

Mid-term report for SUSFOOD ERA-net project “COSUS”

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1. Introduction to COSUS

The role of consumers in food waste issues

A large share of edible food is wasted throughout the supply chain: approximately 33% or 1.3 billion tonnes per year (FAO¹). Consumers are directly and indirectly responsible for a significant share of this waste. While estimates vary, consumers may be responsible for up to 110 kg per person per year when looking at total food waste (FAO¹), and for 40-50 kg per person per year when looking at food waste in the home (e.g. Voedingscentrum², Matvett³). Consumers are also indirectly responsible for food waste. For example, by not accepting foods in the supermarkets that do not look optimal, because they do not have the desired level of freshness (close best-before date), because they have an odd shape, or because of other visual imperfections. It is hard to estimate the impact of consumers demands on food waste, because some of this ‘suboptimal food’ never reaches the supermarket. However, up to 30% of the food waste during production or in the supermarkets may be due to foods being ‘suboptimal’ in the eyes of the consumer (Wrap, 2009⁴; Quedsted et al. 2013⁵).

Suboptimal foods

COSUS focuses on increasing consumer acceptance of suboptimal foods. The working definition of suboptimal foods as used in the project is:

1:FAO 2013 Food wastage footprint: Impacts on natural resources. Summary report, ISBN 978-92-5-107752-8

2: Voedingscentrum.nl

3: Matvett.no

4: Quedsted, T.E., Marsh, E., Stunell, D., Parry, A.D. 2013 Spaghetti soup: The complex world of food waste behaviours. *Resour Conserv Recy.* 79, 43-51.

5: WRAP 2009 Household food and drink waste in the UK. Final report, ISBN 1-84405-430-6

6: J. Aschemann-Witzel, I. de Hooge, P. Amani, T. Bech-Larsen, M. Oostindjer (2015) Consumer-related food waste: causes and potential for action. *Sustainability*, 7, 6457-6477 (Open Access). <http://www.mdpi.com/2071-1050/7/6/6457>

“Foods that consumers perceive as relatively undesirable as compared to otherwise similar foods because they either: (1) are close to, at or beyond the best-before date; or (2) deviate (visually or in other sensory perception) from what is regarded as optimal (usually equal to what is perceived as “normal”). This can be in the “buy/do not buy” choice situation in the store or in the “consume/do not consume” choice situation in the household.” (Aschemann-Witzel et al., 2015, Sustainability⁶).

Figure 1 provides examples of suboptimal foods. Some of these foods are more likely encountered in the store, while others are more likely encountered in the home. Important is that both the taste and the nutritional value is preserved in suboptimal foods, even though other sensory attributes (in particular visual aspects of the food or packaging) are deviating from optimal.



Figure 1. Examples of suboptimal foods as used in the COSUS project

Reducing consumer-caused food waste

In the COSUS project, we aim to investigate what the opportunities are for increasing the consumption of suboptimal foods. This project will generate new insights in consumer behaviour in the context of food waste in general. In addition, the project has the potential to reduce consumer-caused food waste significantly, both in the home and in the store. We work together with stakeholders and involve various actors of the food supply chain in the research, who have good insights into food waste behaviour, both by consumers and in the supply chain. The food



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supply chain is directly involved in the research, because any opportunities for more consumption of suboptimal food should also be feasible for producers and retailers.

2. Organization

The following partners are involved in COSUS:



COSUS is coordinated by Dr. Oostindjer at NMBU (Norway), with Prof. Rohm at TUD (Germany) as deputy project coordinator. Other full partners are Nofima (Norway), Wageningen University (the Netherlands), Aarhus University (Denmark), and SP (Sweden). SLU (Sweden) is subcontracted by SP.

Up to December 2015, 31 researchers and students have been involved in the project, of which 68% women.

Project meetings took place in Copenhagen (kick-off meeting, 11th of September 2014) and in Gothenburg (27-28 August 2015). The next meeting is planned for 20th of May in Aarhus, in conjunction with the Nordic Conference on Consumer Research (18-19 May, Aarhus), where several of the project's results will be presented.

COSUS has invited an Expert Advisory Board, which currently comprises 19 organizations and individuals, from the participating countries and other countries in Europe. Communication with the Expert Advisory Board thus far has been arranged through newsletters (sent out to all stakeholders in February and October 2015), and through local stakeholder meetings or individual communications.

COSUS is looking into the possibility of organizing a workshop in spring 2017, in which all interested parties (including the project team, the Expert Advisory Board and stakeholders) will be invited to participate.

3. Funding

Due to the nature of the ERA-net structure, funding for each partner comes from his or her respective national funding agency.

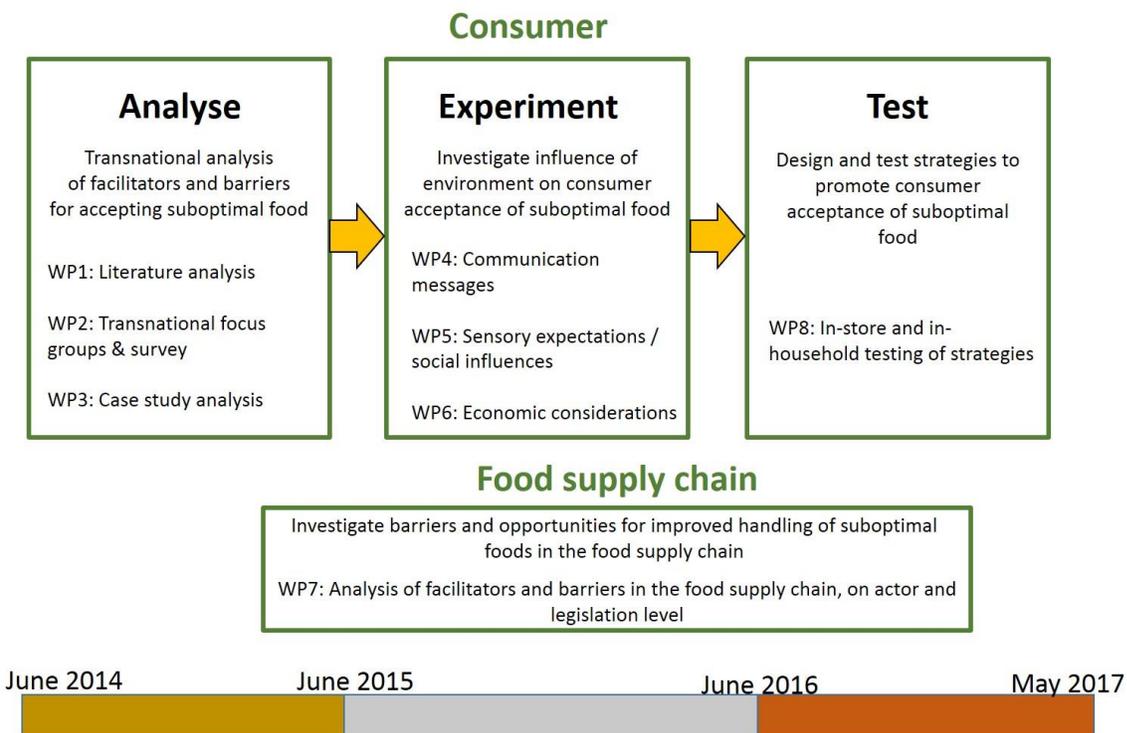
4. Research aims

The three main research aims of the COSUS project are:

1. Understand the barriers and facilitators for acceptance of suboptimal foods
2. Investigate how strategies that stimulate consumer acceptance of suboptimal foods can be successfully implemented into the food supply chain.
3. Design and test strategies that promote the consumption of suboptimal foods

To facilitate investigation of these aims, the project is divided into 8 research work packages (WP) and 1 dissemination work package; more details on the content of these WPs can be found in sections 5 and 6.

5. Timeline





At the time of this report, the “Analyse” phase has been finished: all data has been collected and final manuscripts are being written. The “Experiment” and “Food supply chain” phases are currently in progress, with data being collected in WP 4-7.

6. Progress per work package

Work package 1: Review knowledge on consumer food waste behaviour and the respective food sector environment.

The work for this work package consisted of two parts: 1) literature review and expert interviews on consumer food waste behaviour, and 2) literature review and expert interviews covering the food sector.

For the consumer behaviour part, the literature review and experts statements indicated that the household composition in terms of age and number of household members appears to play a major role in determining to what extent food is wasted. Even more important, though, are the following factors:

- The level of consumers’ motivation to avoid food waste for ethical reasons. These are for example concerns about the environmental impact, unfairness of wasting food in the light of hunger in other regions of the world, or scruples over wasting food rooted in values or religious beliefs.
- The extent to which consumers prioritise goals that might clash with the everyday handling of food in the household. For example, trading off avoidance of food wastage with health or safety concerns, or with convenience and household members’ liking or disliking of certain foods and meals.
- The ways in which consumers organise their food provision and perceive food and meal preparation. For example, consumers differ in the capability to efficiently manage purchase, storage, and preparation of foods (e.g. using shopping lists, integrating leftovers in subsequent meals). This factor also includes how consumers perceive the whole process, such as whether they take pride in being ‘thrifty’ or enjoy the creativity in dealing with leftovers.

However, consumers’ motivations, priorities, capabilities and perceptions are of course heavily influenced by their surroundings. Here, the following factors appear relevant:

- The immediate context in which food is chosen, such as the availability of foods in stores and the way foods are marketed and presented with regard to packaging, pricing and communication.



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- Social influences on food choice and food handling decisions, for example culture or family-specific habits determining which parts or remains are edible or not, and social norms on appropriate food and eating-related behaviour.
- The overall macro-environmental context, such as food safety or date labelling regulation, technological developments in food processing, packaging or storage, and the economic situation and general trend in terms of consumer culture.

A detailed summary of the review and a list of potential actions can be found here: <https://cosus.nmbu.no/download/file/fid/10039>. A podcast on this review is also available: <http://vimeo.com/140784700>. The manuscript was published as: J. Aschemann-Witzel, I. de Hooge, P. Amani, T. Bech-Larsen, M. Oostindjer (2015) Consumer-related food waste: causes and potential for action. *Sustainability*, **7**, 6457-6477 (Open Access). <http://www.mdpi.com/2071-1050/7/6/6457>

The review on literature on the food sector, in particular on producers, is currently under way. The manuscript “Producer-Related Food Waste: Causes and Potential for Action”, will be submitted to *Sustainability* (the same journal as the consumer-related review). Some expert interviews (dairy industry, bakery, meat producers), and qualitative data analysis of these interviews are remaining.

Work package 2: Transnational analysis of consumer motives, attitudes, behaviours and identification of consumer segments

This work package consisted of three parts: 1) transnational focus groups, 2) a transnational survey, and 3) a segmentation analysis based on the results of the survey.

Focus group discussions were carried out in all five countries, with a total of 83 participants divided over 10 discussions. The focus groups were conducted following the same interview guide in all countries and included five main parts: projective mapping, home photos, food waste at home, food waste in supermarkets and idea generation. The interviews were recorded, transcribed and translated into English, then coded by two independent researchers for analysis.

One of the key findings is that all types of foods are thrown away, regardless of their category: fruits and vegetables, bread and bakery products, spices, sauces and canned foods were discussed, among other. Reasons evoked for throwing foods included decreased freshness and past best-before dates, but not exclusively. Several facilitators of food waste were identified: food availability, pleasure of consumption, food habits and time constraints are the main factors that lead consumers to throwing some fully edible foods rather than consuming them. The study



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unveiled a need for tools to increase European consumers' awareness and accountability in food waste reduction.

The focus group results were used to create the transnational survey. A manuscript on the focus group results is in progress.

The transnational survey was conducted in all five countries, with a total of 4250 participants. The survey consisted of 7 parts: A food-related lifestyle measure, a section on attitudes to sustainable food consumption, a choice task on suboptimal foods in the home or the supermarket, a section on communication messages that motivate consumers to buy suboptimal foods, a section on perceived reasons for food waste at home, a section on knowledge of the extent of food waste, and a section on demographic variables.

Preliminary analysis showed that there are many reasons for wasting food at home. Appearance of mould or decay is an obvious reason to waste, but also lack of overview, planning, or creativity was identified, in addition to reasons such as too large food units, needing only part of an ingredient for a specific recipe, and too close best-before date after purchase. In the choice task, there are large differences in acceptability of suboptimal foods between the home condition and the store condition.

Further analyses are ongoing, in which consumer attitudes, motives and knowledge will be linked to consumer choices in the home and in the store conditions of the choice task. A manuscript based on these analyses is in progress. Part of the survey and focus group results may be used in combination with results from work package 7 in a manuscript on retailer perceptions of consumer choices concerning suboptimal foods, and consumer perceptions of suboptimal foods and potential marketing tools.

The segmentation analysis was conducted based on the food waste related lifestyle measure, and the other results from the survey. Preliminary analysis shows that consumers may be grouped into five segments, based on their attitudes, motives and behaviour towards food waste. A manuscript based on this analysis is currently being drafted.

Work package 3: Transnational analysis of societal food waste initiatives and issue communication framing

This workpackage consisted of *an analysis of success factors* in various initiatives that aim at reducing consumer related food waste. Quite a number of such initiatives exist across Europe, with varying success, thus allowing an analysis of what might be the ingredients to success or



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failure of initiatives. The methodology was a case study, which is an approach best applicable to complex phenomena, and when the goal is to learn for future decision-making and policy making.

The five partners involved (MAPP, NMBU, Wageningen, SP and TU Dresden) gathered 26 cases, covering 11 countries, 5 different types of actors (10 Stakeholder-driven NGO and alternative retail organisations such as foodbanks or government/stakeholder-driven organisations; 6 consumer-driven NGO; 7 retailers; 2 processors; 1 government), and 4 actions (8 Information and action to avoid foods becoming / being perceived as suboptimal; 10 Retail sale of suboptimal foods or foods based on processing of suboptimal food; 6 Alternative sales channels for suboptimal; 2 Alternative usage of suboptimal after sale). 23 cases include an interview – mostly with the actor, thus indicating that the data is largely self-reported.

First reflections show that many of the initiatives sprung out of a general trend towards the topic and were triggered by other actors' actions, allowing greater attention by the public as well as entailing business opportunities. Conducting the initiatives, a positive focus (on how to use foods, rather than avoiding wastage) was reported to be favorable, as well as good attention management, as for example effective and smart creation and maintenance of media / consumer attention, including good story-telling and personal charisma. Some questions were raised, as for example what the actual sustainability impact is of the creation of alternative retail (instead of tackling the source of the problem), or what the long-term effect of creating a separate 'suboptimal' category is.

One manuscript based on the case studies has been accepted (Aschemann-Witzel, Jessica; de Hooge, Ilona; Normann, Anne. Consumer-related Food Waste: Role of Food Marketing and Retailers and Potential for Action. *Journal of International Food & Agribusiness Marketing*). A second manuscript "Key characteristics and success factors of supply chain initiatives tackling consumer-related food waste - a multiple case study" has been submitted to a special issue of the *Journal of Cleaner Production*.

Work package 4: Exploration of factors determining consumer attention and response to communication

This work package consists of two parts: 1) which communication about suboptimal foods consumers pay most attention to in an eye-tracking study, and 2) which communication channels, content and flow are most effective in reaching consumers.

The eye-tracking study was finished by the end of last year. Photographic stimuli were generated for the study, resulting in images of 40 different food products, like e.g. fruits, meat, bread, cheese etc. Eight of the 40 products were complemented with suboptimal counterparts, i.e.



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normal and buckled cucumber. Participants were presented with matrices constructed randomly of eight images, some of them including suboptimal food products, while their eye movements were recorded. In some trials, suboptimal food images were enriched with special price and information badges. Subjects' task was to select either a product they would resign to keep in a shopping cart, or one they would select to buy. The focus of data analysis is now on attentional attraction of the price and information badges, independently of subjects' factual choice.

The communication channels study is currently being conducted. Participants will receive communication material promoting food waste reduction (brochures and fridge magnets) in the mail. The brochures invite participants to visit a corresponding website, and the website invites visitors to join a Facebook group. The usage of these materials, the response to their contents, and whether these contents have been shared within their households and/or within their social network will be studied after about 3 weeks from receiving the brochure. In addition, the communication flow from one communication channel to the other will be studied in light of the respondents' socio-demographic characteristics and attitudes to food waste. This study is done in conjunction with the social interaction experiments in work package 5.

Work package 5: Exploration of consumer sensory expectation and experience, and household social interactions

This work package consists of two parts: 1) a set of experiments on sensory expectations of and experience with consuming suboptimal foods, and 2) a set of experiments on how social interactions influence choice of suboptimal foods.

The sensory expectations and experience experiments are under way. Stimuli for two of the experiments (banana and yoghurt) have been chosen and analysed for product attributes (texture, colour, content, flavour profile). The development of a questionnaire that will be used in the experiments is being conducted, and participant recruitment for the experiments has started.

The social interaction studies are under way. Two pilot studies and one survey on household interactions and composition have been conducted, and are currently being analysed. An online choice experiment is being planned now, in which the focus will be on social norm communication. A third study is being planned in conjunction with work package 4.

Work package 6: Exploration of experimental consumer willingness-to-pay and in-store purchase reaction



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This work package consists of two parts: 1) an exploration of consumer acceptance of suboptimal foods (measured as willingness to pay and accept) relate to associative (implicit) and propositional (explicit) evaluation (APE) processes, and 2) investigate the effects of current producer and retailer-initiated initiatives that motivate consumers to accept SOF (supermarket purchase data or alternatives).

The *consumer acceptance studies* investigate several factors that are relevant to final acceptance of suboptimal food by consumers. The specific questions will be: what are consumers' implicit attitudes towards suboptimal food products? What are consumers' explicit attitudes towards suboptimal food products? Is there any difference between implicit and explicit attitudes depending on the characteristic of the stimuli and the level of product suboptimality? How can Associative and Propositional evaluations be “nudged” to a more positive evaluation?

The second part of the work will follow the “from food-to-mood” approach and explores disgust and other key emotions in response to products with different levels (or dimensions) of suboptimality. The aim here is to examine how cognitive-emotional interactions jointly contribute to food choice behavior.

The final part of the work will relate the psychological basis of the evaluation of suboptimality with economic preferences. An in-store experiment is planned as part of this research. An experimental auctions approach will then be used to reveal the real willingness to pay for suboptimal food. Treatments will be designed based on findings from the preceding acceptance and mood studies as well as on relevant findings from WP1-5.

The investigation of the effects of current producer and retailer-initiated initiatives will occur in spring/summer 2016.

Work package 7: Identification of barriers to and opportunities for improved handling of suboptimal food products in the food supply chain

This work package consists of two parts: 1) getting insights into the dealings of suboptimal foods across the food supply chain (more specifically the dealings of not-perfect looking foods), and 2) getting insights into the take-back clause that contributes to food waste across the food supply chain (more specifically the dealings of expired foods).

In the past few months, a joint theoretical framework for these two goals has been developed based on existing literature. In addition, interview questions were developed that relate to these two parts, and the persons that will be interviewed were identified. Part 2 (the take-back clause) also includes some case studies, which are identified. Currently the data for both parts is being collected.



Work package 8: Develop and experimentally test household level and consumer oriented in-store interventions

This work package consists of two parts: an intervention study on household level, and an intervention study targeting consumers in-store. No specific experiments have been planned yet, though various ideas are being gathered. More details regarding these studies will be expected after the next project meeting in May 2016.

7. Dissemination

The website for the project is: cosus.nmbu.no.

Peer-reviewed papers:

- J. Aschemann-Witzel, I. de Hooge, P. Amani, T. Bech-Larsen, M. Oostindjer (2015) Consumer-related food waste: causes and potential for action. *Sustainability*, **7**, 6457-6477 (Open Access). <http://www.mdpi.com/2071-1050/7/6/6457>
- J. Aschemann-Witzel, I. de Hooge, A. Normann (accepted) Consumer-related Food Waste: Role of Food Marketing and Retailers and Potential for Action. *Journal of International Food & Agribusiness Marketing*.

In addition to these publications, there are currently several papers submitted and in preparation.

Conference contributions:

- M. Oostindjer, I. de Hooge, J. Aschemann-Witzel, V. Lengard Almli (2015) Norwegian consumers' choice for 'suboptimal' looking foods: does the shape of the cucumber matter less than the best before date on milk? At 'Norwegian Food Market Research Conference', 4-5 November 2015, Ås, Norway.
- V. Lengard Almli, B. Steenbekkers, H. Rohm, A. Normann, J. Aschemann-Witzel, M. Oostindjer (2015) Quantitative tools and tangible tasks in focus group sessions. Application on food waste discussions in five European countries. At 'Norwegian Food Market Research Conference', 4-5 November 2015, Ås, Norway.



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- M. Oostindjer (2015) Consumers in a sustainable food supply chain: understanding barriers and facilitators for acceptance of visually suboptimal foods. At *'Susfood status seminar'*, 13 October 2015, Brussels, Belgium.
- V. Lengard Almli, G. MacDonald, H. Rohm, J. Aschemann-Witzel, B. Steenbekkers, D. Roodhuyzen, A. Normann, M. Oostindjer (2015) Qualitative usage of projective mapping in focus groups: an application on food waste in five countries. At *'Pangborn Sensory Science Symposium'*, 23-27 August 2015, Gothenburg, Sweden.
- J. Aschemann-Witzel, I. de Hooge, P. Amani, T. Bech-Larsen, J. Gustavsson (2015) A literature review and expert interview study on food waste consumer research. At *'Pangborn Sensory Science Symposium'*, 23-27 August 2015, Gothenburg, Sweden.
- J. Aschemann-Witzel, I. de Hooge, P. Amani, T. Bech-Larsen, M. Oostindjer (2015) Why do foods and meals become waste? Causes of consumer food waste. At *'MAPP workshop'*, 11 May 2015, Middelfahrt, Denmark. Oral presentation.
- J. Aschemann-Witzel, I. de Hooge, P. Amani, T. Bech-Larsen, S. Kolle, M. Oostindjer (2015) Consumer behavior and food waste: factors of relevance and potential for action for food marketers and food marketing research. At *'International Food Marketing Research Symposium'*, Chania, Greece, 17-19 June 2015.
- J. Aschemann-Witzel, I. de Hooge, P. Amani, T. Bech-Larsen, J. Gustavsson (2015) Consumers and food waste – a review of research approaches and findings on point of purchase and in-household consumer behaviour. At *'143rd Joint EAAE/AEA Seminar'*, Naples, Italy, 25-27 March 2015.
- M. Oostindjer (2014) Hvorfor kaster vi ikke-perfekt mat? At *'Frokostseminar: Matavfall – ressurs eller tap?'*, 24 October 2014, Ås, Norway.
- M. Oostindjer (2014) Consumers in a sustainable food supply chain: understanding barriers and facilitators for acceptance of visually suboptimal foods. At *'Susfood final conference'*, 21 October 2014, Paris, France.

Podcasts:

- J. Aschemann-Witzel (2015) Food waste and the consumer - Causes, potential for action and research directions. <http://vimeo.com/140784700>

Other dissemination:

- M. Oostindjer, V. Lengard Almli (2015) Presentation to Norwegian Expert Advisory Board. 17.11.2015.
- Newsletter 2nd edition (October 2015) for Expert Advisory Board members
- J. Aschemann-Witzel (2015) COSUS presentation at ETH Zurich. 08.10.2015.



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- Stand at Forskningstorget, Oslo, Norway on 18-19 September 2015. See: <http://www.forskningstorget.net/utstillere/utstillere-2015/institutt-for-kjemi-bioteknologi-og-matvitenskap-norges-miljo-og-biovitenskapelige-universitet-nmbu-2>
- M. Oostindjer, V. Lengard Almli (2015) Presentation to Norwegian Expert Advisory Board. 23.04.2015.
- Newsletter 1st edition (February 2015) for Expert Advisory Board members
- J. Aschemann-Witzel (2014) Summary of Work Package 1 results. See: <https://cosus.nmbu.no/download/file/fid/10039>
- Newsletter published at university homepage - Faculty news (in German) by Harald Rohm, 20.11.2014
- Hvorfor kaster vi ikke-perfekt mat? Article on Forskning.no. 11. april 2014. See: <http://www.umb.no/forsiden/artikkel/hvorfor-kaster-vi-ikke-perfekt-mat>
Or <http://www.umb.no/frontpage/article/why-is-suboptimal-food-wasted>
- M. Oostindjer (2013) Wasting less food: new EU project as part of the Food Ecology concept. See: www.cas.uio.no/research/1314ecology/eu%20project%20Marije.pdf