differently in literature. Jones (2004) claimed that US households with lower income have lower food loss rates, but 35 years earlier Wenlock et al. (1979) found no statistical significance that more income automatically leads to more food waste. According to WRAP (2007a) lower income people waste more food because they are less likely to plan their shopping and have a 'live for today' attitude. Disposable household income however is strongly related to education and work and so Wassermann and Schneider (2005) found that people with full-time jobs waste higher amounts of food. WRAP (2008) investigated different occupational groups and claimed that self-employed persons waste most and retired least (which is again related to age).

2.4.2 Consumption behaviour and food patterns

Routine is key for shopping behaviour with the majority of consumers going to a supermarket at a regular day, at the same time and most often on a weekly basis (WRAP, 2006). More frequent shopping, like common among young mothers, people without cars and retirees, might lead to less waste but more spontaneous buys. Sonneson et al. (2005) showed that shopping frequency can be related to the amount of food bought. Specialised or convenience shops for example are visited less frequent and cater consumers just to buy a few products. According to Rathje and Murphy (2001) the frequency products are bought influences food waste arising. The common standard sandwich for example is hardly found in US American food waste because it has a high turnover and is re-bought regularly whereas speciality breads (e.g. bagels or hot dog buns) are used once or twice for specific meals and 30-60% of them are thrown away.

Thogersen (1996) claimed that households, looking for variety in their meal planning, will waste more food as there is a higher risk of disappointment and lower competence when preparing a meal from a new recipe. Contrary households that do always buy the same products or are loyal to brands waste less. A similar conclusion was found by Rathje and Murphy (2001) when investigating why Mexican households waste significantly less food than the average Anglo-American household in the USA. Mexicans have a variety of dishes but only use a few ingredients that are combined differently. Hence those standard ingredients are re-bough regularly and it is easy to incorporate leftovers into new meals.

Shopping lists are used by 2/3 of people in the UK (in particular older and lower income persons), but less than 50% stick to those lists as they are merely seen as reminder and not as definite lists (WRAP, 2007a).

2.4.3 Other factors

Households in rural areas produce less food waste than in urban areas (Salhofer et al., 2007). According to Wenlock (1979) more food waste occurs in summer compared to winter and pets or feeding of wild animals will influence the magnitude of edibles thrown away.

Another factor might be cultural differences between nations. If invited for a meal in South Korea for example, it is seen as polite to leave food on the plate and hosts are expected to supply vast feasts which have little prospect of being eaten (Hogg et al., 2007).

2.5 Reasons for household food waste

Little research has been conducted about the reasons of food waste so far. The most appropriate one was a qualitative consumer research (WRAP, 2007c) which investigated the causes of food waste generation among 15 focus groups and found four generic headings:

- Supermarkets
- Poor planning / food management
- Personal choice and lifestyle
- Lack of skills

As the mentioned WRAP research has the closest link to the research question of this study, a more detailed description of the findings can be found in Appendix A.

Other points found in literature are listed below:

- Overshopping

The most obvious reason of food waste is simply because households buy too much or items that are too large for their requirements. According to WRAP (2006) this overshopping can be caused by:

  - No or too little pre-shop planning
  - Lack of knowledge what is in the storage/fridge
  - Impulsive buying due to promotions and marketing influences in the shop
  - The presence of other persons or children during shopping
  - Shopping frequency (e.g. once every two weeks)
  - Giant-size packs (‘better value for money’)

- Preparing too much food in general

WRAP (2008) found that 30% of avoidable food waste arises because it was left on the plate and another 9% was left from cooking (compare Figure 6).

- Special offers

Items bought on offer or spontaneous are more likely to be thrown away (WRAP, 2006). According to Schmalen et al. (1996) special offers might give an impulse to cook things from the storage and prevent food waste. A discount on tomato sauces for example may be the reason to buy this product, cook pasta and use the rest of the wine which was opened the day before.

- Health concerns

Along with the trend of health-conscious living, households try to bring variety in their daily cooking or buy more fresh and perishable products like fruits or vegetables. This causes more inedibles to be found in the waste if they cook more from scratch (WRAP, 2007a).

- Children

Children may influence their parents during shopping ('pester power') but are also 'picky eaters' that do not always like the food prepared for them. Parents don't want to force children eating everything on the plate and health concerns may be another reason as some parents do not give their children reheated food (WRAP, 2007b).

- Expiry date

Many consumers are confused about the meaning of the different expiry dates (see 1.6) on food packaging. When asking UK consumers about the meaning of those dates, almost a third (32%) interpreted the 'use by' date incorrectly and thought that the food would be past its best but not necessarily unsafe. For the 'best before' date there was even more confusion with 36% answering not correct. Men were less likely to give the correct answer for the 'use by' date, but more likely to do so for 'best before'. Women are therefore more precautious in their interpretation of the safety of food than men (Food Standards Agency, 2008a).

- Cooking skills

Only 50% of people aged under 24 cook from scratch and many of them have no skills in using leftovers or the existing storage (WRAP, 2007a).

- Improper storage

Especially persons under 35 years are unable to assess whether food is safe to eat or not (Kantor et al., 1997). Pfau and Piekarski (2003) showed that 10% of consumers buying long-life milk, store it at unsuitable locations after opening. In general participants thought that even an opened package can be kept longer than fresh milk.

Not eating in date order or too warm fridge temperatures are other important storage failures. The recommended temperature to hinder bacterial growth in the fridge is under 5℃ for perishable products like raw meat and under 8℃ for

others. Despite those recommendations, fridge temperature is over 5℃ in 70% of UK and over 7℃ in 36% of German households (Tho mas, 2007).

- Storage control

Methodical regular storage control would keep the household members informed what is in the store and when it expires. Instead, ad hoc cleaning just a few times a year (‘spring cleaning’) is common among most households (WRAP, 2007a).

- Lifestyle

The personal lifestyle influences the meal preparation frequency and the time for planning or preparing dishes. Unforeseen invitations for a dinner or eating out may be a reason for some households not to use the bought food as planned (WRAP, 2007a).

- Inconvenience

Smelly leftovers (e.g. fish dishes) are more likely to dispose them quickly rather than keeping in the fridge/storage to eat them the next day. The smell of food waste may also influence shopping behaviour as alternative products will be bought (e.g. frozen fish) or the day somebody buys certain products is timed with the waste collection day.

- Loss of economic and personal value of food (compare 1.3)

2.6 Measures for preventing food waste from households

According to Salhofer et al. (2007) waste prevention “is a long-term process which requires modifying the behaviours of households, producers and other participants in the economy”. In general, waste prevention is divided into qualitative (reducing the hazardousness of waste) and quantitative (reduction of the amount generated) prevention.

Some of the conventional measures and recommendations for a quantitative food waste prevention or reduction in households are listed below:

- Consumer education (meal planners, change in perception of food)
- Economic incentives (pay as you throw schemes)
- Pre-shop planning (storage control and shopping list)
- Buy loose fruits instead of pre-packaged in certain amounts
- Cookbook for leftovers
- Clear labelling of expiry dates (just one label for all products)
- Self dispensing systems in supermarkets (WRAP, 2007d)
- Internet shopping (It keeps unintended purchases down (WRAP, 2006) and homepages can provide helpful functions like a shopping list or recipes that put leftovers and new ingredients together (WRAP, 2007a).)

2.7 Methods for investigating food waste in households

2.7.1 Households involved in the study

Questionnaires can be used to ask households about food waste. They are easy to set up and can use sampling methods, which are statistically representative. As food waste is an emotional topic, participating households could tick those answers which are most acceptable by the public or which they believe to be the correct ones. Linked to 'socially accepted answers', Rathje and Murphy (2001) mentioned three problematic syndromes that occur in surveys about food waste if participants are assessing themselves:

a) 'Good Provider Syndrome': In questionnaires people might claim that more food was consumed than there is empirical evidence through waste composition analysis or bills collected. Prepared foods are under represented and the amounts of fresh products employed in cooking meals from scratch are over reported.

b) 'Lean Cuisine Syndrome': When participants are self reporting about the food patterns of their household, they tend to minimize the volume of certain types of food consumed (like chocolate or pastries) and over report the amount of others (e.g. fruits).

c) 'Surrogate Syndrome': People provide inaccurate consumption reports about themselves. The amount of own alcohol consumption for example is under reported by 40-60% whereas other members of family or neighbours are described more accurately.

Qualitative face-to-face interviews can avoid those problems and are more useful when the reasons for food waste arisings are investigated.

'Kitchen diaries' is another approach where households have to self report the amount of food they waste. It can be cross linked with several other tasks (e.g. reporting the reason for each item of food waste thrown away) and supported by a pre- and post diary questionnaire.

2.7.2 Households not involved in the study

Composition analyses are the main method to give information about the amount of food waste arising but no information about the reasons are collected. Residual waste is split into its fractions and searched for food waste. Results are not directly influenced by participants but other disposal paths (e.g. toilets or home composting) may be used and so some food waste is lost for weighting. Composition analyses are expensive if statistical representativeness is required.

A combination of different methods is useful as found food waste masses could underpin results found through interviews.

2.8 Case study: Household food waste in the UK

In May 2008 a comprehensive report from WRAP (Waste and Resource Action Programme) was released, called 'The food we waste' (WRAP, 2008). It shows the scale of the food waste problem arising from households in the UK.

2.8.1 Methods used

The report is based on three methodological elements from separate reports that were put together:

a) Qualitative, guided interviews (WRAP, 2006)

This research aimed to investigate the food management behaviour (i.e. pre-shop planning, in-shop behaviour, storage management, food preparations practices, leftovers, route of disposal for food waste and packaging considerations) of different households. Ten 90-minute focus group discussions were carried out and the groups divided according to their socio-demographic backgrounds (e.g. income or age). Additionally a self-completion food management diary was given to every participant one week in advance to record waste related behaviour and give examples for household habits and routines. Due to the small sample size and the research methods used, findings should be seen as illustrative only and are not representative for the UK in a statistical sense.

b) Kitchen diaries (WRAP, 2007b)

Types, amounts, costs, reasons and disposal practices of food waste in households should be investigated with this research. 284 participating households were asked to keep a one week record of every food item thrown away in February 2007. Amounts were usually expressed in terms of units, spoons or handfuls and had been translated into grammes and costs afterwards. A pre- and post-questionnaire was used to provide insights about attitudes, perceptions and behaviour in relation to food waste and possible changes afterwards. Again the sample size was too small to be representative for all households in the UK.

c) Composition analysis (WRAP, 2008)

This research aimed to give a statistically representative sample across England and Wales to determine the mass and cost of food waste. Starting in July 2007, 2,715 households took part in a questionnaire which asked for socio-demographic background data, waste collection habits, home composting and recycling experiences and perceptions towards food waste. Four weeks later, municipal waste from 2,138 of these households was collected, sorted, weighted and divided into 13 food groups (see Appendix B) as well as food stage categories (compare Figure 5). Annual mass of food waste for all UK homes was calculated through the average mass by household type (i.e. households of singles, shared unrelated adults, related adults and related

adults with children). Cost was allocated with the mass in grammes according to a mean price for every food item identified. Analysis was focused on the mass and cost of 'avoidable' waste (see 2.8.2). Even though participants were selected on a random basis, some factors are statistically not representative for the UK. These include:

- No samples from Scotland and Northern Ireland
- Under-representation of smaller households and some employment statuses (part-time, self-employed, unemployed, long-term sick and students)
- Flats are excluded
- Asian households are over-represented in terms of ethnic origin

2.8.2 Results

a) Mass and cost

6.7 million tonnes, equivalent to 14.5 billion Pounds (18.8 billion Euros[2]) of food are thrown away in the UK every year. This represents around 20% of all domestic waste generated in the UK. For the purpose of WRAP's report, food waste was divided into three main categories:

- 'Avoidable' food waste: Products that are no longer wanted or have been allowed to go past its date (e.g. whole fruits, leftovers, half a pack of cheese).
- 'Possibly avoidable' food waste: Edibles that some people choose not to eat or products that can be consumed if prepared in another way (e.g. bread crusts, potato skins).
- 'Unavoidable' food waste: Waste which arises from food preparation that cannot be eaten (e.g. bones, tea bags, fruit cores).

The average UK household throws away 270 or 170 kg, worth 590 £ (764 €[2]) or 420 £ (544 €[2]) of total or avoidable food waste per year (compare Figure 3).

[2] Exchange rate Pounds to Euros of 1.295 on the 4th of July 2008 according to UBS (2008).

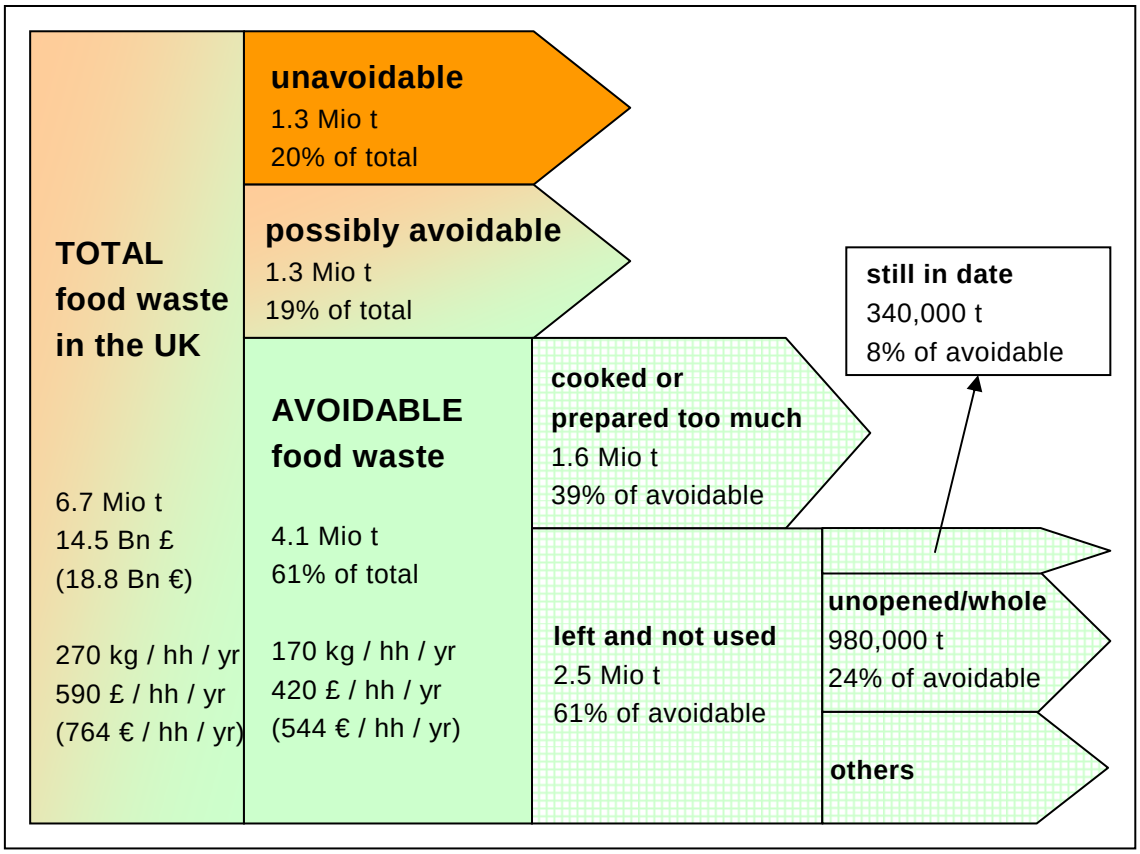

Figure 3: Food waste balance for the UK in 2007 (WRAP, 2008)

Products discarded but still in date at the day of the sorting analysis, account for at least 8.3% of avoidable food waste under which drinks, confectionary and condiments have the highest proportions.

The top three food items wasted in % of mass of avoidable food waste are:

1) potatoes (9.7%)
2) bread slices (8.8%)
3) apples (5.1%)

Food waste was divided into different food categories and preparation states during composition analysis (compare Figure 4 and Figure 5). The difference between total and avoidable food waste in the category ‘vegetables’ (see Figure 4) is caused by peelings and inedible parts. Despite potatoes are the food items found most, the category vegetables is ranked second for avoidable food waste after bakery.

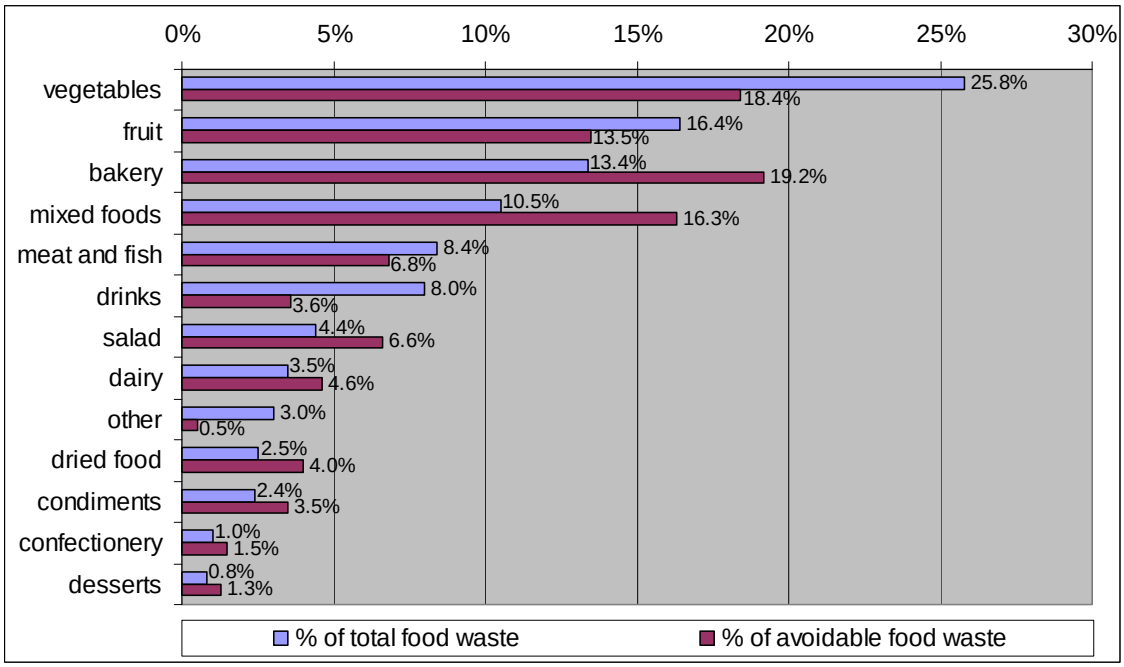

Figure 4: Proportion of total and avoidable food waste mass by food categories (WRAP, 2008)

WRAP (2008) found that 46.5% (or 38.5%) of all (or avoidable) food waste in the UK consists of products that are usually bought in a fresh state (vegetables, fruit and salad).

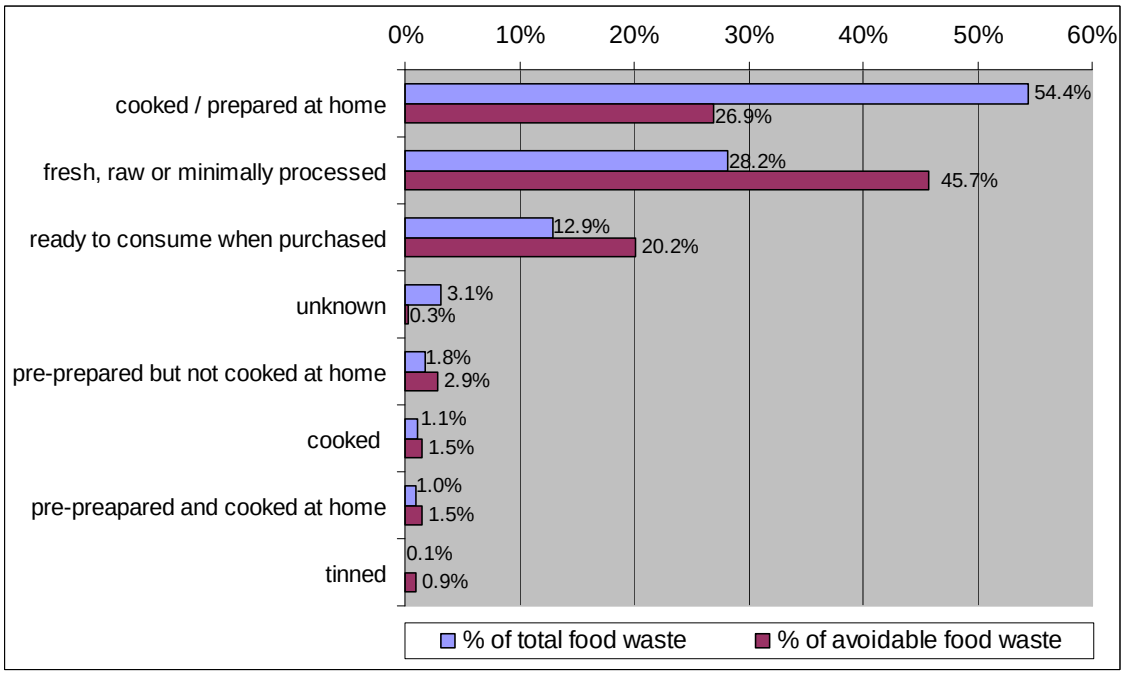

Figure 5: Proportion of total and avoidable food waste mass by preparation state (WRAP, 2008)

According to the preparation state, leftovers are by far the most important influence of total food waste arising. For avoidable food waste, unprepared products (e.g. raw potatoes) have the biggest impact.

b) Reasons for food waste

The amount of food waste was significantly related to household size (88%), age (85%) and household composition (67%).

Reasons for food disposal (see Figure 6) were derived from the kitchen diary approach where participants had to keep record for each food waste item according to a pre-given list. Brackets show the item mentioned most for each reason given.

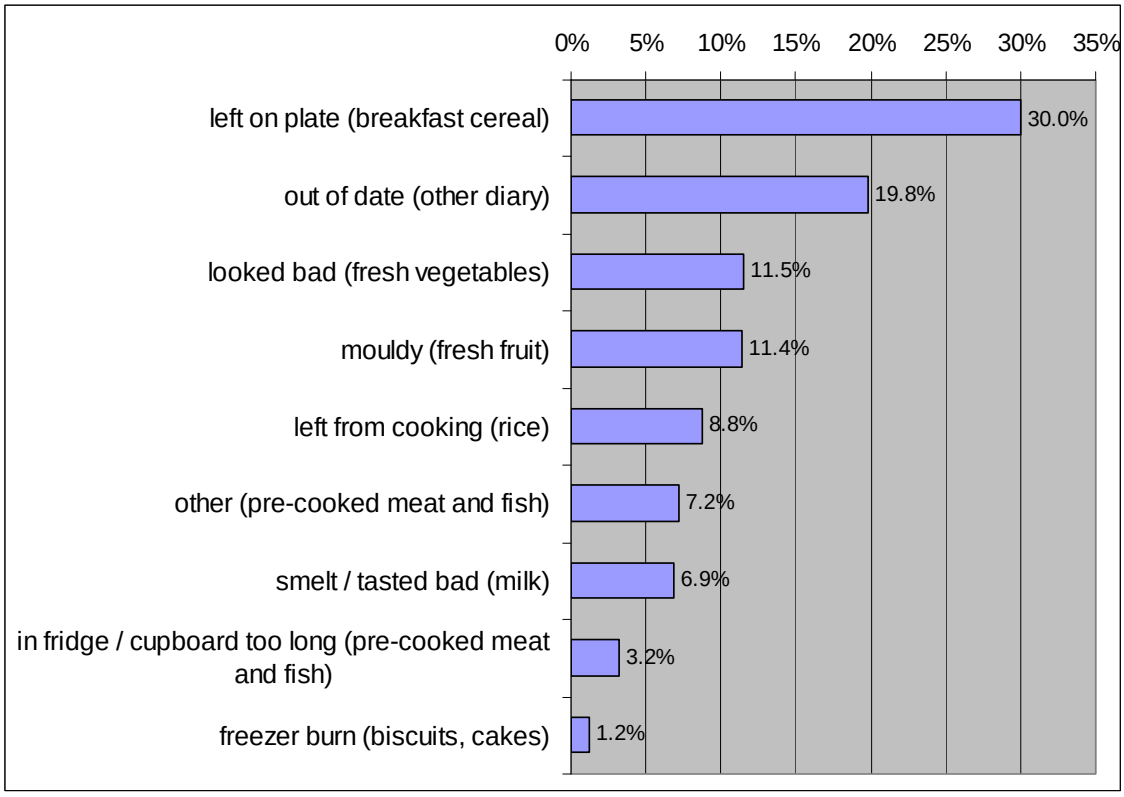

Figure 6: Proportion of avoidable food waste thrown away by reason (WRAP, 2008)

3. Methodology

As the focus of the present thesis is wasted food (compare Table 1) and not all types of food waste, methods used in 'The food we waste' report are inadequate for the research question because:

- WRAP's kitchen diary approach limited the participants in their choice about the reasons of food disposal to a pre-set list. Besides those reported disposal reason (e.g. 'left on plate' or 'mouldy') have little to do with the causes of food waste arising (e.g. cooked or bought too much).
- Composition analyses investigate the amounts of food waste arising but give no hint about the profound causes.
- As food waste is a delicate subject to many people and linked to emotions or memories, questionnaires are likely to give a warped picture due to 'socially accepted answers' (compare 2.7.1).

3.1 Method selection

This thesis is based on qualitative social research and used a combination of different methods:

- Qualitative, problem-oriented face-to-face interviews
- Record of expired products found in the household
- Questionnaire about socio-demographic background and other data

3.2 Qualitative research in general

Empirical social research is the systematic recording and scientific interpretation of the social world. It is divided into two major method blocks: quantitative and qualitative social research. Quantitative methods start with hypotheses as a basis and try to verify or falsify them. Qualitative research uses a circular approach like shown in Figure 7 to gain a better understanding of human behaviour and the reasons governing it. Hence it investigates the why and how of decision making rather than what, where and when. Based on empirical data, this inductive approach tries to describe assumed coherences for the generation of new hypotheses (Atteslander, 2008).

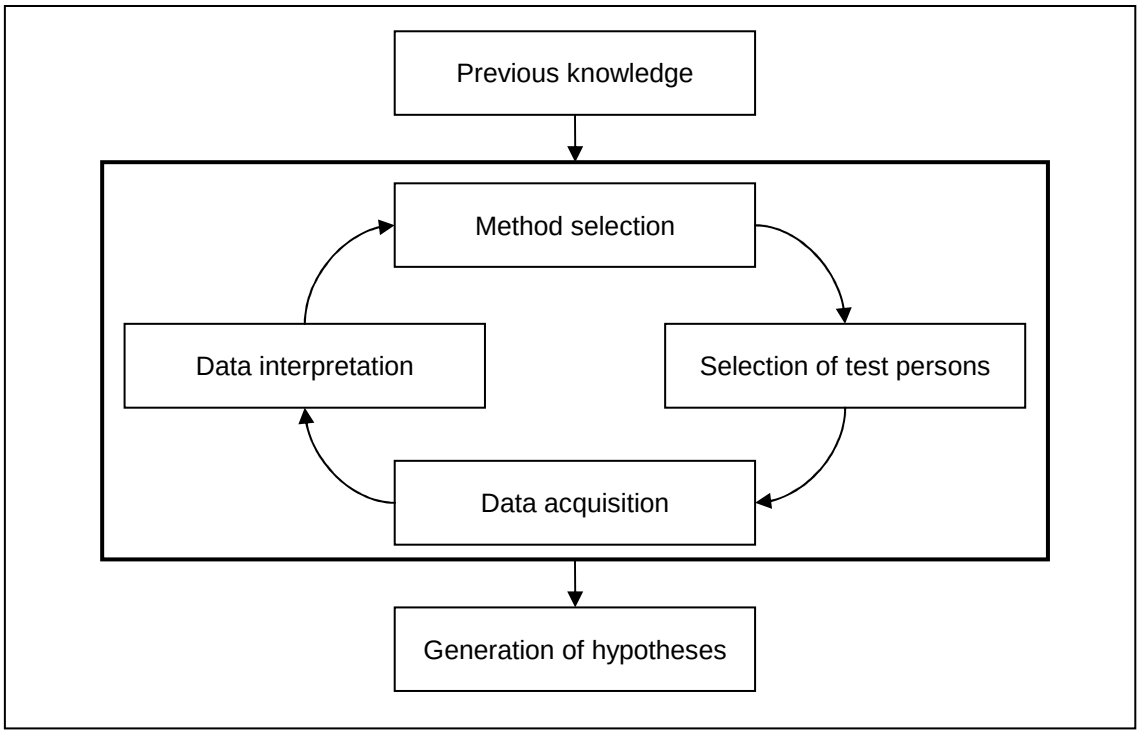

Figure 7: Circular approach of qualitative social research according to Lamnek (2005)

Hypotheses generated are depended on the researcher's assumptions and therefore intersubjectivity is the main point of critique in qualitative research.

3.3 Selection of test households

A theoretical sampling method was used so that the researcher could choose individuals of interest and did not have to be statistically representative. This concept should increase the variety of the participants according to their socio-demographic characteristics (compare Appendix C). The sample size was predetermined to 20 and was expanded to 21 households.

In practical terms, households from Vienna and Lower Austria were selected according to a 'pyramid scheme', starting with relatives, friends and university colleagues and using their relatives, friends, colleagues at work etc. to find new participants.

3.4 Sequence of interviews and data acquisition

a) First contact

The first contact to participants was always established via a telephone call. Most prospective participants had been informed in advance from the person who did the interview before. Information about the duration and interview style (audio record) was given. The first nine households were informed about the topic ('food waste') of the thesis. This was changed from then on, stating that

the interview is about ‘food in general’ to avoid participants looking into their storage or taking some extra care before the visit.

b) Problem-oriented interview

Interviews were carried out in the homes of participants and had always started with small talk and information about the researcher before starting the audio tape. The recorded interviews lasted ¾ to two hours and were done with the person most responsible for food in the household. If other household members were around, they had been invited to take part which resulted in a group discussion in ten cases. Things said have been recorded via a digital voice recorder and transliterated afterwards together with breaks and interruptions.

c) Search for expired products

After the guided part of the interview, a search for potentially wasted food in the storage was carried out together and with the approval of participants. Fridges, cupboards and other parts of the storage (excluding freezers) were searched for products that have been expired or that won’t be eaten anymore. Most participants helped to find products as interest was raised through the interview. Name, date of expiry and place where items had been found were noticed for each product and weighting postponed till later if the household agreed the expired edibles to be taken away (see Appendix D for a factsheet example). Household members were asked not to tell prospective participants about this storage control to avoid distortions.

d) Interview why products had been allowed to run off their expiry date

This interview was solely focussed on the items found and accompanying reasons for each item were asked.

e) Questionnaire

A short questionnaire was used at the very end of the interview session to gain socio-demographic information about the test person and ask several other questions linked to eating habits, consumption and disposal patterns or the storage of food (compare Appendix E). As the survey was carried out in Austria, the questionnaire was originally set up and filled out by participants in German and the form was translated into English afterwards.

f) Post script

It was written after each interview and gives background information about the interview situation. Non-verbal reactions, the interview setting and things mentioned before and after recording have been noticed.

3.5 Qualitative, problem oriented interviews

According to Lamnek (2005) open interviews are the best method to find new, unexpected outcomes that can be transformed into hypotheses. Semi-

structured, problem-oriented interviews were chosen as the main qualitative research method. Unlike the narrative interview style, previous knowledge is accepted and applied. The researcher was informed about the topic through literature and established a theoretical questioning concept (see Appendix F for the interview guideline). Questions asked have been prepared and stock phrased in advance. They acted as a guideline for the interview but were open to change in terms of sequence or new emerging topics which were welcomed to be followed up.

Typical phases of the recorded problem-oriented interview applied by the researcher are described by Lamnek (2005):

1. Opening

The interviewee was encouraged to talk freely about questions. Open questions do not have specific answers and were useful for starting the conversation.

2. Discussion

With the help of interposed questions, the discussion should lead to the main points of interest. In terms of the narrative continuity and fluency of the discussion, it was important to ask the right questions at the right time. In the discussion phase, several questioning options were applied:

a) Reflexion: Interviewer and the interviewee should have the same idea about the meaning of words or topics asked.
b) Clarification questions: Contradictions or evasive answers were specified.
c) Confrontation: The interviewee was confronted about contradictions and obviously wrong answers. If this option was used, special care was necessary not to destroy a good discussion climate.

3. Direct questioning

At the end of the interview, a free and open questioning style was changed to a more direct one if necessary. Topics according to the guideline and directly linked to the research question were asked which have not yet been discussed.

According to Atteslander (2008), the main disadvantages arising from a problem-oriented interview style are:

a) The need of a skilled and trained interviewer
b) Higher expenditure on time compared to standardised questioning techniques
c) Decreased comparability and a more complex evaluation of the findings

3.6 Data interpretation

Qualitative interviews were interpreted through content analysis which is the name for numerous analysing techniques. It was originally developed for quantitative research and has different definitions depending on the author and the research area. Some points those definitions have in common are mentioned by Mayring (2007):

- Analysis of ‘fixed’ communication (texts, pictures etc.)
- Systematic approach for the interpretation of data
- Systematic analysis: traceability for others
- Theoretical methodology: Outputs are interpreted on a theoretical background

Frequency analyses in combination with qualitative data analyses were used to interpret interviews. Qualitative data analysis tries to take into account all possible meanings arising from each single household to find hypothesis and is rooted on a clearly defined research question. General characteristics according to Lamnek (2005) are:

- Openness to the test persons, test situation and the theoretical concept
- Interaction and communication has to be allowed through direct contact to the interviewees
- The interview situation should be as natural as possible
- The overall aim is to generate hypotheses and not to falsify them

Eight steps mentioned by Lamnek (2005) are recommended for carrying out a qualitative data analysis and have been taken into account for interpretation purposes:

1. Choose the relevant passages of the interview that are linked to the research question
2. Analyse the interview situation
3. Formal characterisation of the interview through the transcript
4. Determine the framework and the direction of the interpretation through investigation units
5. Specify the research question with theoretical principles
6. Choose the analysing technique
7. Define the units and themes of investigation (text components, feature characteristics)
8. Interpretation

The qualitative analysing technique of ‘content structuring’ was used to filter and summarize certain topics, contents and aspects from the transcript into categories. Figure 8 shows 10 practical steps how this method was applied according to Mayring (2007):

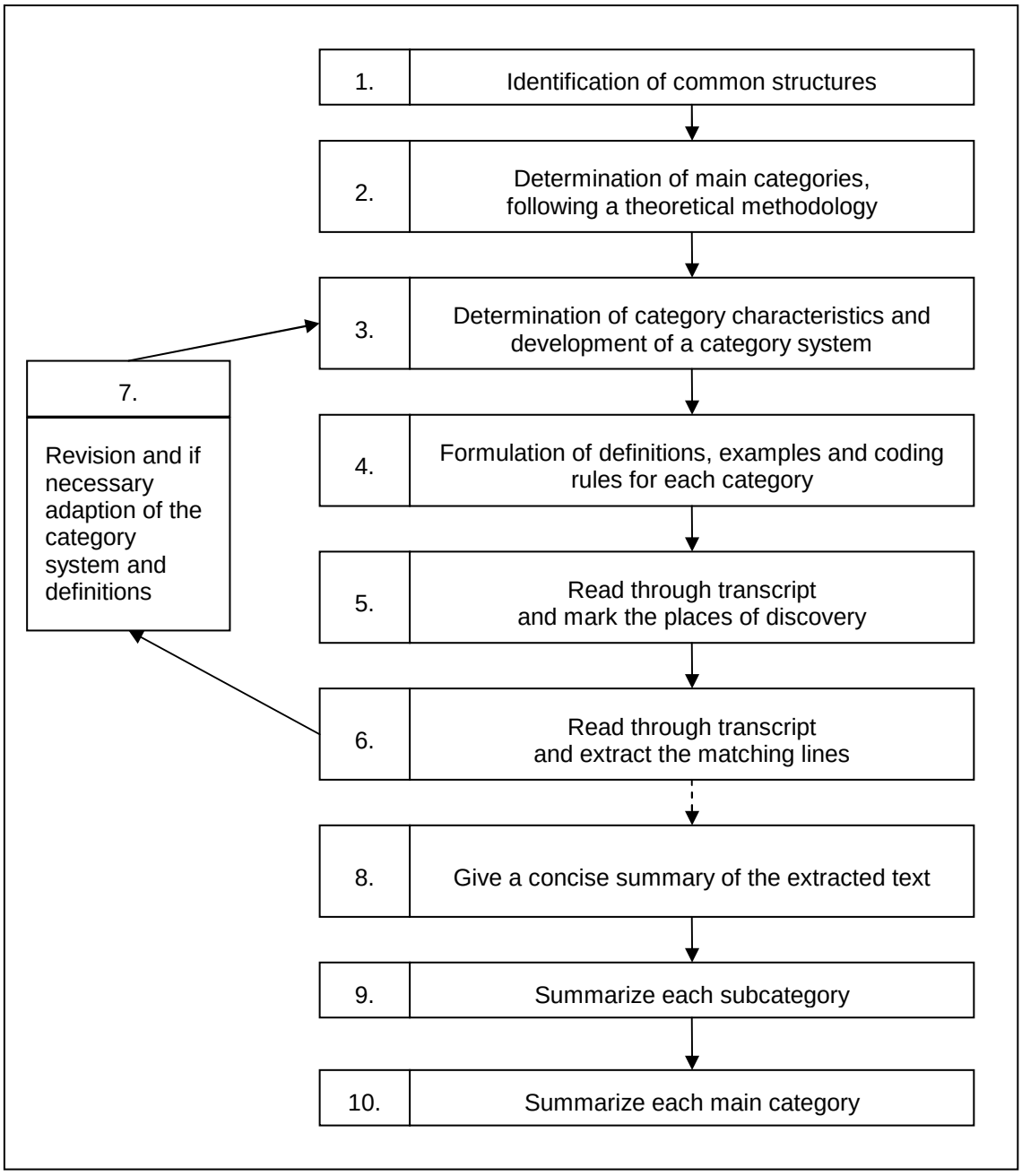

Figure 8: Sequence of content structuring as a qualitative analysing technique of content analysis (Mayring, 2007)

The category system constitutes the coding rules for each subcategory. Therefore rules need to be clearly defined, plausible and derived from the transcript (compare Appendix G). According to Lamnek (2005) the following six criteria have to be met for a valid categorisation:

- The category system has to be theoretically derived from the study
- Categories have to be independent
- Categories have to be completely specified
- Categories have to be mutually exclusive

- Values of each category have to be classified through the same principles
- Values and categories have to be defined unambiguously

For the frequency analysis, each household was counted once when a subcategory was mentioned in the transcript. The counts have been added to give an importance ranking of the investigated reasons (compare Appendix G).

3.7 Qualitative research problems

If the interviewee won't or can't give a 'true' answer, the researcher had to accept it. Indirect questions helped to keep the discussion running and create an atmosphere of trust which was important for the interviewee to talk freely even about emotive things like food consumption. The interview situation was tried to be held in a relaxing atmosphere (living room or kitchen of participants) and anonymity was guaranteed.

The common stimuli – reaction model was not applicable as everything asked during the interview is evaluated and so answers are not always causal results of the questions. It is more realistic to use a stimuli – person – reaction model which emphasizes that the answers are influenced by the emotions and perception of the interviewee who might think: "What expects me the interviewer to say and which impressions do I give him?" (Atteslander, 2008)

In practical terms the digital voice recorder was a psychological stress factor. As soon as the interview began to be recorded, most participants changed their voice and became unsure in things they said for the very first minutes. Therefore the recorder was placed out of sight which caused a worse audio quality but a better communication.

As it is not only important what is said, but also how, the behaviour and appearance of the interviewer might affect the answers. These influences were tried to be minimised with a neutral interviewing style. A 'neutral' interviewer shows no feelings or reactions to things mentioned in the discussion. The personal attitude to the topic and surprise or disapprobation was concealed. In this context the body language was kept neutral and nodding avoided. However the neutral behaviour should not disturb a positive discussion atmosphere and so personal points of view were given if necessary.

III. PAPER FOR PUBLICATION

Selected journal: „Resources, Conservation and Recycling“

Guidelines for authors are included in Appendix H.

Title

Causes of food waste generation in households – an empirical analysis

R. Glanz[1]*, F. Schneider[1], S. Salhofer[1], and P. Longhurst[2]

[1] Institute of Waste Management, Department of Water, Atmosphere and Environment, University of Natural Resources and Applied Life Sciences, Muthgasse 107, 1190 Vienna, Austria
[2] Centre for Resource Management and Efficiency, Sustainable Systems Department, School of Applied Sciences, Cranfield University, Bedfordshire, MK43 0AL, UK
* Corresponding author

Abstract

Food waste is a comparatively new topic for waste prevention initiatives. Previous composition analysis showed the scale of the problem but give little hint about the reasons of disposal. This paper focuses on unopened food in original packaging and opened, partially used food with the aim to give a variety of possible causes why those two types of food waste are discarded in households. Face-to-face interviews with 21 households in Vienna and Lower Austria were the basis for a category system derived via content analysis, summarizing 43 different reasons into 6 main and 27 subcategories by content structuring. Results show that households are not always to blame for the arising food waste. Furthermore personal attitudes towards edibles, cooking and eating habits, shopping behaviour and storage of edibles have been identified as relevant factors.

Interviews were supported by a quantitative analysis of expired products found in the households and a questionnaire about the socio-demographic background of participants. A total of 212 expired products with a net mass of 30.2 kg were recorded. Food in original packaging was found more frequent and was twice as long stored after its expiry date than partially used food. In general non-perishable products were kept longer in the storage after they expired than perishable edibles. In eight households none or just one expired item was found which could be traced back to place of residence and age of participants.

Keywords

food waste; household; reasons; causes; qualitative; waste prevention; behaviour; content analysis; quantitative; Austria

1. Introduction

Food waste causes several problems in the whole waste management chain including odour, contamination of bins and vehicles, vermin or liquid and gaseous emissions. Landfills and agriculture, each accounting for 30% of methane gas emissions within the European Union (Lechner and Huber-Humer, 2004), are connected to food waste. Hence environmental problems occur after disposal (e.g. methane gas production) as well as in the whole lifecycle of food as it is the second most energy demanding group in households after housing (Engström, 2004). Public awareness and media attention has been raised by increasing food prices and the amount of food in residual waste. Composition analyses showed that food waste accounts for around 17.6% of municipal solid waste in Austria (see Figure 9) (Schneider and Obersteiner, 2007). Various interconnected factors influence the magnitude of food waste production with social background of households, consumption behaviour and food patterns being the most important factors.

[FIGURE 9]

Four different types of food waste can be distinguished (compare Figure 9):

- Unopened food in original packaging: Products which are in their original packaging regardless of expiration date (e.g. unopened yogurt) This type accounts for 14% of all household food losses in the USA (Jones, 2004).
- Opened, partially used food: Food that was partially used but discarded (e.g. half a package of spread)
- Inedibles: Preparation residues and inedible parts of food (e.g. onion peelings)
- Leftovers: Food waste due to excessive cooking amounts (e.g. 1 kg of boiled rice for two people)

This study focuses solely on the first two categories (original packaged and partially used food, called ‘wasted food’) which are responsible for 6 – 12% of residual waste in Austria (Schneider and Obersteiner, 2007). Unlike inedibles and leftovers, wasted food is not influenced by the availability of a separate kitchen waste collection as products are mainly still in their packaging and discarded together with residual waste (Salhofer et al., 2007). Wasted food is said to have a theoretical prevention potential of 100% (Salhofer et al., 2007) but little research has been conducted to investigate the underlying causes of food waste, which are important to know for the implementation of effective prevention measures.

2. Methodology and aim

The aim of this study was to list all possible causes why original packaged and partially used food are discarded in households. The research was conducted through a literature review and an empirical social analysis.

Previous studies were mainly based on composition analysis, sometimes supported by questionnaires. Another approach are 'kitchen waste diaries' where participating households record the type, amount and reasons for food waste. This is a promising method if participants are free to list any causes to each food item they waste and are not restricted to a pre-set list of disposal reasons. However, questionnaires and kitchen waste diaries are problematic for food waste research as they tempt participants into socially accepted answers and therefore distort results (compare Rathje and Murphy, 2001).

For this study, a combination of three different research approaches was used:

- Face-to-face interview
- Record of expired products found in the storage (except freezers) at the day of visit
- Questionnaire

A theoretical sampling method was used to maximise differences in terms of household size, age of interviewee, job status, place of residence, life stage and income. In order to identify all possible causes of food waste, the sample pool consisted of diverse social backgrounds. All interviews were conducted between July and September 2007. The participants consisted of 13 households from Vienna (1.66 million inhabitants), 7 from villages (under 5,000 inhabitants) and one from a small city (under 30,000 inhabitants) in Lower Austria. The focus on a big city was intended as significantly more food waste occurred in urban areas as compared to rural areas, demonstrated by Wassermann and Schneider (2005).

Each visit was divided into four steps:

a) Guided, problem-oriented face-to-face interview

An open questioning style about associations and memories linked to food was used as introduction, followed by another 11 questions related to cooking behaviour, shopping, storage and food waste. The neutral interviewer did not stick to the question sequence of the prepared guideline to allow participants to come up with their own topics and ideas. Interposed questions helped to create a fluent discussion and led to the main points of interest. More direct questioning was used at the end of the interview, in order to clarify contradictions or evasive answers and get to those points that had not been mentioned. If other household members were present, they were invited to take part, which resulted in a group discussion in ten cases. Interviews were audio-recorded in the homes of participants and transcribed afterwards together with additional information about non-verbal reactions and the interview situation.

b) Expired products

Without the previous knowledge of participants, already expired products or those with little prospect of being eaten were collected from storage areas (excluding freezers) together with participants. Net mass in gram (food products without packaging), storage place, number of items found and days after expiry date were noted and products classified into nine food categories derived from WRAP (2008).

c) Interview about expired products found

The second interview focussed on the expired items and asked for underlying causes why the products had been allowed to expire. This was the main stage for identifying the reasons for the wasted food.

d) Questionnaire

At the end of the visit, a short questionnaire was used to gain socio-demographic background information about participating households.

Transcripts derived from the two interviews in each household were interpreted through content analysis following the technique of content structuring described by Mayring (2007). Common structures were identified across all households and main categories for wasted food established. Subcategories were defined and exemplified in a second reading and numbers of matching statements from each household were counted according to a frequency analysis.

3. Results

3.1 Content analysis

Only reasons mentioned during the interview (either related to a question or an expired product found in the storage) were taken into account for interpretation. As interviewees were the most responsible persons for purchasing and preparing food, it was assumed that statements at the interview were correct.

Following analysis, 43 different reasons were found and categorised into 6 main and 27 subcategories (compare Figure 10). Reasons for wasted food were divided whether or not households were responsible for the discard of food. If the amount of wasted food could be influenced by any household action, it was assumed that they can be hold responsible. Brackets in Figure 10 show how often each subcategory was mentioned according to the frequency analysis. Multiple reasons, belonging to the same subcategory were counted once per household.

[FIGURE 10]

The developed category system is explained below and illustrated with examples from the study:

- Households not responsible for wasted food

Interviewed persons mentioned five cases in which they were not responsible for the food they waste. If products were already spoiled (e.g. melons mouldy on the inside) or exposed to improper cold storage (e.g. milk) before the time of purchase, food had to be discarded before its expiry date. Food intolerances towards certain ingredients caused some products (e.g. peas) in the storage to be not prepared anymore. One household stated that due to a power failure, perishable products in the fridge got spoiled afterwards. Another one blamed low food quality (e.g. bakery from a discount supermarket) that products should be eaten within one day as they could not be stored longer.

- Attitude

If food (e.g. opened package of crisps or spread) was thought not to be fresh or tasty, it was likely to get overlooked for fresher products (e.g. new loaf of bread) which were eaten first, causing older ones to spoil. Just in case products were food purchases meant for possible meals and events. One household for example stored already expired beer in the fridge to offer it to possible guests that never came. Health concerns prompted some participants to throw away food and meat in particular. In one young family household for example, meat was not stored longer than three days as a principle, no matter if it was still edible. Hygiene aspects can also cause food to expire faster (e.g. one knife used for butter and jam). The low internal valuation of food allowed one household to ignore wasting food, stating that “It’s worth just one Euro, so I don’t mind”. Individual household practices determined food waste. For example the last item of a package was left in one household because of an internal agreement between household members that would force the person who takes it to discard packaging.

- Habits

Concentrated products (e.g. anchovy paste) which were not used very often or products bought to prepare a special recipe (e.g. horseradish) were often partially used with the rest left to spoil. Furthermore, there are seasonal dishes requiring specific ingredients (e.g. Christmas spices) that were habitually purchased every year. A change in cooking habits caused some households to use surrogate ingredients (e.g. fresh spices instead of dried ones). A change of cooking plans (e.g. household members were surprisingly invited for dinner elsewhere) was said to be the reason for perishable products to spoil. In two cases it was too much effort to cook certain products (e.g. soy cubes) for the preparation of a meal. Changing eating habits were mainly due to a change in food philosophy (e.g. no more glutamate) which mirrors a greater demand on food quality due to a healthier lifestyle. The decision to eat several days in a row out caused the spoilage of food in one household.

- Shopping

Influenced by advertisements, friends or relatives, household members tried new products (e.g. sesame paste) but did not know how to cook with them or were unsatisfied and did not use them anymore. Participants did not know what to do with food if they simply bought too much (e.g. vegetables on a market) or the packages were too big (e.g. ready packed 2 kg of onions). Special offers in supermarkets were partly responsible for food waste as they tempt consumers into buying bulk discounts. Products sold at a discount nearing their expiration date have little prospect of being used in time. Perishable products (e.g. bread or milk) were more likely to spoil if households went food shopping just once a week. In one case a lack of shopping coordination caused two household members to buy the same products at the same time.

- Storage

Some products spoil sooner due to improper storage conditions or places (e.g. potatoes started to grow). Moths in the storage were named to be a reason to throw away all contaminated food. Strange, unusual storage places lead to food spoilage because food was not found. Overlooking of edibles in the storage is another reason for wasted food (e.g. if the fridge was refilled from the front and older products moved to the back). Improper handling during transport between supermarket and home caused some edibles to expire before their best before date. Food (especially meat) stored too long in the freezer was wasted because of freezer burn.

- Others

Households who produced their own vegetables were not able to consume them completely in time after harvest. Giving away the extra food did not reduce the amount of waste, because the recipients could not use them in time either. A change in household size (e.g. two singles moving in together) caused a surplus of certain products as both brought their stored food with them. It also happened that households forgot about bought products (e.g. a full shopping bag in the car during summer) until they were inedible. Food brought from a holiday that had not been used (e.g. powdered soup from a camping holiday) or a weekend trip while leaving perishable products in the fridge were other reasons for wasted food in households.

3.2 Quantitative analysis

A total of 212 expired food products with a net mass of 30.2 kg were found in participating households. They were classified into nine different product categories derived from WRAP (2008) and divided into unopened, originally packaged and opened, partially used food (see Table 3). A few items found in the storage (except freezers) were hard to distinguish between these two food waste types. A whole kiwi for example was categorised as original packaged if it was bought single but as partially used food if found in a packaging containing more than one kiwi.

[TABLE 3]

- Amount and items of wasted food

More unopened food in original packaging was found in terms of amount and items than opened, partially used food. The categories ‘Sauces and spices’ and ‘Dried foods and powder’ were the most important categories. Most frequently found products were spices (45 items), cook-in-sauces (13 items) and pudding powder (11 items) which all have a long durability and are common to buy in bulk discounts. Although the category ‘Drinks’ had a large proportion of the mass, relatively few items were found because each item has a large mass (e.g. one litre of orange juice).

- Days expired

To calculate the days items had been stored between their expiry date and the day of the interview, the mean average within and between each product group was used.

Some products (especially partially used loose fruits and vegetables) did not have any expiry date and were assumed to expire on the day of the interview (i.e. 0 days expired). Seven food items were discarded before their expiry date (which resulted in a negative figure for days expired) because of health concerns (e.g. mayonnaise) or diminishing taste (e.g. opened package of crisps). In the categories ‘Bakery’ and ‘Meat and fish’, waffles and anchovy had been the products that were kept in original packaging over one year without being recognized by the household. Opened, partially used food and ‘Dairy’, ‘Fruits’ or ‘Vegetables’ in particular are more likely to be noticed because of smell or mould which explains the low figures in those categories. Without the outlier of a package of tea from 1996, ‘Drinks’ would count only 109 days after their average expiry date, resulting in the category ‘Sauces and spices’ to be stored the longest.

- Storage place

The majority of food items were found in drawers (46%), the fridge (27%) and the pantry (24%). The category ‘Dried foods and powder’ together with ‘Sauces and spices’ were mainly stored in drawers and all diary and meat were found in the fridge. The storage place for food is dependent on habits, knowledge, experiences and the type of accommodation. A separate pantry was not found in any one of the seven participating households living in flats due to limited floor space.

3.3 Socio-demographic background

On average 10 expired products were found per household. In 8 households nothing or just one wasted food item was found. If these households are not considered, this figure would increase to an average of 16 found items per household. All 4 interviewed retirees came from these households with the average age of 59 years compared to 46 of all participants. Furthermore 7 of these 8 households came from villages and produced their own vegetables.

On average participants claimed to spend 30.0% of their household budget on food which is twice as much compared to the national average expenditure of 13.5% in 2006 (Statistik Austria, 2008). This may be explained by shopping on a regular basis (on average 2.9 times a week, especially for bread and milk) by most participants and the associated time spent in supermarkets. Shopping frequency was related by Sonneson et al. (2005) to the amount of food bought. Three households went shopping just once a week. Two of them to optimise spare time and another one because no car was available for transport. All three reported that perishable products are more likely to spoil in their households because of infrequent shopping.

In agreement with a national survey by Lebensministerium (2003), freshness was ranked as most important for participants when going shopping. Only three participants mentioned that they would eat the found products despite expiration. Among them one vegetarian said to eat five out of eight found expired partially used food items.

4. Discussion

Statistically valid results arising from the quantitative analysis are not possible because of the small sample size of 21 households. One household, where 26% of all items were found, reported that had the interview occurred one week later, fewer items would have been found because of the yearly storage cleaning before summer. This exemplifies the problem when expired products are specifically searched for in just one visit for the analysis. If a kitchen diary approach had been used, it is likely that more perishable products would have been found but the results are dependent on households reporting. Despite one out of four participants mentioned spoiled bread to occur more often, no spoiled bread was found.

Household waste and food waste in particular are highly emotional topics. This was observed as questions about the arising food waste in most interviewed households were rejected and the initial reaction was negative. Older people especially rejected the idea that any food waste occurred in their households. The observation that older people waste less food supports investigations from Lebersorger (2004) and Wassermann and Schneider (2005). Reasons for this tendency are financial restrictions of retirees and a higher esteem for food possibly caused by experienced food shortages. A loss of emotional and social linkage to food described by Pudel and Westenhöfer (1998) was observed in one young family household who stated that food is cheap to repurchase and sometimes “not worth storing if discarded later anyway”. In general young working people are higher food wasters (WRAP, 2007a).

Less food waste occurs, the more time is spent at home by household members (Lebersorger 2004). According to Lebensministerium (2003), young single households are most likely to eat out, which was supported by this study. More partly used food was found from this group than original packaged food.

Across all age groups, participants blamed others if directly asked about wasted food. Corresponding to a study in the UK (WRAP, 2007b), supermarkets were mentioned in particular to increase the amount of food waste by selling pre-packed low quality products, having inappropriate packaging sizes or an irrational discount policy. Value for money was a more important factor than the need of the extra product with 'buy one, get one free' discounts.

One subcategory mentioned by almost half of participants was 'special ingredients and products' (compare Figure 10) where concentrated products, meal preparation frequency or seasons for certain dishes lead to an increase in wasted food. These reasons are similar to Rathje and Murphy (2001) who reported that the frequency products are bought relates to the corresponding food waste. Hence products with a high turnover or which are re-bought on a regular basis are less likely to spoil than specialised ones used for certain dishes. New products are used especially if a new recipe is tried or interest has been raised through advertisements or by friends and relatives. Seven households mentioned 'trial buys' as reason why certain products were expired as they did not know what else to cook apart from the recipe these products were bought for. Thogersen (1996) claimed that on the one hand, households looking for variety in their meal planning waste more food as there is a higher risk of disappointment and lower competence when preparing a meal from a new recipe. On the other hand, households who buy the same products or are loyal to brands waste less. The variety in meal planning is important for most households as they don't want to eat the same thing twice in a row or want something to eat "if they fancy it" (WRAP, 2007b). This 'just-in-case-products' attitude was also found in this study.

In the UK the average time to store bought meat or fish in the fridge after shopping is 43 minutes (Thomas, 2007). Households are self responsible to minimise any improper cold storage but only 18% of consumers in Germany use a cooling bag when transporting food from the place of purchase to their homes. The surrounding temperature (e.g. inside a car during summer) can influence bacterial growth and decrease durability of food. Practical considerations are more relevant than hygiene when it comes to ordering products into the fridge. Products are placed according to habits or the availability of space and most people are not aware that there are different temperatures within the fridge (Thomas, 2007).

5. Conclusion

There are several causes for wasted food in households, each of which is not necessarily significant on its own but has a large synergistic effect. If household size decreases (e.g. sudden death of a household member), cooking habits are influenced as less food is needed. This means that products on storage will be used less frequently and shopping behaviour will change as well. Participating households usually had more than one reason why they waste food which were

summarized under six generic headings: Households are not responsible for wasted food, attitudes, habits, shopping, storage and others. A theoretical prevention potential of 100% for wasted food, as claimed by Salhofer et al. (2007), is not achievable as there are reasons where households are not to be held responsible for discarded edibles. ‘Improper storage’ together with ‘Special ingredients or products’ were the categories mentioned most frequently, followed by ‘Overlooking of edibles’ and ‘Home food production and presents’. Quantitative analysis of expired products showed that more original packaged than partially used food was found in the storage. Longer lasting products (excluding frozen ones) in original packaging were kept longer on storage after the expiry date as they did not attract attention via mould or smell and became overlooked.

Prevention campaigns should target the variety of interconnected reasons for wasted food disposal. A change in attitudes or valuation towards food is a tedious process which could be implemented by consumer education. A first basic step for the raising of people’s awareness is the knowledge about the existence of this type of waste. Improper storage could be reduced if food producers are bound by law to provide information about the optimal storage place or conditions on packaging. Households are only the last stage for food losses, which occur throughout the food system. Hence effective prevention measures should be embedded in a holistic approach across sectors and social differences.

This research tried to give a broad variety of causes why wasted food occurs. Further research is needed what kind of measures will reduce food waste in the first place and how they can be implemented or monitored.

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Tables

Table 3: Amount (in grammes and percentage of total amount), number of items and days after expiry date of wasted food found in households

Wasted food categories	unopened food in original packaging				opened, partially used food			
	amount		items found	days expired	amount		items found	days expired
	[g]	% of total	items	days	[g]	% of total	items	days
Bakery	55	0.3%	1	548	265	2.3%	2	81
Meat and Fish	28	0.2%	1	438	158	1.4%	2	50
Dairy	2,285	12.3%	11	34	692	6.0%	4	16
Dried foods and powder	3,566	19.2%	24	378	3,654	31.5%	12	178
Fruits	800	4.3%	2	59	536	4.6%	4	0
Vegetables	1,350	7.3%	3	22	711	6.1%	3	0
Confectionery and snacks	1,093	5.9%	7	163	460	4.0%	9	322
Drinks	3,744	20.1%	8	1,106	1,421	12.3%	11	394
Sauces and spices	5,674	30.5%	57	401	3,685	31.8%	51	409
Total:	18,595	100%	114	350	11,582	100%	98	161

Figures

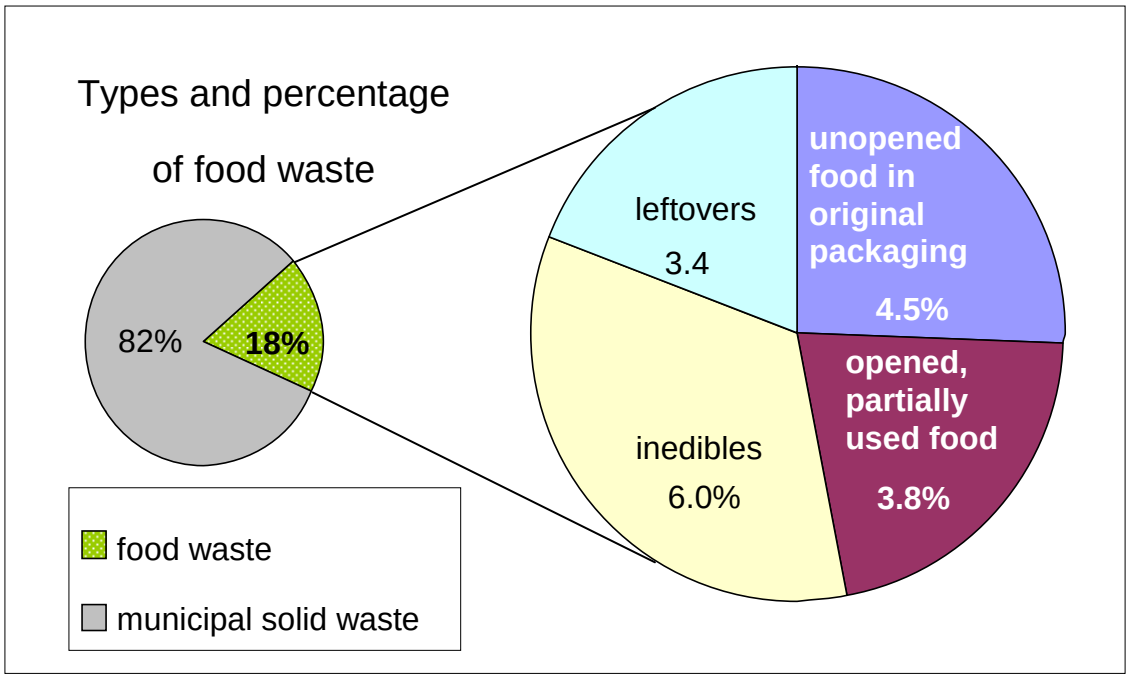

Figure 9: Types of food waste and their percentage in municipal solid waste of Austria (Schneider and Obersteiner, 2007)

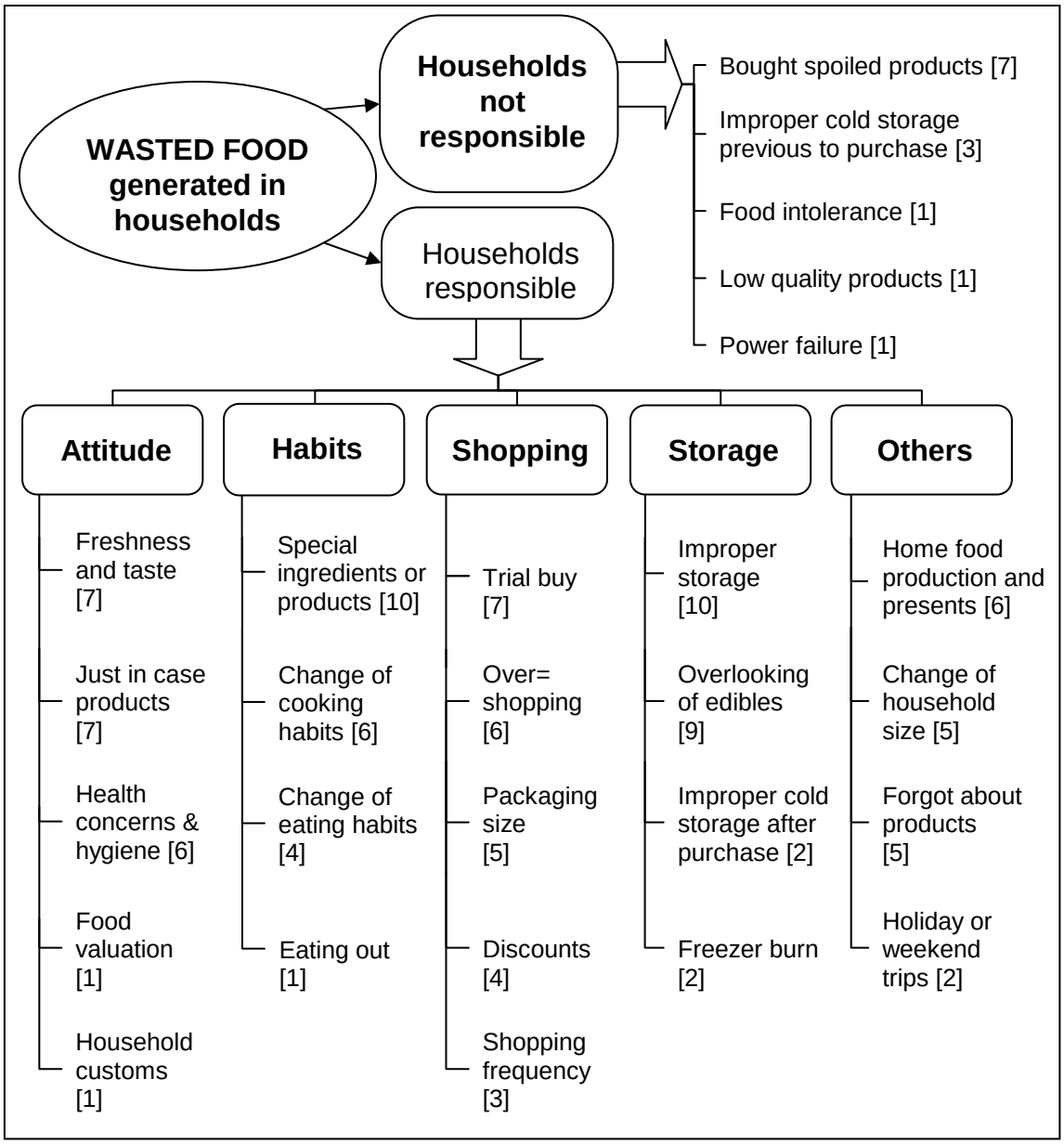

Figure 10: Causes of wasted food derived from content analysis with the number of mentioned subcategories in brackets

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V. APPENDICES

Appendix A: Reasons of food waste from WRAP (2007c)

Table 4: Categorised reasons of food waste from an UK study (WRAP, 2007c)

Categories	Subcategories
Supermarkets	'Buy one get one free' and other similar offers
	Inappropriate pack sizes
	Rapid decay
	Excess choice
	Bulk weekly, fortnightly or monthly shopping
Poor planning / food management	Not making shopping lists
	Weekly clear outs of fridge or cupboards
	Forgetting to freeze things
	Not eating food that has either been frozen, defrosted or left in the fridge
	Over-ordering takeaways
	Someone other than the usual shopper (e.g. the husband) doing the shopping
	Over-serving children
	Being unsure when a pack was opened
Personal choice and lifestyle	Not wanting to eat the same thing twice in a row
	Wanting to know you will have something if you fancy it
	Cooking different meals for different family members
	Unpredictable lifestyles
Lack of skills	Best before, use buy and sell buy dates
	Not knowing how to cook leftovers
	Not knowing when leftovers can be eaten and when they can't

Appendix B: Categories and subcategories of food waste

Expired food found in the households was diverted into nine main categories and different subcategories whereas each one represents a product group. Hence products which had not been found like bread are not mentioned as subcategory. The nine main categories were derived from 'The food we waste' report (WRAP, 2008) as a template.

Table 5: Comparison of food waste categories and product groups found in a UK (WRAP, 2008) and this study.

WRAP			this thesis		
cate= gories	**Subcategories**		**cate= gories**	**subcategories**	
Bakery	1.1	bread loaf	**bakery**	1.a	waffles
	1.2	bread roll / baguette		1.b	pastries
	1.3	bread slice		1.c	soy products
	1.4	bread crust			
	1.5	world breads (naan, tortillas etc.)			
	1.6	cake			
	1.7	biscuits / crackers / crisp breads			
	1.8	yorkshire pudding and other batters			
	1.9	other bakery			
	1.10	waffles			
	1.11	garlic bread			
	1.12	breadsticks			
	1.13	Scotch pancakes			
	1.14	scones			
	1.15	potato cakes			
	1.16	pie crusts and remains			
	1.17	pastry			
	1.18	malt loaf			
	1.19	hot cross buns			
	1.20	fruit loaf and fruit buns			
	1.21	dumplings			
	1.22	doughnuts			
	1.23	dough			
	1.24	Danish pastries			
	1.25	crumpets			
	1.26	croissants			
	1.27	brioche			
	1.28	bread scraps and chunks			

	1.29	bagels			
meat and fish	2.1	pork / ham / bacon	**meat and fish**	2.a	sausage (salami)
	2.2	beef		2.b	anchovy
	2.3	poultry (chicken / turkey / duck)			
	2.4	fish (including fish fingers)			
	2.5	shelf fish (prawns, crab, lobster etc.)			
	2.6	sandwich spreads			
	2.7	other meat and fish			
	2.8	cured meat			
	2.9	mincemeat			
	2.10	meatballs			
	2.11	lamb			
	2.12	hotdogs / frankfurters			
	2.13	unidentifiable / mixed bones			
	2.14	black pudding			
	2.15	unidentified meat / offal			
	2.16	burgers			
dairy	3.1	milk	**dairy**	3.a	milk
	3.2	cream		3.b	cream
	3.3	yoghurt / yoghurt drinks		3.c	yoghurt
	3.4	cheese		3.d	cheese
	3.5	eggs		3.e	sour cream
	3.6	butter / margarine / lard		3.f	butter
	3.7	other dairy		3.g	creme fraiche
	3.8	creme fraiche			
dried foods and powders	4.1	pasta	**dried foods and powders**	4.a	pasta
	4.2	rice		4.b	rice
	4.3	flour		4.c	flour
	4.4	wheat products (semolina, tapioca)		4.d	semolina
	4.5	breakfast cereals		4.e	breakfast cereals
	4.6	powdered soups and drinks		4.f	powdered soup
	4.7	other dried foods		4.g	polenta powder
	4.8	dried fruit		4.h	dried fruit
				4.i	potato powder
				4.j	pudding powder
fruit	5.1	apples	**fruit**	5.a	apples
	5.2	bananas		5.b	apricots
	5.3	cherries		5.c	kiwis
	5.4	grapes		5.d	mangos
	5.5	lemons		5.e	lemons
	5.6	limes		5.f	pineapples
	5.7	melons			
	5.8	oranges, satsumas etc.			
	5.9	pears			

	5.10	pineapples			
	5.11	plums			
	5.12	strawberries			
	5.13	other fruit			
	5.14	mangos			
	5.15	kiwis			
	5.16	pomegranates			
	5.17	nectarines			
	5.18	peaches			
	5.19	avocados			
	5.20	mixed fruit			
salads	6.1	lettuce	**vegetables**	6.a	lettuce
	6.2	cucumbers		6.b	cucumbers
	6.3	tomatoes		6.c	cabbages
	6.4	spring onions		6.d	peas
	6.5	coleslaws and hummus		6.e	horseradish
	6.6	mixed salads			
	6.7	other salads			
	6.8	rocket			
	6.9	roadish			
	6.10	potato salad			
	6.11	beetroot			
	6.12	celery			
vegetables	7.1	potatoes			
	7.2	carrots parsnips			
	7.3	onions			
	7.4	mushrooms			
	7.5	turnips			
	7.6	cabbage			
	7.7	mixed vegetables			
	7.8	other raw vegetables			
	7.9	sandwich spreads (vegetable-based)			
	7.10	baked beans			
	7.11	sweetcorn / corn on the cob			
	7.12	peppers			
	7.13	leeks			
	7.14	courgettes			
	7.15	cauliflowers			
	7.16	broccoli			
	7.17	beans			
	7.18	peas			
	7.19	sprouts			
	7.20	spinach			
	7.21	aubergines			

Confectionery and snacks	8.1	chocolate / sweets	**confectionery and snacks**	7.a	chocolate
	8.2	crisps		7.b	other confectionery / snacks
	8.3	nuts		7.c	nuts
	8.4	cereal bars		7.d	crisps / popcorn
	8.5	other confectionery / snacks			
	8.6	prawn crackers			
	8.7	popcorn			
	8.8	savoury snacks / biscuits			
drinks	9.1	tea / teabags	**drinks**	8.a	tea
	9.2	coffee / granules		8.b	drink chocolate
	9.3	sodas		8.c	fruit juice
	9.4	squash		8.d	beer
	9.5	other drinks		8.e	yogurt drinks
	9.6	fruit juice			
	9.7	milkshake / milk drinks			
	9.8	water			
condiments, sauces, herbs and spices	10.1	sugar	**sauces and spices**	9.a	soup cubes
	10.2	salt		9.b	salt
	10.3	herbs / spices		9.c	herbs / spices
	10.4	jams		9.d	jams
	10.5	gravy		9.e	coconut grease (‘Ceres’)
	10.6	pickles		9.f	mustard
	10.7	ketchup		9.g	ketchup
	10.8	mayonnaise / salad cream		9.h	mayonnaise / salad cream
	10.9	oils		9.i	oils
	10.10	other sauces, condiments, etc.		9.j	other sauces (pesto)
	10.11	other sauces		9.k	tomato sauce (sugo)
	10.12	other condiments		9.l	spread
	10.13	cook-in sauces		9.m	cook-in sauces
	10.14	spreads		9.n	yeast
	10.15	dips			
	10.16	olives			
	10.17	honey			
desserts	11.1	milk puddings (custard etc.)			
	11.2	ice cream			
	11.3	other puddings			
	11.4	fruit pie / strudel / crumble			
	11.5	cheesecake			
	11.6	mousse			
	11.7	trifle			
	11.8	dessert cakes / gateaux			
	11.9	jelly			

	11.10	chocolate puddings / desserts	
mixed foods	12.1	soups	
	12.2	stews	
	12.3	sandwiches	
	12.4	composite / other	
	12.5	composite meal	
	12.6	composite snack	
	12.7	mixed foods	
other	13.1	pet food	
	13.2	baby milk	
	13.3	baby food	
	13.4	other	
	13.5	gunge	
	13.6	medicinal	

Appendix C: Socio-demographic characteristics of selected households

According to the theoretical sampling concept, 21 households with different socio-demographic backgrounds had been chosen to give a wide range of reasons for food waste arising.

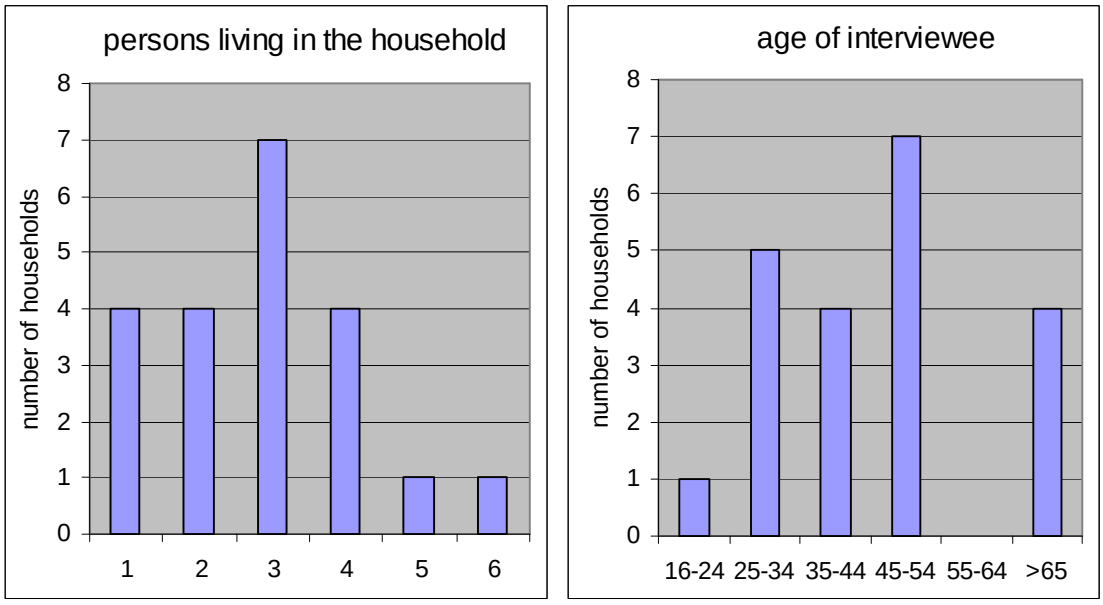

Figure 11: Number of persons living in the household and age of participants

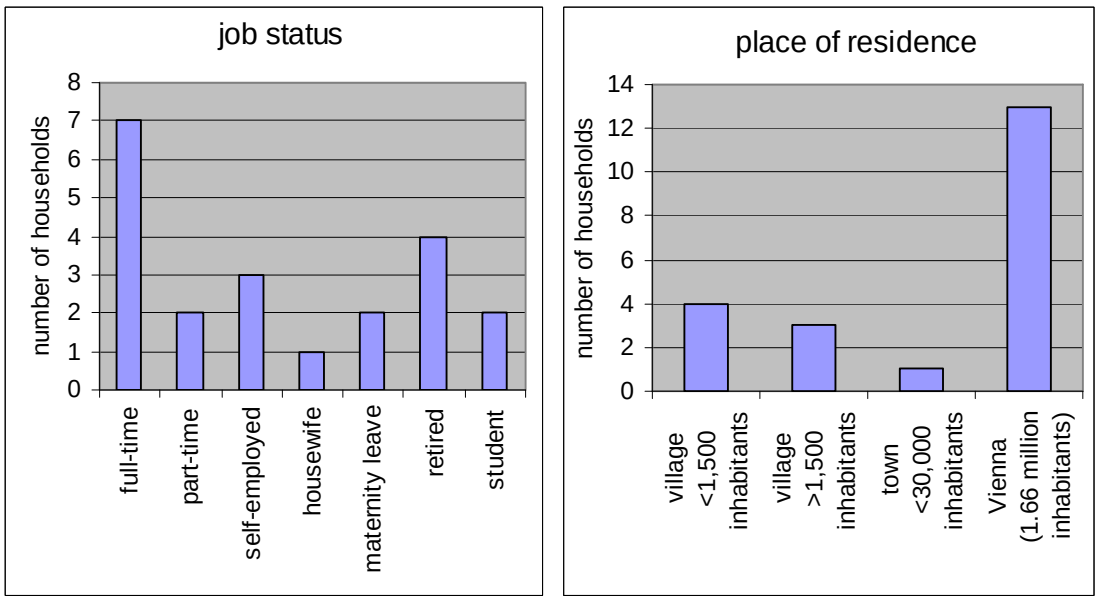

Figure 12: Job status of participants and place of residence

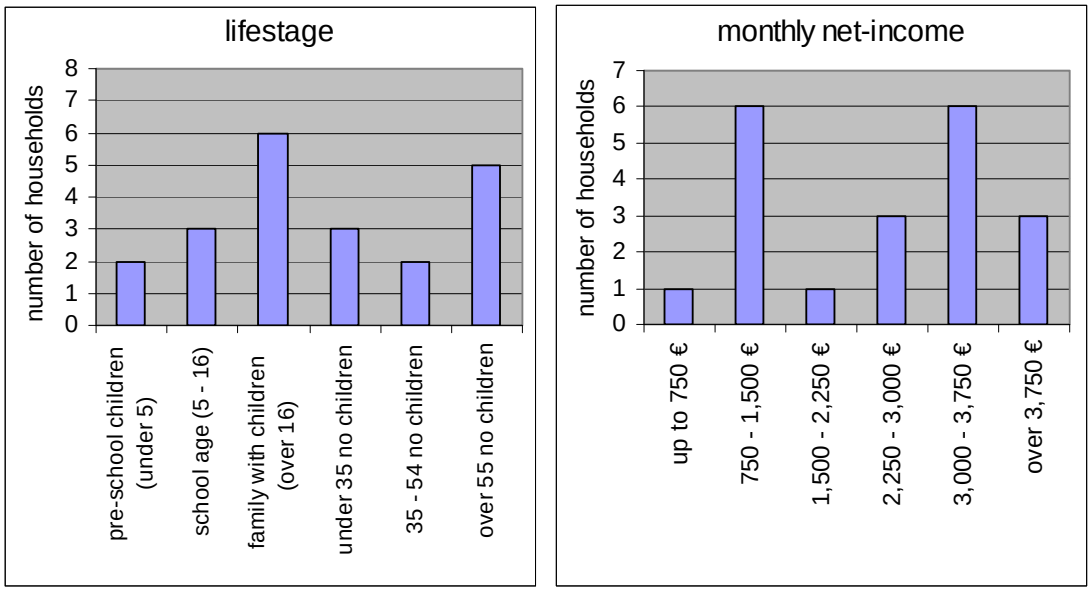

Figure 13: Lifestage and monthly net-income of participating households

Appendix D: Expired products found in households

Each item found was divided into original packaged and partly used food waste and given an unique identification number. The place where it was found was recorded and the products categorised according to Appendix B. Net mass was weighted in grammes, expiry date and any comments noticed. The days expired were calculated through the difference between expiry date and the day of the interview. If a product did not have an expiry date (e.g. vegetables bought loose), it was suggested that they expire on the day of the interview (i.e. 0 days expired). A negative number was noted if items were still in date but said to be not eaten anymore (e.g. crisps).

Table 6: Example how expired products found in households have been recorded

Household code: C Date: 22.07.2008 Duration of interview (hours): 1.5							
ORIGINAL PACKAGED FOOD							
ID	where	cat	product name	mass [g]	expiry date	days since expired	comment
45	P	4j	pudding powder	37	01.03.2007	143	
46	P	6a	lettuce	350		0	old
PARTLY USED FOOD							
ID	where	cat	product name	mass [g]	expiry date	days since expired	comment
134	T	1b	whole grain roll	115		0	
135	P	2a	salami	85		0	
136	P	4b	rice	85	01.03.2007	143	will be eaten
137	D	4e	corn flakes	386	01.03.2007	143	
138	T	5a	apples	330		0	
139	T	5b	apricot	122		0	from garden
140	T	5c	kiwi	69		0	package
141	D	7a	chocolates (Pralinen)	60	18.07.2007	4	present
142	P	7b	Schnitten	29	13.07.2007	9	
143	T	7d	crisps (Zigeunerräder)	46	10.11.2007	-111	
144	P	9l	spread (Zigeuneraufstrich)	98		0	
145	P	9l	spread (liver pie)	56	27.07.2007	-5	

where: F…fridge P…pantry D…drawer T…table

Appendix E: Questionnaire in English and German

Household code:

Q E S T I O N N A I R E
on food

GENERAL:

1. What is your sex? ☐ male ☐ female

2. How many persons live in your household?

   ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ _____

3. How old are the persons in the household (in years)? ☐ live alone

   1. Person (you): _____ 2. Person: _____3. Person: _____

   4. Person: _____ 5. Person: _____6. Person: _____

4. What is your highest level of education?

   ☐ compulsory school
   ☐ apprenticeship / technical college / commercial business school
   ☐ A-level exams ☐ university

5. What is your current occupation? _____

6. Are you:

☐ full-time employed (more than 36 hrs per week)
☐ full-time employed (12 to 35 hrs per week)
☐ part-time employed (up to 12 hrs per week)
☐ self-employed
☐ housewife / husband staying at home
☐ other source of income
☐ unemployed
☐ pensioner
☐ maternity leave
☐ student
☐ military service
☐ not specified

7. What is the occupation of the other persons in the household?

(Please tick X for every single person!)

☐ full-time employed (more than 36 hrs per week)
☐ full-time employed (12 to 35 hrs per week)
☐ part-time employed (up to 12 hrs per week)
☐ self-employed
☐ housewife / husband staying at home
☐ other source of income
☐ unemployed
☐ pensioner
☐ maternity leave
☐ student
☐ military service
☐ not specified

8. What is the monthly net-income of all the persons in your household together?

(For the net-income remove taxes and add other regular payments like child benefits, social benefits, support payments, etc. …)

☐ up to 750 €
☐ 750 to 1,500 €
☐ 1,500 to 2,250 €
☐ 2,250 to 3,000 €
☐ 3,000 to 3,750 €
☐ more than 3,750 €

9. Which type of accommodation are you living in?

☐ single house floor space: _____ m²
☐ terraced house floor space: _____ m²
☐ flat floor space: _____ m²

HOUSEHOLD:

10. Where is your accommodation situated?

☐ village (less than 750 habitants) ☐ town (less than 15,000 habitants)
☐ village (750 to 1,500 habitants) ☐ town (more than 15,000 habitants)
☐ village (more than 1,500 habitants) ☐ Vienna

11. Do you have a second home?

☐ no ☐ yes

12. Who is mainly responsible for running the household?
(e.g. chores, shopping, waste, …)

☐ my duty ☐ we share the chores
☐ another member of the household: _____

13. Are you or is somebody in the household a farmer?

☐ no ☐ yes

14. Do you have a garden?

☐ no ☐ yes _____ m²

15. Do you use your garden / balcony / windowsill / … to grow plants?

☐ no ☐ yes

16. Do you yourself grow vegetables etc.?

☐ no

☐ yes, I produce:

☐ fruits	☐ spices	☐ vegetables
☐ jam	☐ wine	☐ dried fruits
☐ fruit juices	☐ miscellaneous	

CONSUMER BEHAVIOUR:

17. What percentage of your household budget do you approximately spend on food?

_____ [%]

18. Do you generally use a shopping list?

☐ no ☐ yes

19. Who is responsible for buying food in your household?

☐ one person ☐ two persons ☐ more than two persons

20. How often do you go (food) shopping?

☐ every day ☐ ____ times per week

21. Where do you usually buy your food?

☐ supermarket (name of the supermarket: _____)

☐ market ☐ retailer

☐ _____

22. What is the distance between your main food shop and your household?

_____ km

23. What means of transport do you usually use for carrying your food home?

☐ on foot ☐ bicycle ☐ public transport ☐ car

☐ miscellaneous: _____

24. Do you combine your shopping with other activities?

(e.g. going shopping after work on the way back home)

☐ hardly ever ☐ rarely ☐ sometimes ☐ regularly

25. What is important to you when you buy food?

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

EATING HABITS:

26. Where do you usually eat your meals?

☐ only at home

☐ mainly at home

☐ partly at home, partly out

☐ mainly eating out

☐ only eating out

27. How often do you prepare food in your household? (only hot dishes)

☐ several times a day
☐ twice a day
☐ once a day
☐ several times a week (3 to 5 times)
☐ once or twice a week
☐ hardly ever

28. How often do you prepare food in your household? (without hot dishes) (e.g. breakfast, cold dinners, snacks)

☐ several times a day
☐ twice a day
☐ once a day
☐ several times a week (3 to 5 times)
☐ once or twice a week
☐ hardly ever

29. How many persons usually eat together?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ ___

30. Do the same persons usually have their meals together? (breakfast – lunch - dinner)

☐ no ☐ yes

31. Do you prepare different dishes in your household each day?

☐ hardly ever ☐ rarely ☐ sometimes ☐ frequently ☐ regularly

32. Do you normally use recipes when preparing your dishes?

☐ hardly ever ☐ rarely ☐ sometimes ☐ frequently ☐ regularly

33. Is usually everything eaten up?

☐ hardly ever ☐ rarely ☐ sometimes ☐ frequently ☐ regularly

34. How many times do you eat the following products:

bread, toast, rolls
☐ hardly ever ☐ rarely ☐ sometimes ☐ frequently ☐ regularly

fresh meat
☐ hardly ever ☐ rarely ☐ sometimes ☐ frequently ☐ regularly

fresh vegetables
☐ hardly ever ☐ rarely ☐ sometimes ☐ frequently ☐ regularly

fresh fruits
☐ hardly ever ☐ rarely ☐ sometimes ☐ frequently ☐ regularly

dairy products (milk, cheese, eggs)
☐ hardly ever ☐ rarely ☐ sometimes ☐ frequently ☐ regularly

convenience food (frozen pizza, frozen vegetable mixtures, …)
☐ hardly ever ☐ rarely ☐ sometimes ☐ frequently ☐ regularly

preserved food (food in tins, frozen food, …)
☐ hardly ever ☐ rarely ☐ sometimes ☐ frequently ☐ regularly

35. Are you or any other member of the household:

☐ vegetarian ☐ vegan (no meat or diary products)
☐ food intolerance against: _____
☐ no special eating habits

STORAGE: (multiple ticking possible)

36. In your household, do you have:

☐ fridge ☐ fridge with included freezer ☐ several fridges
☐ freezer ☐ several freezers ☐ larder
☐ cellar ☐ other places to store food: _____

37. What are your criteria to proof the edibility of food in your storage / fridge?

☐ date of expiry ☐ appearance ☐ smell ☐ taste

☐ _____

☐ _____

☐ _____

☐ _____

DISPOSAL:

38. Do you use leftovers in any way?

☐ hardly ever ☐ rarely ☐ sometimes ☐ frequently ☐ regularly

39. Do you dispose food which is still originally packed?

☐ hardly ever ☐ rarely ☐ sometimes ☐ frequently ☐ regularly

40. Do you dispose superposed food?

☐ hardly ever ☐ rarely ☐ sometimes ☐ frequently ☐ regularly

41. Is food waste being collected separately in your household?

☐ no ☐ yes

If yes, what happens with the food waste? _____

THANK YOU!

Haushalt Code:

F R A G E B O G E N
zum Thema Lebensmittel

ALLGEMEIN:

1. Was ist Ihr Geschlecht? ☐ männlich ☐ weiblich

2. Wie viele Personen wohnen in Ihrem Haushalt?

   ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ _____

3. Wie alt sind die Personen im Haushalt (in Jahren)? ☐ wohne allein

   1. Person (Sie selbst): _____ 2. Person: _____3. Person: _____

   4. Person: _____5. Person: _____6. Person: _____

4. Was ist Ihre höchste abgeschlossene Schulausbildung?

   ☐ Pflichtschule
   ☐ Lehre / Fachschule / Handelsschule
   ☐ Matura / HTL / HAK ☐ Universitätsabschluss

5. Was ist Ihr derzeitiger Beruf? _____

6. Sind Sie selbst:

   ☐ vollzeitbeschäftigt (über 36 h pro Woche) ☐ arbeitslos
   ☐ teilzeitbeschäftigt (12 bis 35 h pro Woche) ☐ Pensionist(in)
   ☐ teilzeitbeschäftigt (bis 12 h pro Woche) ☐ Karenzurlaub
   ☐ selbstständig erwerbstätig ☐ Schüler(in) / Student(in)
   ☐ Hausfrau / Hausmann ☐ Präsenz- / Zivildiener
   ☐ sonstig erhaltene Person ☐ keine Angabe

7. Welcher Tätigkeit gehen die anderen Personen in Ihrem Haushalt nach?
   (Bitte für jede Person ein X machen!)

   ☐ vollzeitbeschäftigt (über 36 h pro Woche)
   ☐ teilzeitbeschäftigt (12 bis 35 h pro Woche)
   ☐ teilzeitbeschäftigt (bis 12 h pro Woche)
   ☐ selbstständig erwerbstätig
   ☐ Hausfrau / Hausmann
   ☐ sonstig erhaltene Person
   ☐ arbeitslos
   ☐ Pensionist(in)
   ☐ Karenzurlaub
   ☐ Schüler(in) / Student(in)
   ☐ Präsenz- / Zivildiener
   ☐ keine Angabe

8. Wie hoch ist insgesamt das monatliche Nettoeinkommen aller Personen im Haushalt?
   (Für das Nettoeinkommen ziehen Sie bitte Steuern ab und rechnen regelmäßige Zahlungen hinzu wie zB: Kindergeld, Sozialhilfe, Unterhaltszahlungen, …)

   ☐ bis 750 €
   ☐ 750 bis 1500 €
   ☐ 1500 bis 2250 €
   ☐ 2250 bis 3000 €
   ☐ 3000 bis 3750 €
   ☐ mehr als 3750 €

9. In welcher Wohnform leben Sie?

   ☐ Einzelhaus Wohnungsnutzfläche: _____ m²
   ☐ Reihenhaus Wohnungsnutzfläche: _____ m²
   ☐ Wohnung Wohnungsnutzfläche: _____ m²

HAUSHALT:

10. Wo wohnen Sie?

    ☐ Dorf (unter 750 Einwohner)
    ☐ Dorf (750 bis 1.500 Einwohner)
    ☐ Dorf (über 1.500 Einwohner)
    ☐ Stadt (unter 15.000 Einwohner)
    ☐ Stadt (über 15.000 Einwohner)
    ☐ Wien

11. Haben Sie einen Zweitwohnsitz?

    ☐ nein
    ☐ ja

12. Wer ist bei Ihnen hauptsächlich für den Haushalt verantwortlich?
(z.B.: Hausarbeit, Einkaufen, Müll, …)

☐ ich ☐ gemeinschaftliche Aufgabenverteilung
☐ ein anderes Haushaltsmitglied: _____

13. Betreiben Sie oder jemand in Ihrem Haushalt eine Landwirtschaft?

☐ nein ☐ ja

14. Besitzen Sie einen Garten?

☐ nein ☐ ja und zwar _____ m²

15. Nutzen Sie Ihren Garten / Balkon / Fensterbrett / … für die Aufzucht von Nutzpflanzen?

☐ nein ☐ ja

16. Produzieren Sie selbst Lebensmittel?

☐ nein
☐ ja und zwar ☐ Obst ☐ Gewürze
☐ Gemüse ☐ Marmelade
☐ Wein ☐ eingelegte Früchte
☐ Fruchtsäfte ☐ sonstiges

KONSUMVERHALTEN:

17. Wie viel Prozent Ihres Haushaltsbudget geben Sie schätzungsweise für Lebensmittel aus?

_____ [%]

18. Verwenden Sie üblicherweise eine Einkaufsliste?

☐ nein ☐ ja

19. Wer ist für den Einkauf von Lebensmitteln in Ihrem Haushalt verantwortlich?

☐ eine Person ☐ zwei Personen ☐ mehrere Personen

20. Wie oft gehen Sie Lebensmittel einkaufen?

☐ täglich ☐ ____ mal die Woche

21. Wo kaufen Sie diese überwiegend ein?

☐ Supermarkt, Handelskette (Name der Handelskette: _____)
☐ Markt ☐ Einzelhandel, Greißler
☐ _____

22. Wie weit ist dieser in etwa entfernt von Ihrem Haushalt? _____ km

23. Wie transportieren Sie Ihren Einkauf überwiegend nach Hause?

☐ zu Fuß ☐ Fahrrad ☐ Auto ☐ öffentliche Verkehrsmittel
☐ sonst: _____

24. Steht die Einkaufsfahrt in Verbindung mit anderen Tätigkeiten?
(Wie z.B. Heimkehr von der Arbeit.)

☐ fast nie ☐ selten ☐ manchmal ☐ regelmäßig

25. Auf was achten Sie beim Einkauf von Lebensmitteln?

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

ESSGEWOHNHEITEN:

26. Wo essen Sie für gewöhnlich Ihre großen und kleinen Mahlzeiten?

☐ nur zu Hause
☐ überwiegend zu Hause
☐ zum Teil zu Hause, zum Teil auswärts
☐ überwiegend außer Haus
☐ nur außer Haus

27. Wie oft wird in Ihrem Haushalt Essen gekocht? (nur warme Speisen)

☐ mehrmals täglich
☐ 2 mal täglich
☐ einmal täglich
☐ mehrmals pro Woche (3 bis 5 mal)
☐ 1 bis 2 mal pro Woche
☐ selten bis nie

28. Wie oft wird in Ihrem Haushalt Essen zubereitet ohne warme Speisen?
(z.B.: Frühstück, Abendessen, Zwischendurch)

☐ mehrmals täglich
☐ 2 mal täglich
☐ einmal täglich
☐ mehrmals pro Woche (3 bis 5 mal)
☐ 1 bis 2 mal pro Woche
☐ selten bis nie

29. Für wie viele Personen wird normalerweise gekocht?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ ___

30. Essen für gewöhnlich die gleichen Personen miteinander?
(Frühstück – Mittagessen – Abendessen)

☐ nein ☐ ja

31. Gibt es bei Ihnen jeden Tag verschiedene Speisen zu essen?

☐ fast nie ☐ selten ☐ manchmal ☐ öfters ☐ regelmäßig

32. Kochen Sie üblicherweise nach Rezepten?

☐ fast nie ☐ selten ☐ manchmal ☐ öfters ☐ regelmäßig

33. Wird bei Ihnen üblicherweise alles aufgegessen?

☐ fast nie ☐ selten ☐ manchmal ☐ öfters ☐ regelmäßig

34. Wie oft essen sie folgende Produkte?

Brot, Gebäck (Semmeln)
☐ fast nie ☐ selten ☐ manchmal ☐ öfters ☐ regelmäßig

Frisches Fleisch

☐ fast nie ☐ selten ☐ manchmal ☐ öfters ☐ regelmäßig

Frisches Gemüse
☐ fast nie ☐ selten ☐ manchmal ☐ öfters ☐ regelmäßig

Frisches Obst
☐ fast nie ☐ selten ☐ manchmal ☐ öfters ☐ regelmäßig

Milchprodukte (Milch, Käse, Eier)
☐ fast nie ☐ selten ☐ manchmal ☐ öfters ☐ regelmäßig

Fertiggerichte (Tiefkühlpizza, Fertigteige, Tiefkühlgemüsemischungen,…)
☐ fast nie ☐ selten ☐ manchmal ☐ öfters ☐ regelmäßig

Konservierte Lebensmittel (Konservendosen, Tiefkühlwaren, …)
☐ fast nie ☐ selten ☐ manchmal ☐ öfters ☐ regelmäßig

35. Sind Sie oder ein Haushaltsmitglied

☐ Vegetarier ☐ Veganer (ohne Fleisch und Milchprodukte)
☐ Unverträglichkeit gegenüber_____
☐ keine besondere Essgewohnheiten

LAGER: (Mehrfachnennungen möglich)

36. Ist Ihr Haushalt im Besitz von

☐ Kühlschrank ☐ Kühlschrank mit Eiswürfelfach ☐ mehrere Kühlschränke
☐ Tiefkühltruhe ☐ mehrere Tiefkühltruhen ☐ Speisekammer
☐ Kartoffelkeller
☐ sonstige Plätze zum Aufbewahren von Lebensmitteln: _____

37. Nach welchen Kriterien beurteilen Sie die Genießbarkeit von Lebensmitteln aus ihrem Vorratslager / Kühlschrank?

☐ Haltbarkeitsdatum ☐ Aussehen ☐ Geruch ☐ Geschmack

☐ _____

☐ _____

☐ _____

☐ _____

ENTSORGUNG:

38. Verwerten Sie die angefallenen Speisereste in irgendeiner Weise?

☐ fast nie ☐ selten ☐ manchmal ☐ öfters ☐ regelmäßig

39. Kommt es vor, dass original verpackte Lebensmittel in Ihrem Haushalt verderben?

☐ fast nie ☐ selten ☐ manchmal ☐ öfters ☐ regelmäßig

40. Fallen in Ihrem Haushalt überlagerte Lebensmittel an?

☐ fast nie ☐ selten ☐ manchmal ☐ öfters ☐ regelmäßig

41. Wird Biomüll in Ihrem Haushalt getrennt gesammelt?

☐ nein ☐ ja

Wenn ja: was passiert damit? _____

DANKE für Ihre Mitarbeit!

Appendix F: Interview guideline

Nr.	Questions in English and German:	Things to talk about:
1	What comes to your mind when you hear the term 'food'? Was fällt Ihnen stichwortartig ein, wenn ich den Begriff ‚Lebensmittel' / ‚Nahrungsmittel' sage?	• start of conversation • associations to food
2	What is the difference between food and other products? Was unterscheidet Nahrungsmittel von anderen Produkten?	• personal food valuation
3	Do you have any special memories linked with food? Welche Erinnerungen haben sie im Bezug auf Lebensmittel?	• good or bad memories • illnesses caused by food • experienced food scarcity
4	Tell me about your cooking habits! Erzählen Sie mir etwas über Ihre Kochgewohnheiten!	• Cooking habits • use of recipes • how often and for how many people is cooked • use of ready-made food • cooking plan or spontaneous cooking • variety of dishes • regularly try something new to cook
5	Tell me something about your food-shopping planning? Erzählen Sie mir etwas über die Einkaufsplanung in Ihrem Haushalt?	• use of shopping list • share household bill or separate shopping of each household member • how many things are bought at once • how long is food bought ahead • self production of food (use of own garden) • are relatives farmers
6	What are your criteria when buying food?	• special offers • freshness

	Nach welchen Gesichtspunkten kaufen Sie Ihre Lebensmittel ein?	• packaging • advertisements • date of expiry
7	Do you generally prefer packaged food? Bevorzugen Sie verpackte Produkte?	• choice between loose and packaged fruit or meat • optimal packaging size
8	How do you respond to food advertisements? Wie reagieren Sie auf Lebensmittelwerbung?	• preferred media (TV, print, etc.) • information about special offers • information about quantity discounts
9	How do you judge the edibility of food from your fridge or storage? Wie beurteilen Sie die Genießbarkeit von Produkten aus Ihrem Kühlschrank / Lager?	• do smell, appearance and taste matter • confusion with dates of expiry • regular control of expiry dates of products in the storage
10	How and where is food stored in your household? Wie und wo werden Lebensmittel bei Ihnen gelagert?	• wrong storage • lack of storage room
11	Which food products come to your mind that go bad more often than others? Welche Produkte fallen Ihnen ein, die öfters in Ihrem Haushalt verderben?	• why • what about drinks
12	Is there a time of the year when there is more food waste than usual? Kommt es im Laufe des Jahres vor, dass bei Ihnen vermehrt Lebensmittelabfälle anfallen?	• before or after holidays • special banquets • cooking for friends • presents from foreign countries
13	What do you think are the reasons for partly used food or food which is discarded in its original packaging? Warum glauben Sie, dass original verpackte und überlagerte Lebensmittel verderben?	• beliefs about reasons of food waste in other households

Appendix G: Category system and coding rules

Category	Subcategory	DESCRIPTION and EXAMPLES	Nr. of house=holds	
HOUSEHOLDS NOT RESPONSIBLE	Bought spoiled products	Products are already spoiled at the time of purchase e.g. melons mouldy inside; raspberries mouldy inside packaging	7	
	Improper cold storage previous to purchase	Cold chain is interrupted before buying of a product e.g. milk spoiled before expiry date	3	
	Food intolerance	Change of eating habits due to a food intolerance e.g. peas are not allowed to eat anymore	1	
	Low quality products	Products should be eaten within a few days whereas the same product with a higher quality can be kept longer e.g. bakery from supermarkets got hard within one day	1	
	Power failure	e.g. perishable products in the fridge were spoiled afterwards	1	
ATTITUDE	Freshness and taste	Taste is diminishing or food is not tasty enough to eat e.g. opened products (spread etc.) were not fresh enough	7	7*
		Eating of fresh products first and older ones get spoiled e.g. older bread got spoiled while everybody ate the fresh one	2	
	Just in case products	Certain products are bought just because of a (possible) visit which households do not eat e.g. beer bought for visitors but household members did not drink beer	5	7
		Products are stored for certain events or meals but are not used e.g. households want to keep the possibility to cook different meals	2	

	Health concerns and hygiene	Health concerns prompt households to throw away food e.g. meat was not stored longer than certain days in the fridge because of safety reasons	5	6
		A lack of hygiene decreases storage time e.g. knife in butter and then in jam	1	
	Food valuation	Single products are cheap to re-buy e.g. „It's worth just 1€, so I don't mind“	1	1
	Household customs	Special household customs or agreements e.g. last item of a package was left because person would have had to discard the packaging	1	1
HABITS	Special ingredients or products	High yield products in concentrated form which are not used very often e.g. anchovy paste; chocolate crumbles for cakes	6	10*
		Certain meals are rarely prepared and some ingredients or products for that meals are left e.g. horseradish was used for a recipe but for nothing else	5	
		There are seasons for certain products which are not used in the rest of the year e.g. Christmas spices; Christmas tea	4	
	Change of cooking habits	Children are cooking but loose their interest or stop cooking e.g. baking ingredients for a special cake were left over because it was not prepared anymore;	2	6*
		Change of cooking habits e.g. some meals were not prepared anymore or ingredients had changed	2	
		Change of cooking plan e.g. meal plan changed and products got spoiled	2	
		Too much effort to cook or use certain products e.g. soy cubes; oranges that are hard to peel	2	

	Change of eating habits	Some products are not used anymore because household does not want to eat them e.g. greater demands on food quality due to a healthier lifestyle	4	4
	Eating out	Household has a storage of food that is not used because people are eating out e.g. single-household was eating out for a few days	1	1
SHOPPING	Trial buy	Households try a new product but do not know how or what to cook with it e.g. sesame-paste	7	7
	Overshopping	Households buy too much food e.g. vegetables bought on markets	6	6
	Packaging size	Packaging size is too big and households do not know what to do with the rest e.g. onions in 2 kg packaging; crisps for a single-household	5	5
	Discounts	Bulk discounts e.g. value for money (buy one, get one free)	4	4
		Discount for products near their expiry date e.g. products bought but not used in time	1	
	Shopping frequency	Shopping once a week or less e.g. perishable products (bread, milk etc.) got spoiled	2	3
		Different household members shop at the same time similar products e.g. butter bought at the same time from different persons of the same household	1	

STORAGE	Improper storage	Wrong storage conditions or place for certain products e.g. potatoes start growing because they were stored in the fridge	8	10*
		Moths in the storage and all affected food items are thrown away for safety reasons	3	
		Products stored after shop at unusual places where nobody will search them e.g. jam in the drawer	3	
	Overlooking of edibles	Products in the fridge get overlooked e.g. fridge refilled from the front and older products moved to the back	5	9*
		Products in the storage get overlooked e.g. different kinds of food stored in boxes	5	
	Improper cold storage after purchase	e.g. transport between supermarket and home caused products to spoil before their expiry date	2	2
	Freezer burn	Products are stored too long in the freezer e.g. meat was stored over one year	2	2
OTHERS	Home food production and presents	Food presents (only single products) which are not used e.g. from friends, companies or supermarkets	6	8*
		Garden harvest (i.e. too much food to use in a short time period) e.g. presents of fruits and vegetables after harvest	5	
	Change of household size	Households bring products from somewhere else e.g. a couple moved into a common flat or old people moving out of their home into old people's home and stored products are brought into another household	3	5
		Less persons in the household e.g. children move out and it takes time for the family adapt their shopping or cooking behaviour	2	

	Forgot about products	Households forget products somewhere before use e.g. full shopping bag forgot in the car during summer	2	2
	Holidays or weekend trips	Holiday or weekend trip e.g. perishable products get spoiled	1	2
		Products brought from holiday but are not used e.g. powdered soups after a camping trip	1	

* Numbers not matching because some household mentioned both reasons but were counted just once for every subcategory

Appendix H: Guidelines for authors

Name of the journal

Resources, Conservation and Recycling

Description

The editors welcome contributions from research, which consider sustainable management and conservation of resources. The journal emphasizes the transformation processes involved in a transition toward more sustainable production and consumption systems. Emphasis is upon technological, economic, institutional and policy aspects of specific resource management practices, such as conservation, recycling and resource substitution, and of 'systems-wide' strategies, such as resource productivity improvement, the restructuring of production and consumption profiles and the transformation of industry. Contributions may have relevance at regional, national or international scales and may focus at any level of research from individual resources or technologies to whole sectors or systems of interest. Contributors may emphasise any of the aforementioned aspects as well as scientific and methodological issues. However, manuscripts that consider only laboratory experiments, without a discussion of the practical, environmental and economic implications of the presented research, are excluded from publication in the journal.

Scope

The journal publishes papers, reviews, analyses and case studies on topics, which include:

- Material flow analysis and the understanding of resource use and flows in society and the impact on the environment, including resource extraction and waste generation.
- Societal, economic and technological change for improved recovery and reuse of materials and energy from domestic, commercial or industrial waste streams.
- Transformation of the industrial and societal system towards more sustainable production and consumption patterns, including management, instruments, methods and processes of change.
- Information and management systems involving resource status, use and material flows in society.
- Innovation processes, tools and methods relating to resource productivity improvement.
- Technical, societal, economic, business and policy aspects of strategies to improve the sustainability and productivity of resource use, including strategies for managing resource supply and demand, valorizing waste,

lowering energy and material intensities and increasing the serviceability of products.
- Substitution of primary resources by renewable or regenerative alternatives, including agricultural and forest resources and wastes.
- Life cycle assessment and management of resources, materials and products to improve resource efficiency and productivity, conserve resources and reduce pollution.
- Efficient management and use of all resources, including air and water, with regard to the qualitative as well as quantitative aspects of resource use.

Audience

Environmental scientists, engineers, managers and economists; policy makers; corporate strategists, business decision makers; design engineers; systems analysts; members of NGOs interested in environmental and developmental issues; and those interested in industrial transformation and the management of change.

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Review process:

All manuscripts are sent to at least two independent reviewers to ensure both accuracy and relevance to the journal. The final decision on acceptance will be made by the Editor. Manuscripts may be sent back to authors for revision if necessary. Revised manuscript submissions should be made as soon as possible (within 6 weeks) after the receipt of the reviewer's reports.

All authors are asked to submit full contact details for three potential reviewers of their manuscript. Typically the Editor will not contact all individuals, often one will be selected as a third reviewer.

Peer review is essential to maintain the quality of the scientific literature. On acceptance of a manuscript for publication, it is expected that the authors will also serve as reviewers of future manuscripts in the same area of research as the manuscript submitted to the journal.

II. Manuscript Preparation

In general manuscripts should be organised in the following order: Title (should be clear, descriptive and concise), Name(s) of author(s), Complete postal address(es) of affiliations, Full telephone and fax numbers of the corresponding author (plus present address(es) of author(s) if applicable), Complete correspondence address, Abstract, Keywords (indexing terms), Introduction, Material studied, area descriptions, methods, techniques, Results, Discussion, Conclusion, Acknowledgements, References, Tables and Figures.

Text

Manuscripts should be typed, double-spaced with side margins. The article should be preceded by a succinct abstract of no more than 300 words, clearly describing the entire paper, and a keyword list (5-10 words). No abstract is required for short articles/communications. The title of the paper should be brief and stated on a separate page along with the authors' names and addresses to enable the Publisher to prepare this text in the correct typeface and sizes. If the title exceeds 70 characters, a suggestion for an abbreviated running head should be given. The SI system should be used for all scientific and laboratory data; if in certain instances it is necessary to use other units these should be added in parentheses. Temperatures should be given in degrees Celsius. The unit 'billion' (10^9 in America, 10^{12} in Europe) is ambiguous and should be qualified when used. Where abbreviations are likely to cause ambiguity or not be readily understood by an international readership, units should be given in full. Every page of the manuscript including the title page, references, tables etc. should be numbered. However in the text no reference should be made to page numbers.

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Books: Popovics, S., 1979. Concrete-Making Materials. Surrey Press, London, UK.

Multi-author books: Ramaswamy, S.D.; Murthy, C.K. and Nagaraj, T.S., 1983. Use of waste materials and industrial by- products in concrete construction. In: R.N. Swamy (Ed.), Concrete Technology and Design, Vol. 1: New Concrete Materials. Surrey University Press, London, UK, pp. 137-172.

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