



Behavioural insights from food waste initiatives: What do they teach us?

Case study Food Waste Free United

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Summary

The case study that is described in this report, is part of the project "Governance in Transitions (KB-1-1D-1)". This Wageningen Research project generates the knowledge base for behavioural change and decision-making possibilities in the transition towards a circular and climate neutral society. The project belongs to the WUR Knowledgebase (KB) program 'Towards a Circular and Climate Positive Society' and is funded by the Dutch Ministry of Agriculture, Nature and Food Quality.

In this particular case study, the focus is on food loss and waste. Worldwide around one third of all food that is produced for human consumption is never eaten, and this has detrimental impact on the economy, the climate and the society. A transition towards a more circular food systems with less food loss and waste requires insights in the behaviour and incentives/drivers of actors involved. Therefore, the main aim of this case study was to explore how behavioural change insights were included in food waste initiatives and what could be learned from this analysis to support future food loss and waste prevention and reduction initiatives.

A qualitative approach was chosen as the best way to explore this topic. Five initiatives were included in the case study to cover a wide range of initiatives, different actors and various parts in the food supply chain. All these initiatives were implemented by stakeholders (members) of the Dutch Foundation Food Waste Free United (Samen Tegen Voedselverspilling, hereafter STV). STV is an ecosystem in which all important initiatives, expertise and actions against food loss and waste in The Netherlands are brought together and accelerated. Companies from the entire food supply chain, government, social organizations and knowledge institutions join forces to reach the ambition of retaining 1 billion kilos of food within the food supply chain every year.

A total of eight respondents were interviewed. For three initiatives, both initiators and participants of the initiative were interviewed. For the other two interviews, the initiators were interviewed. The research protocol was approved by the Social Ethical Committee from Wageningen University. All participants gave written consent for participating in the study and recording of the interviews.

An interview guide was developed to structure the 60-75-minute-interviews. The guide was developed based on an extensive literature study and the theoretical frameworks MOA and the Behavioural Intervention Wheel. To get insight into the motivational, ability and opportunity aspects of the initiatives, the respondents were asked to express how the initiative started, which elements it contained, and which barriers and success factors came forward. To deepen our understanding of the initiative and to distract lessons learned, respondents were also asked which effects occurred due to the initiative (on food waste reduction or other (un)expected negative effects or gains), which changes occurred during or after the initiative, and which suggestions and adaptations they proposed for improvement or scale-up of the initiative. Finally, questions were asked about the role of STV, and respondents' expectations regarding STV. A thematic analysis was carried out using both an inductive and deductive approach. The results were analysed for commonalities between the initiatives, as well as specificities that occurred for particular initiatives to get a broad overview of success factors, barriers and learnings for the future.

The results showed that there was a large focus on Motivation and Opportunity aspects within the initiatives, and there was less focus on Ability aspects. Also for initiating the initiative, Motivation and Opportunity were key elements. A high motivation seems logical for frontrunners, but this may not be enough to bring the motivation into practice (behaviour change). Opportunity was most often formed by the initiative (by providing resources) and/or by coincidence.

All initiatives contained multiple intervention elements. This is a positive aspect, since various behaviour change studies indicate that multiple-component interventions are usually more effective than single component interventions. 'Enablement' was applied in all initiatives and 'Education' in almost all initiatives. The two interventions complement each other well in food waste initiatives.

Six key success factors were identified from the interviews. These were motivated individuals, awareness of the food waste problem, collaboration, presence of resources (time, money, manpower), capabilities (skills, expertise and entrepreneurship) and sufficient communication within one's own organisation, within the collaboration and towards the outside world. Four key barriers were identified. These include the different interests of stakeholders (also different expectations and priorities), a lack of resources (time, money, manpower), the challenges of new initiatives such as uncertainty and getting commitment, and the vulnerability of initiatives that flourish on motivation.

Strengths of this case study are the diversity of initiatives, resulting in an extensive overview of perspectives, and the fact that the initiatives have been implemented in practice, leading to real-world behavioural insights. A limitation was that a maximum of five initiatives could be included and the guide was developed from an initiator point of view, making certain questions less applicable to participants.

By taking all results into account, several key learnings came forward to support future food loss and waste reduction initiatives. Firstly, use an integrated sector approach and stimulate collaboration and partnerships. Secondly, ensure continuity by constant attention, agenda setting and having a long-term vision. Thirdly, it is important to start small and simple, and keep some flexibility to adapt to the situation at hand. Furthermore, it is recommended to assess the impact by measuring the effects on food waste reduction as well as other gains. Showing and sharing these successes works 'connecting', helps setting new (social/company) norms and acts as a motivator for action. Finally, because the focus of the initiatives was on motivation and opportunity, it is recommended that developers also check whether (c)apabilities (knowledge and skills) of actors are sufficient for the required behavioural change. The key learning for STV is to be as clear as possible towards her stakeholders on what it means to be part of STV and what can be expected from STV during the start-up and execution of food loss and waste reduction initiatives.

List of definitions and abbreviations

General definitions

FW	Food Waste
FLW	Food Loss and Waste
STV	Samen Tegen Voedselverspilling (Food Waste Free United)

Abbreviations initiatives

Food Waste Challenge	FW Challenge
Bread & Dough Session	B&D Session
MBO Challenge	MBO Challenge
Verspillingsvoucher BrewBar	BrewBar Voucher
Retail Zelfmonitor Voedselverspilling	Retail Self-monitor
Initiator	-I
Participant	-P

1 Introduction

The case study that is described in this report, is part of the Knowledgebase (KB) project "Governance in Transitions (KB-1-1D-1)". This Wageningen Research program generates the knowledge base for behavioural change and decision-making possibilities in the transition towards a circular and climate neutral society. Its main objective is "to understand actors and test the impact of interventions at various levels in agro-food systems resulting in (new) business models for a circular and climate neutral society". The project belongs to the WUR Knowledgebase (KB) program 'Towards a Circular and Climate Positive Society' and is funded by the Dutch Ministry of Agriculture, Nature and Food Quality.

In this case study, the focus is on food loss and food waste (FLW) and the case study deals with FLW reduction initiatives within the Foundation Food Waste Free United (Samen Tegen Voedselverspilling, hereafter STV). STV is an ecosystem in which all important initiatives, expertise and actions against food loss and waste in The Netherlands are brought together and accelerated. Companies from the entire food supply chain, government, social organizations and knowledge institutions join forces to reach the ambition of retaining 1 billion kilos of food within the food supply chain every year.

STV was founded in December 2018, thereby formalizing its predecessor the 'Taskforce Circular Economy in Food' which was launched during the National Food Summit in The Netherlands in January 2017. STV has stakeholders who contribute a yearly fee, in addition to receiving financial support by the Ministry of Agriculture, Nature & Food Quality. Its main aim is to reduce food waste in The Netherlands by 50% by 2030 (SDG12.3) together with Dutch companies, organizations, universities, government and consumers. In March 2018, a National Agenda on FLW prevention was launched, which formulated activities and piloting actions along four different action lines. Action line 1 focuses on measuring & monitoring FLW on organisational, sectorial and national level. Action line 2 stimulates business innovation action across the agri-food chain. Action line 3 focuses on awareness raising and specific interventions for consumers. Action line 4 refers to changing regulation, legislation and business agreements to remove barriers for FLW prevention and reduction. Currently, 73 organisations have committed themselves as members to the STV.

The goal of this case study is to understand the role of attitude and behaviour and behaviour(al) change in creating circular food systems to prevent and reduce FLW, hence contributing to a climate neutral society. The technical aspects of innovation and systemic changes for reducing FLW are quite well known, and applications are available in practice. However, adoption and scaling of these technical innovations as successful, scalable and impactful new practice is not self-evident: an important reason lies within social and personal (human) factors, the awareness and willingness to change, the willingness to implement changes and to commit stakeholders involved in the supply chain and food system. A transition requires insights in behaviour and incentives/drivers of stakeholders involved. Within the case of STV, we generate knowledge in the behavioural dimensions of reducing FLW.

Worldwide about a third of all food that is produced for human consumption is never eaten (Gustavsson, Cederberg et al. 2011); this phenomenon is known as *food loss* or *food waste (FLW)*. It is widely acknowledged that FLW have a detrimental impact on the economy, the climate and the society, which has led to an increasing societal and academic interest in food loss and food waste reduction. There is a clear aim set in the UN Sustainable Development Goal 12.3: halving the world's food loss and waste by 2030. Both the EU and the Netherlands have committed themselves to this target, and is included in the EU Farm to Fork Strategy (2020).

Reducing FLW presents a challenge. It is a complex and multifaceted problem, to which no straightforward solution exists. FLW is associated with a variety of both avoidable and unavoidable causes, and it involves multiple actors along the entire food supply chain (Figure 1).



Figure 1 Actors involved in FLW along the food supply chain.

In 2019, an extensive literature research was executed by the authors to identify drivers and barriers of FLW reduction behaviour from an actor perspective, and to explore possible solutions to the FLW problem across the food supply chain (Zeinstra, van der Haar 2020). The focus of this literature research was specifically on human behaviour within the food system. This literature study showed that most studies focus on drivers and barriers of FLW behaviour, and less on behavioural interventions to reduce FLW. Furthermore, the overview of drivers and barriers along the food supply chain showed that most of them relate to the consumer level, followed by the retail and hospitality sector. Most identified interventions focused at FLW of the consumers as end-user: interventions at the retail level focus on providing consumers with options (or opportunities) to reduce FLW, whereas household-level interventions focus on enhancing consumers' motivations and abilities to reduce FLW.

In this case study, we look at FLW initiatives from a practice point of view to enrich our understanding of behavioural aspects in FLW reduction initiatives and to extend the findings from the literature research. Five FLW initiatives that have been executed in The Netherlands were studied, with again a focus on human behaviour and a behavioural change perspective. All these initiatives were implemented by stakeholders of STV.

This case study aims to understand how behavioural aspects were included in the initiatives, which personal and contextual factors hindered or facilitated the execution of the initiative, and what behavioural insights can be distracted from this case study for strengthening future initiatives. In line with the literature research report, the MOA consumer food waste model with the aspect Motivations, Opportunities and Abilities was taken as starting framework for the case study to analyse and distract behavioural change insights. This report forms the starting point for the activities in year 3 (final year).

The central question for this STV case study was: How were behavioural change insights included in previous STV food loss and waste reduction activities and initiatives, and what can we learn from them to encourage behaviour change in the food chain in order to reduce food waste?

2 Methods

The STV case study in 2020 consisted of two parts. First, the literature search from 2019 was updated to ensure that relevant knowledge and insights from recent scientific papers could be included in the second part of the case study. The second part was a qualitative study, consisting of in-depth interviews with stakeholders of STV. A qualitative approach was chosen, as we aimed to explore this topic and collect in-depth information from the respondents, thereby using their own words to describe the initiatives (Jeanfreau & Jack, 2010; Maso & Smaling, 1998).

Five FLW reduction initiatives were chosen based on the following criteria:

- 1) Covering a diverse range of initiatives;
- 2) Initiatives in various parts of the chain;
- 3) Involving different stakeholders;
- 4) The initiative was finished in 2019/ beginning of 2020 in order to look back to it (although the initiative could have a successor);
- 5) Where possible, the initiator of, and a participant in the initiative were invited to explore multiple perspectives of the same initiative;
- 6) The respondent was willing to participation in the case study.

Within the project restraints, a total of eight interviews were conducted: five with initiators and three with participants. Ethical clearance for the qualitative study was obtained from the Social Ethics Committee of Wageningen University (Annex 1).

2.1 Literature search

The exact same search on behavioural aspects of FWL in the food chain as the extensive literature search of 2019 (Zeinstra, van der Haar 2020) was performed to look for new publications in Q4 2019 and Q1 2020. The literature framework was updated to be sure to have included all relevant papers up to now as a basis for the development of the interview guide.

The search was performed in Scopus, Web of Science, ABI/Inform, CAB Abstracts and PsychInfo in March 2020.

The following search terms were used:

Behavio(u)r:

(behaviour OR behaviur OR attitud OR habit) AND (modif* OR chang* OR revers* OR shift OR transform* OR transist*)*

Food Waste:

(Food OR Foods OR Kitchen OR Plate OR Postharvest) AND (Waste OR Wastage OR Wasting OR Leftover OR Loss OR Losses)*

Food System Approach:

Food system OR integrated value chain OR food chain OR food supply chain OR Farm to Fork OR Field to fork OR primary production

In addition, in CAB Abstracts and ABI/Inform the following terms were used:

Driver OR Cause* OR Reason* OR Explanation* OR Factor* OR Effect* OR Barrier* OR Solution* Consumer* OR Household* OR Retail* OR farmer* OR Supermarket* OR Food company OR Stakehoulder* OR Players*

The additional search resulted in 10 relevant papers, that were summarized and added to the literature framework.

2.2 Participants & procedures

For three initiatives, the initiator (organizer) and a participant were interviewed. For the other two initiatives, only the initiator was interviewed. The STV contact person from Wageningen Food & Biobased Research invited the participants via an email, explaining the main aim and procedure of the study. After agreement, the research team planned the interview and asked participants to sign an Informed Consent. All respondents provided consent to be interviewed and having the interview recorded for data analyses. Upon request, the respondent could receive the interview questions prior to the interview, to become acquainted with the questions.

For the in-depth interviews with STV stakeholders, an interview guide was developed to structure the interviews and to trigger the respondent to tell their story, because qualitative research is valued for the fact that respondents can give meaning to their experiences in their own words and it focuses on how something is experienced (Jeanfreau & Jack, 2010; Maso & Smaling, 1998). The interviews were executed in October 2020. Each interview was done online (via Microsoft Teams) and lasted between 60 and 75 minutes. Two researchers were present during each interview: one person led the interview and asked the questions, the other took notes and checked on completeness. Transcripts were returned to the respondents for a final check on the transcription and minor adaptations were done based on their feedback or additions.

2.3 Development of interview guide

The aim of the interviews was to look at the STV initiatives from a behavioural perspective. Therefore, the theoretical MOA framework of van Geffen (Figure 2) the COM-B Behavioural Intervention Wheel of Michie (Figure 3) and an earlier report within this KB project (Zeinstra, van der Haar 2020) were used to guide the development of interview questions. The questions were developed with the initiators of the initiative in mind. To get insight into the motivational, ability and opportunity aspects of the initiatives, the respondents were asked to express how the initiative started, which elements it contained, and which barriers and success factors came forward. To deepen our understanding of the initiative and to distract lessons learned, respondents were also asked which effects occurred due to the initiative (on food waste reduction or other expected or unexpected negative effects or gains), which changes occurred during or after the initiative, and proposed suggestions and adaptations to improve or scale-up the initiative. Finally, questions were asked about the role of STV, and respondents' expectations regarding STV. The final guide can be found in Annex 2.

Consumers Food Waste Model

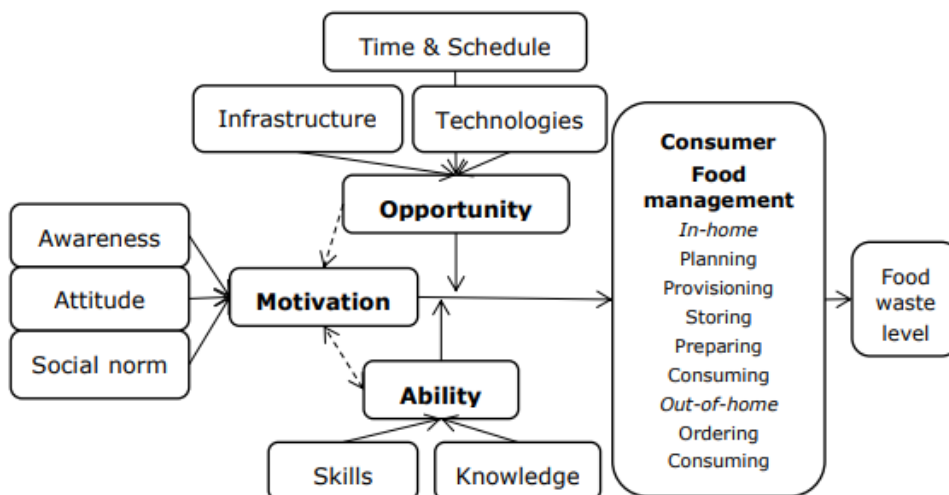


Figure 2 Consumer Food Waste Model (MOA framework) of van Geffen (2016).

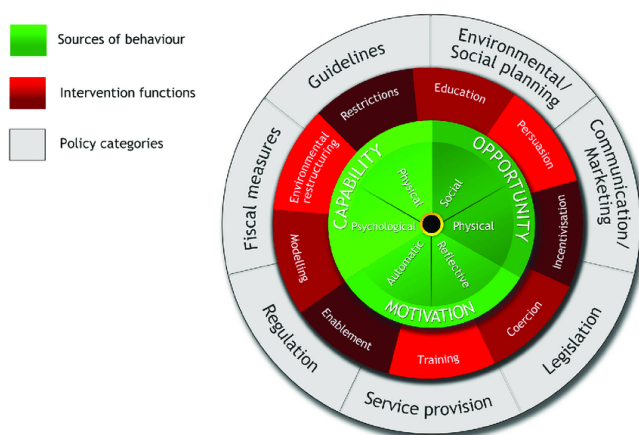


Figure 3 COM-B Behavioural Intervention Wheel (Michie, 2011).

2.4 Analyses

Each interview was transcribed verbatim. Transcripts were sent to the respondents for a final check. The initiatives were first described according to their main activities, the origin of the initiative, and where the initiative was implemented (location in the chain visually shown).

Subsequently, the initiatives were described according to the inclusion of aspects of the MOA-framework. It was tabulated which motivation, ability and opportunity aspects were applied or took place in the initiatives. Based on these aspects, the initiatives were categorized according to an intervention category as proposed by Michie et al (2011). Table 1 shows the definitions of these interventions.

Since the intervention description is relatively broad, a few decision rules were needed when the decision for a certain intervention was not that obvious:

- Collaboration has been placed under the interventions 'Environmental structuring (social)' and Enablement (working together changes the social environment and often saves time/ money).
- Increasing or creating awareness has been placed under education, as it is aimed to increase knowledge or understanding.
- Communication + competition, generally seen as persuasion, because some form of communication is used to induce a motivation (feeling) to act.

Table 1 *Definitions of interventions and policies according to the COM-B framework of Michie et al (2011).*

Table 1 Definitions of interventions and policies

Interventions	Definition	Examples
Education	Increasing knowledge or understanding	Providing information to promote healthy eating
Persuasion	Using communication to induce positive or negative feelings or stimulate action	Using imagery to motivate increases in physical activity
Incentivisation	Creating expectation of reward	Using prize draws to induce attempts to stop smoking
Coercion	Creating expectation of punishment or cost	Raising the financial cost to reduce excessive alcohol consumption
Training	Imparting skills	Advanced driver training to increase safe driving
Restriction	Using rules to reduce the opportunity to engage in the target behaviour (or to increase the target behaviour by reducing the opportunity to engage in competing behaviours)	Prohibiting sales of solvents to people under 18 to reduce use for intoxication
Environmental restructuring	Changing the physical or social context	Providing on-screen prompts for GPs to ask about smoking behaviour
Modelling	Providing an example for people to aspire to or imitate	Using TV drama scenes involving safe-sex practices to increase condom use
Enablement	Increasing means/reducing barriers to increase capability or opportunity ¹	Behavioural support for smoking cessation, medication for cognitive deficits, surgery to reduce obesity, prostheses to promote physical activity
Policies		
Communication/marketing	Using print, electronic, telephonic or broadcast media	Conducting mass media campaigns
Guidelines	Creating documents that recommend or mandate practice. This includes all changes to service provision	Producing and disseminating treatment protocols
Fiscal	Using the tax system to reduce or increase the financial cost	Increasing duty or increasing anti-smuggling activities
Regulation	Establishing rules or principles of behaviour or practice	Establishing voluntary agreements on advertising
Legislation	Making or changing laws	Prohibiting sale or use
Environmental/social planning	Designing and/or controlling the physical or social environment	Using town planning
Service provision	Delivering a service	Establishing support services in workplaces, communities etc.

¹Capability beyond education and training; opportunity beyond environmental restructuring

Furthermore, for the other interview topics, a table was made per topic with responses categorized in two or three main categories. These tables served as an overview to explore the main themes for each of these topics. The categorization and distraction of themes was done by two researchers who had done the interviews and were discussed in a team of four researchers. Attention was paid to both similarities in responses or themes that were present in all initiatives as well as differences in responses, for example themes that were specific for one particular initiative. Main conclusions and lessons learned were distracted from the data.

A thematic analysis was carried out using both an inductive and deductive approach. The results were analysed for commonalities between the initiatives, as well as specificities that occurred for particular initiatives to explore a broad range of behavioural factors that facilitated or hindered implementation of the initiative.

3 Results

3.1 Description of the initiatives

Table 2 describes the five initiatives that were discussed in the interviews with the corresponding respondents for these initiatives.

Table 2 *Overview of the five initiatives and the corresponding respondents that were interviewed for this case study.*

Initiative	Respondents	Other actors	Short description
Food Waste Challenge (Sept 2019-Jan 2020)	Rabobank (I) Event Hotels (P)	Hotelschool The Hague Wastewatchers Hotel and kitchen personnel STV	Part one was a campaign to recruit hospitality participants. Part two consisted of several steps. After sign-in, Wastewatchers and/or Hotelschool did an intake and food waste baseline measure at the company. Subsequently, location-relevant activities to reduce food waste were implemented for four weeks. After these four weeks, there was a post-measurement of food waste. Results of all participants shared at Horecava event. Event Hotels specific: They made the challenge to a competition among the 17 participating hotels. Their food waste reduction activities focused on the buffet breakfast situation.
Bread & dough Session (January 30 th 2020)	Milgro (I) Nedverbak (P)	MVO Nederland Various participants in the session STV	Part one "Insight in the chain": make an overview of data about food losses and food waste in the bread & dough chain. Part two: Discussion session of four hours, where the part 1 results were presented and possible solutions discussed in smaller groups.
MBO Challenge (Sept 2019 – Jan 2020)	Clusius College (I)	Katapult NH Food Coöperatie DOON Leren Voor Morgen Jong Leren Eten Provincie Noord-Holland Participating MBO schools in the challenge Partners: Groen Kennisnet Rabobank STV	A food waste challenge between different teams of MBO students (mainly from food, hospitality and marketing educations). The student teams work on a business case for 10-20 weeks in which they look for a solution for reducing food waste. The final product is a short movie of 2 minutes, where they present their solution. The movies are judged by a professional jury and the top 10 movies are invited to a large event at the end of the challenge.
Verspillingsvoucher BrewBar (July 2020)	MaGie Creations (I)	Gemeente Den Haag WUR STV	MaGie creations works on upgrading the residual product brewer's grain to an ingredient for the food industry. It can be used as a replacer for flour and they call it 'PowerFlour'. The team consists of the founder, a process-technologist, 3 marketeers and 3 food technologists. MaGie creations made use of the Verspillingsvoucher arrangement from STV, in order to optimize their process with scientists from WUR. After that they created the BrewBar, a direct application of PowerFlour in a product. The BrewBar was launched at Lidl stores in the Netherlands during the 'Future Goods week'.
Retail Zelfmonitor Voedselverspilling (2019)	CBL (I) Lidl (P)	Albert Heijn, Aldi, Jumbo, Lidl en PLUS (participating supermarkets) WUR Dutch Ministry of Agriculture (LNV)	This initiative is a baseline measurement of food waste generated at the retailer level. Members of the branch organization CBL (five supermarket-chains in the Netherlands; Albert Heijn, Lidl, Aldi, Plus and Jumbo, together ~78% of the Dutch market), self-reported their food waste numbers to WUR, who analyzed these numbers. The outcome was that 1.7% of the food in supermarkets is wasted. Due to this initiative, reliable insights are available on food waste numbers at the retailers level,

Initiative	Respondents	Other actors	Short description
		STV	specified for five product categories 1) potatoes, vegetables and fruits 2) fresh meat and fish 3) dairy, eggs and fresh ready-to-eat meals 4) bread and banquet 5) other fresh and preserved products

(I) = initiator
(P) = participant

As intended, the initiatives vary in size, duration and approach. Whereas the Retail Zelfmonitor Voedselverspilling [=Retail Self-monitor] clearly fits with Action line 1 of STV (Measuring & monitoring FLW on organisational, sectorial and national level), the other four initiatives fit more to action line 2 (Stimulating business innovation action across the agri-food chain). Two initiatives (Food Waste Challenge [=FW Challenge] and Retail Self-monitor had a clear focus on measuring the amount of food waste in a structured way. Two initiatives were designed as a challenge (FW Challenge + MBO Challenge). Two initiatives were focused on solutions for residual streams, where one aimed to make a novel ingredient for the food industry with a concrete food product as a result (BrewBar Voucher) and the other focused on broader possible solutions for valorisation of side streams in the bread and dough sector (Bread & Dough session [=B&D Session]). All initiatives consisted of multiple activities (steps). Involving various actors occurred in all initiatives, which seems to point to the awareness that working on food waste reduction should not only be done by one single actor in the chain. The B&D Session was focused on stimulating collaboration, whereas in the other four initiatives, collaboration formed the basis for executing the initiative.

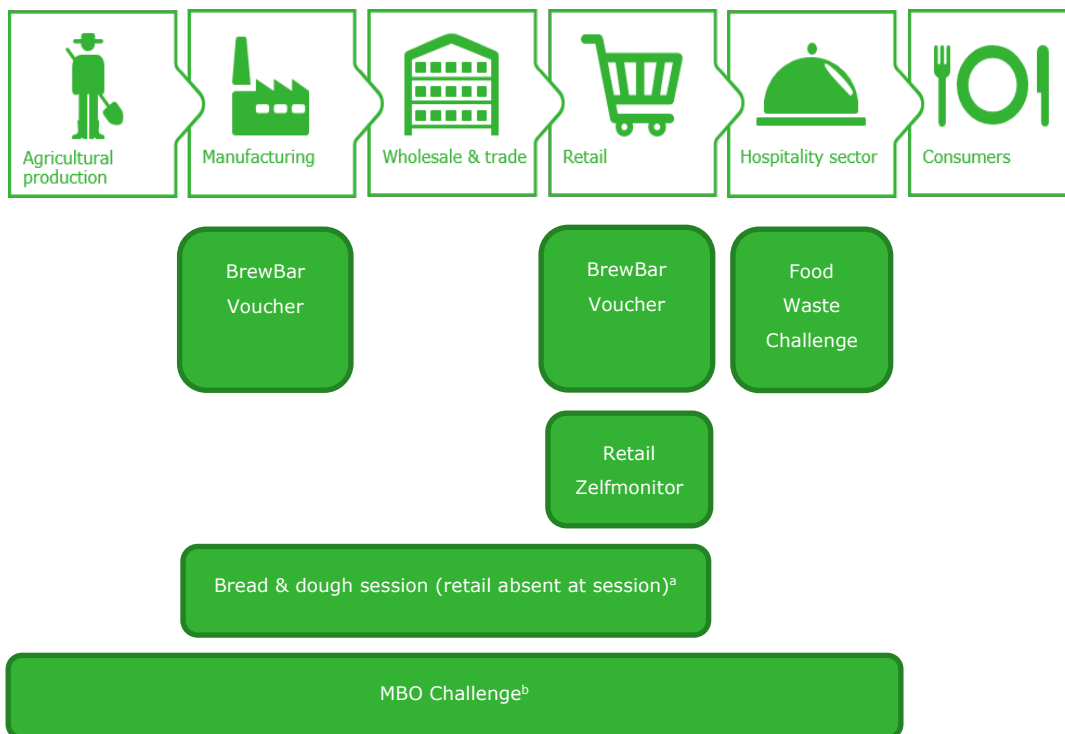


Figure 4 Overview of where (in which part of the food value chain) the initiatives were implemented.

^a The activities of this initiative were focused on these target groups (collection of data + discussion session); these activities can be positioned as 'stage before' implementation of food waste reduction activities

^b Whether the solutions that the MBO students worked on during the MBO challenge were actually implemented in the chain, was not assessed/measured.

Figure 4 shows visually where the initiatives were implemented in the food value chain. Two initiatives were implemented in one particular part of the chain (Retail Self-monitor & FW Challenge), whereas the other three initiatives were implemented across a broader range of actors. It is important to note that B&D Session focused on various actors in the chain with regard to the bread sector, but some caution is needed in regarding this initiative as implementation of a food waste reduction activity, as the session should lead to such activities. A similar reasoning can be applied for the MBO Challenge, as it was unclear which solutions have been implemented. In two initiatives, consumers were the end-users of the initiative. For the FW Challenge, consumers in the hotels experienced the food waste reduction activities that were implemented at the breakfast buffets. For the BrewBar Voucher, consumers see, buy and eat the bars that were developed by them. For the other three initiatives, consumers are less prominently present in the initiatives, as these initiatives focus more on the earlier parts of the chain.

3.2 Drivers to start the initiative

When we look at the drivers that play an important role in the start of each of the five initiatives (see Table 3), then the most important drivers are personal motivation and the opportunities that were present for starting the initiative. This opportunity could for example be formed by networks, funding, connections or manpower. For one initiative (Retail Self-monitor), the STV was the trigger to start the initiative, as part of her action line 1 on monitoring, in close collaboration with CBL (Centraal Bureau Levensmiddelenhandel).

Furthermore, a driver that was often mentioned was simply coincidence. This could mean coincidence in collaborations that were found, or that the initiative just came at the right moment and fitted the needs of the initiator or participant. Often things were coming together, such as people that were enthusiastic, funding and manpower. Sometimes, the initiative provided an opportunity to start something (BrewBar Voucher), scale up (FW Challenge) or to learn more about the topic of FW (B&D Session, MBO Challenge).

Table 3 *Drivers to start each of the five initiatives based on the responses of the respondents.*

Drivers	Food Waste Challenge	Bread & Dough session	MBO Challenge	BrewBar Voucher	Retail Zelfmonitor Voedselverspilling
Personal drive (motivation)	X		X	X	
Looking for a win-win	X		X		
Need for numbers to show the problem	X	X			X
Coincidence - things coming together	X		X	X	
Roadmap/agenda point of STV					X
Approached by other party with request				X	
Opportunities for starting the initiative (e.g. money, network, connections, manpower)	X	X	X	X	X
Right momentum to work on FW reduction	X		X		X
Initiative provided an opportunity	X	X	X	X	

Looking for a win-win also played a role in a few initiatives, meaning reaching a reduction in FW, plus for example saving money (FW Challenge), or making MBO students 'shine' (MBO Challenge). Furthermore, in three initiatives (FW Challenge, B&D Session + Retail Self-monitor) there was a need for numbers (measuring=knowing), and therefore this was the first step. The data and numbers were needed to show the problem or convince others for action. These insights could also serve as a personal driver and a starting point for action in reducing FW (Retail Self-monitor).

None of the respondents had considered another initiative. Often the initiative was particularly chosen because the initiative fitted exactly the needs of the participants (Retail Self-monitor-P, FW Challenge-P, B&D Session-P) or the initiators thought it was needed (Retail Self-monitor-I, MBO Challenge, BrewBar Voucher). In other initiatives (i.e. FW Challenge-I + B&D Session-I), the steps of the initiative were developed on the go. Table 10 in Annex 3 shows the origin history per initiative.

3.3 Motivations, Abilities, Opportunities (MOA) and Intervention elements in the initiatives

Table 4 shows per initiative which aspects of the initiative link to the Motivation, Ability and Opportunity framework (MOA). Based on these elements, it was distracted which intervention elements (Michie, 2011) were applied in the initiatives (final column), with the core intervention depicted in bold.

All initiatives contained several Motivation and Opportunity elements, whereas the link with Abilities to reduce FLW was less obvious present (only the MBO Challenge and Retail Self-monitor-P). In the initiatives where Ability aspects were mentioned by the respondents, the participants in the initiatives actually acquired skills or new knowledge regarding FW reduction.

Motivational aspects were frequently mentioned by the respondents for all initiatives. Respondents talked about a person's intrinsic motivation to reduce FLW, this could be the motivation of the initiator him/herself or the motivation of employees/participants in the initiative. Respondents in the FW Challenge clearly stated that individual motivations for food waste reduction can vary, and that it is important to find the right motivational button to 'push on'. They described individual motivations such as a sustainable (better) world, passion for the food, lowering work load, or saving money. Other initiatives also mentioned Corporate Social responsibility (B&D Session-P) or creating a win-win (reducing FLW and giving student a possibility to shine; MBO Challenge).

Creating awareness on the topic of FLW was also an often mentioned Motivation element in the initiatives (FW Challenge-P, B&D Session-I and -P, Retail Self-monitor-I and -P). Awareness was seen as the first step in the process of creating (behavioural) action. Respondents argued that by showing the relevance of the problem, this could lead to agenda setting or a sense of urgency to take action (attitude change).

The FW Challenge initiative tried to change the social norm, which also belongs to the Motivational aspect of the MOA model. They worked on this from two viewpoints. First, they strived for a new norm regarding what the amount of food that is served to customers: From more than enough food for a guest towards 'just enough food' for guests. Secondly, they strived for a new norm among employees, in the sense that working on food waste reduction is a regular task for each individual employee. Therefore, new employees sign a commitment letter where they state that they will work on food waste reduction.

With regard to Opportunities, the initiatives often enabled participants to work on FLW reduction, via the provision of resources such as help or lowering costs, which facilitated and accelerated action (FW Challenge-I, FW Challenge-P, MBO Challenge and BrewBar Voucher). The B&D Session initiative was really aimed at encouraging collaboration in the area of FWL reduction, and provided an opportunity for persons who were interested in FWL reduction to meet. Furthermore, in MBO Challenge actual business cases coming from the field were connected to the student teams to work on and this collaboration created a win-win situation (both the students as well as the entrepreneurs benefit).

All initiatives made use of multiple intervention elements, and cannot be categorized into one single intervention type. Some of the initiatives consist of a wider variety of elements, such as the MBO Challenge and the FW Challenge, whereas other initiatives contain less intervention elements (e.g. BrewBar Voucher, Retail Self-monitor). Enablement was used in all initiatives. As described above, the initiative provided resources, such as manpower, money, expertise or it encouraged collaboration. This increased means or reduced barriers, and often facilitate or accelerated action. Education was applied in almost all initiatives, for example via providing tips or talking about solutions, or via creating awareness among participants or the general public, thereby increasing a person’s knowledge and understanding about food waste and its potential solutions.

Persuasion (FW Challenge -I and -P, MBO Challenge, Retail Self-monitor -I and -P), Modelling (FW Challenge-I, B&D Session-I and -P, MBO Challenge) and Environmental (social) restructuring (FW Challenge-P, B&D Session -P and BrewBar Voucher-I) were applied in three of the five initiatives. Focusing on individual motivations, providing a strict deadline, showing that food waste can be reduced, or showing food waste numbers were used as persuasion approaches. Role models were used to provide tips, to motivate organizations to participate in the initiative, or to demonstrate possible solutions (inspiring examples). The role model used was similar to the intended target group to support identification. Environmental restructuring was especially in the social domain, via new collaborations.

Training (MBO Challenge, Retail Self-monitor-P) and Incentivization (FW Challenge-P, MBO Challenge) were used in two initiatives each. In the MBO Challenge, participating students were trained by working on business cases and finding practical solutions for reducing FW. Thereby they required the skills for reducing food waste in practice. Celebrating success together and rewarding the winner of the challenge were used as incentives.

Table 4 *Overview of how the five initiatives link to the Motivation, Ability and Opportunity framework (MOA) and which interventions elements were included.*

Initiative	Motivation	Ability	Opportunity	Intervention elements
Food Waste Challenge (I)	<ul style="list-style-type: none"> To motivate organizations to participate in FW Challenge: peer-to-peer influence (Modelling) + practical assistance promised (Enablement) Motivations to participate are diverse: love for the food (passion), for future generations, sustainability and saving money (less said, but about 33%; Persuasion) If entrepreneurs see that it works, they will subsequently invest (Persuasion) 	<ul style="list-style-type: none"> Nudges and films of other entrepreneurs with tips (Education/ Modelling) 	<ul style="list-style-type: none"> FW Challenge provided an opportunity (helping hand) to work on FWR (Enablement) FW Challenge provided a clear deadline leading to a sense of urgency (Persuasion / Regulation) 	<ul style="list-style-type: none"> Enablement * Modelling Education Persuasion Regulation
Food Waste Challenge (P)	<ul style="list-style-type: none"> To motivate and convince management to work on FWR, a pilot was executed in one 		<ul style="list-style-type: none"> FW Challenge provided an opportunity for participants to work on FWR: reducing the burden of time and 	<ul style="list-style-type: none"> Enablement Education Persuasion Incentivization

Initiative	Motivation	Ability	Opportunity	Intervention elements
	<p>hotel, showing the size of the FW problem (Persuasion).</p> <ul style="list-style-type: none"> To motivate individual employees to participate in the FW Challenge/ FWR, individual intrinsic motivation was sought: better world, saving money, lower work load (Persuasion) Goals were frequently mentioned to motivate as well (Persuasion). Creative ways to motivate and enthuse employees: post-card, facts, videos with reasons why we work on this topic + celebrate success together (Persuasion + Incentivization). Discussion sessions about the meaning of food waste and explore possible solutions to create awareness among employees (Education). A competition between the 17 participating Event hotels to support their motivation in the FW Challenge (Persuasion). Social norm started to change by working intensively on FW: 1) moving from more than enough food for guests to 'just enough food' for guests; 2) you are a loser if you do not work on food waste – to address each other; 3) Commitment letter for new employees to state: I will work on food waste reduction (Environmental restructuring social: BCT 'agree on behavioural contract') 		<p>money, enabling participants to do it (Enablement).</p> <ul style="list-style-type: none"> In order to keep the FW Challenge feasible, it was focused on one particular situation: breakfast only (Enablement: BCT set graded tasks). Solutions were practical, easy, not time-consuming (Enablement: focused, concrete and easy solutions: BCT set graded tasks). 	<ul style="list-style-type: none"> Environmental restructuring (social)

Initiative	Motivation	Ability	Opportunity	Intervention elements
Bread & dough Session (I)	<ul style="list-style-type: none"> • Creating awareness by showing the relevance of the problem (Education) • Encourage collaboration, do it together (Enablement/ Environmental restructuring) • Providing interesting existing examples to inspire (Modelling) 		<ul style="list-style-type: none"> • Matches were made between different parties (start-ups and bigger producers) to enable and encourage collaboration (Enablement/ Environmental restructuring) 	<ul style="list-style-type: none"> • Education • Modelling • Enablement/ Environmental social restructuring
Bread & dough Session (P)	<ul style="list-style-type: none"> • Creating awareness among members by informing them about the session as well as the results (Education) • Seeing each other and hearing what others do in the area of FWR works stimulating (Modelling) • Showing examples during the session gives rise to awareness (Modelling) 		<ul style="list-style-type: none"> • Bring people in contact with each other to support collaboration (Enablement/ Environmental restructuring) 	<ul style="list-style-type: none"> • Education • Modelling • Enablement/ Environmental social restructuring
MBO Challenge	<ul style="list-style-type: none"> • Intrinsic motivation of the initiator to make the MBO students 'shine' and to do something on the topic of food waste (individual motivation) • Initiator motivated both businesses and students to participate in this challenge and communication was wide-spread (Persuasion) • Assigning names of the students to a case and making them responsible for the final solution for their business case (Incentivisation) • The final event that was organized for this challenge, where the 	<ul style="list-style-type: none"> • MBO students learn about the topic of food waste and develop the skills for reducing food waste in practice (Education, Training) 	<ul style="list-style-type: none"> • Matches were made between student teams and a business case, so that the students could work on food waste reduction in real life (Enablement) • Connection with other MBO schools that could sign up for participating in this challenge (Enablement) 	<ul style="list-style-type: none"> • Education • Training • Persuasion • Incentivization • Modelling • Enablement

Initiative	Motivation	Ability	Opportunity	Intervention elements
	<p>final movies were judged by a professional jury and a winner was chosen (Incentivisation)</p> <ul style="list-style-type: none"> • Making the MBO students excited and motivated about reducing FW, hoping they will spread the word to their peers (Modelling) 			
Verspillingsvoucher BrewBar	<ul style="list-style-type: none"> • Motivation and endurance of founder to work on making the food chain more sustainable. Being a frontrunner (individual motivation) • Motivation/willingness of municipality to decrease residual streams (environmental planning) 		<ul style="list-style-type: none"> • The question to upgrade the by-product brewer's grain to an ingredient for the food industry came from the municipality of The Hague. They were the facilitating environment and looking for ways to reduce side streams in their municipality (Enablement/environmental restructuring) • Bringing a new (more sustainable) ingredient to the market and creating a market for it (Enablement) • The Verspillingsvoucher of STV made it possible to optimize the process of stabilizing the brewer's grain in a pilot test (Enablement) • Collaboration with Krush Food made it possible to develop the 'Brewbar' (Enablement) • Lidl supermarket organized a 'Future-Goods week' where the product could be presented and sold (Enablement, communication/marketing) 	<ul style="list-style-type: none"> • Enablement • Environmental restructuring • Communication /marketing
Retail Zelfmonitor Voedselverspilling (1)	<ul style="list-style-type: none"> • Providing insight in current food waste numbers for five food categories in retail sector (Education) 		<ul style="list-style-type: none"> • Right momentum for this monitor, interest from policymakers and STV in these numbers (Enablement) 	<ul style="list-style-type: none"> • Education • Persuasion • Enablement

Initiative	Motivation	Ability	Opportunity	Intervention elements
	<ul style="list-style-type: none"> Numbers providing insight in food waste and thereby creating a starting point for action (Persuasion) 			
Retail Zelfmonitor Voedselverspilling (P)	<ul style="list-style-type: none"> Creating awareness amongst retailers on actual food waste numbers (Education) Comparison of own food waste numbers in relation to other participating supermarkets (Persuasion) 	<ul style="list-style-type: none"> Acquiring skills in data collection on FW in own supermarket. This was measured internally and the numbers were shared with WUR (Education, Training) 	<ul style="list-style-type: none"> Influence other supermarkets, since the (mean) numbers were shared and published (Persuasion) 	<ul style="list-style-type: none"> Education Persuasion Training

* *Bold refers to the core intervention of the initiative.*

BCT = Behavioural Change Technique (Abraham & Michie, 2008)

3.4 Effects of the initiatives

Table 5 shows the effects of the initiatives in relation to food waste reduction or to other gains. There was only one initiative that actually measured the effects on food waste (FW Challenge) by performing a baseline measurement and another measurement after 4 weeks. Two initiatives were not directly interventions aiming at reducing FLW, but were providing quantitative insights (actual numbers) (Retail Self-monitor, B&D Session). For B&D Session, it was anticipated that the session would encourage collaboration to work on potential solutions. They asked participants of the session afterwards what they did with the results of the session to get an idea of the impact. The Retail Self-monitor can be seen as a baseline measurement for the retail sector and served for the participants as a benchmark.

The other three initiatives (B&D Session, MBO Challenge, Brewbar Voucher) did not measure the actual reduction in FW, but evaluated their impact in a different way. For the MBO Challenge for example, an impact measurement was done at the end of the challenge, by performing focus group sessions with the teachers of the student teams. Brewbar Voucher indicated that they realize a demonstration plant in which the brewer's grain can be processed next year. Calculations are made on how much brewer's grain they will upgrade and how large their impact on FW, CO2 and water usage reduction will be (anticipated reduction). They also made estimations on how much agricultural land will become available.

Even when the actual effects on food waste were not always assessed, there were several other gains and results for all the initiatives. An important gain for most of the initiatives is the awareness for the topic of FLW that was created and the eventual outreach, which was sometimes larger than expected (for example for the MBO Challenge). In addition, two initiatives created actual insights (numbers) in where FLW occurs within a whole sector (FW Challenge and Retail Self-monitor). The results of these initiatives created a starting point for action (Retail Self-monitor) or for actual food waste reduction (FW Challenge) and a movement within a whole sector. Furthermore, new collaborations or feelings of connectedness were also mentioned as gains.

Table 5 *Effects of the initiatives on food waste or other gains/ results of the initiative.*

Initiative	Effects on Food Waste	Other gains/ results
Food Waste Challenge (I)	21% reduction in food waste ^a (Expectation was 12.5%); maximum achieved was a 60% reduction. Participating restaurants and hotels: 61 million kilo less food waste, saving 582 million euro. So, advantages in kilo's, CO2 emission and in euro.	<ul style="list-style-type: none"> • 80% of restaurant and hotel entrepreneurs reached with the campaign. • 173 subscriptions, 136 participated in the baseline measure and 100 in the post-measurement (3x as much reached as before). Aim was 300 participants, but this was practically not feasible. • Movement created in the sector
Food Waste Challenge (P)	39% reduction (aim was 15%)	<ul style="list-style-type: none"> • Insight in how much FW, where FW occurs (buffet waste was largest, mise-en-place smallest) and which foods lead most often to waste (pictures) • New norm in company: Working on FWR is the norm • Working together on this topic works 'connecting' • Insight in which solutions help to reduce FW
Bread & dough Session (I)	No intervention – Effects on FLW not assessed	<ul style="list-style-type: none"> • Discussion session led to new collaborations • Discussion session led to new ideas for reducing FLW • Initiative might have helped for agenda setting in retail • The evaluation by MVO showed the following activities that were reported by the participants to be done/ intended as a result of the session: activities to reduce or prevent food waste, internal discussion about next steps to reduce FLW, meeting (new) contacts to (start) collaborating, sharing insights with colleagues, increase communication towards customers and consumers
Bread & dough Session (P)	Not assessed	<ul style="list-style-type: none"> • Difficult to say, because you cannot distract cause and effect, but I am aware of various activities among our members, number 3 may have occurred/ been accelerated due to the session: <ol style="list-style-type: none"> 1 Pilot freezing fresh bread to prevent that it becomes a return stream 2 Reusing return bread to make new bread 3 One bakery has employed a data specialist to better align supply and demand (prevent food waste)
MBO Challenge	Not measured	<ul style="list-style-type: none"> • The structure and content of the didactics was experienced as very good and is now part of the curriculum of the initiators MBO school • The created impact: eventually 12 MBO schools participated and 25 final movies were submitted • Impact measurement amongst teachers – learning for the MBO challenge 2020
Verspillingsvoucher BrewBar	Effects are not measured yet. By the end of 2021 when the Demonstration Plant is ready: MaGie creations calculated that 10 million kilo of brewer's grain will be upgraded per year. MaGie Creations also made estimations on how much agricultural land will become available, by how much CO2 emission and water usage is	<ul style="list-style-type: none"> • Brewer's grain is now used as a replacer for flour in several products, such as bread and a bar • Inherent positive effect, since we upgrade a residual stream that would otherwise be used as fodder, for human consumption

Initiative	Effects on Food Waste	Other gains/ results
	reduced and those numbers look very promising.	
Retail Zelfmonitor Voedselverspilling	No intervention targeted at reducing FW, but baseline measurement of FW in retail sector. Five supermarket chains participated (AH, Lidl, Jumbo, Plus and Aldi) that cover 78% of the market in the Netherlands. The main outcome was that 1.7% of all food is wasted in the supermarket.	<ul style="list-style-type: none"> • A good and reliable insight in food waste numbers at the retail level in the Netherlands, for 5 different food categories. • The awareness that was created amongst all participating supermarkets, also in comparison to each other • This baseline measurement serves as a starting point for action (for other FW reducing activities) • New initiatives to reduce FW in the supermarkets have arisen after this baseline measurement

^a measured by difference pre- and post-test en 4-week intervention period

3.5 Success factors and barriers in the initiatives

Table 6 shows the identified success factors that were distracted from the responses of the participants (See Table 11 in Annex 3). On a more personal level, the motivation of an individual or a group of individuals who work on the initiative came forward as a key success factor in all initiatives. This motivation seems a kind of essential fuel for working on the initiative, a prerequisite.

For example, “*highly motivated sustainability managers and sustainability teams*” was a success factor in the Retail Self-monitor and “*motivated teachers*” in the MBO Challenge. For the B&D session, it was mentioned “*When an individual is motivated, they will make FW a priority*”. It is important to pay attention to the different motivations that individuals have, as “*an intense preparation phase to motivate all individual employees*” was mentioned as a success factor for executing the initiative.

It will help when individuals/ employees are aware of the problem. Being aware of the problem may create a sense of urgency/ unpleasant feeling, which may facilitate action. “*Many bakeries are aware of the facts that bread is in the top list of wasted products, which is an unpleasant situation for them*”. Showing numbers on the problem size (creating awareness) or showing the effects that have been achieved were identified by several respondents as a success factor, that is clearly linked to motivation.

Table 6 Success factors in the five initiatives based on the responses of the respondents.

Success factors	Food Waste Challenge	Bread & Dough session	MBO Challenge	Brewbar Voucher	Retail Zelfmonitor Voedselverspilling
Personal level					
Individual motivation (M)	X	X	X	X	X
Awareness of the FW problem (M)	X	X			
Show data (numbers) on problem size or effects/ results (M)	X				X
Key person(s) in the lead (M/A)	X	X	X		
Hands-on mentality/ focus on action (A)	X		X		
Project management skills (A)	(X)		X		
Entrepreneurship & expertise (A)	X		X	X	

Success factors	Food Waste Challenge	Bread & Dough session	MBO Challenge	Brewbar Voucher	Retail Zelfmonitor Voedselverspilling
Context level					
Collaboration: Do it together/ shared goal	X	X	X	X	X
Whole sector approach	X	X			
Communication & marketing	X	X	X	X	X
Continuous attention internally and externally	X				
Make use of internal and external networks (and expertise)	X	X	X	X	
Unburden or providing resources: money, time, manpower	X		X	X	X
Momentum	X		X		X
Flexibility in approach (one-size-does-not-fit all)	X				

Various participants identified a key person or core team as a success factor. This often referred to one or a few persons who were in charge. This helped in decision making. In connection to this key person or core team, three success factors that are related to ability (A) were identified. First, having good project management skills was mentioned as an enabler. Secondly, a hands-on mentality was seen as facilitating factor. Various participants indicated that they were eager to do something with their internal drive to reduce food waste; they wanted to go for action instead of “talking too long”. The fact that several initiatives were formed on the go, underpins this drive for action. Also the advice “Go for something that works instead of something perfect” relates to this drive for action. Thirdly, entrepreneurship and expertise were mentioned several times as success factors. This was distracted from responses such as “Showing courage”, “experience in positioning a new ingredient on the market”, “knowledge of the teachers on the topic”, “being specialized in topic or sector”, “creative team with problem-solving abilities”, “the help of WUR experts to optimize the technological process”, and “technological skills and knowledge on processing and upgrading by-products”.

On the context level, collaboration was often mentioned as a key success factor: “Do it together”, “Bringing knowledge and expertise together” and “come together with different stakeholders who are part of the problem but also of the solution”. Respondents mentioned several suggestions or forms that facilitated good collaboration, such as “working sessions with different stakeholders” “Regular contact to align with each other”, “shared goals”, “interactive sessions” and “physically presence of people”. It was mentioned that working together may result in feelings of connectedness, which may be motivating in itself. Another success factor related to collaboration was the use of existing networks: “Connections that teachers have in the field were really helpful in finding business cases” , “Network connections through STV” or “Being part of accelerator programs, such as Climate Kick and market readiness Oost NL”. Respondents indicated that it is really enabling when internal and external networks are used. This in turn may help to find the people with the right motivation, skills or expertise to join the initiative. On the other hand, it referred also to making use of existing expertise; don’t start from scratch. “Showing inspiring examples” and “Sharing best practices” were mentioned in this respect. Respondents also mentioned the importance of involving the whole sector as a success factor.

Another factor that was frequently mentioned as a success factor, was communication & marketing. This referred to internal communication as well as communication to the outside world. In this respect, “a shared story”, “short communication lines”, “making use of other media attention” and “help of a professional communication department” were mentioned as facilitating factors for communication. With regard to marketing, “the wrap and storytelling of the Brewbar” was mentioned. Internal and external communication was seen as helpful in enthusing other persons or partners, thereby motivating others to join the initiative or make them aware of what is possible: “Spreading the word, making everyone excited for this challenge” and “Show what is possible, to the whole sector and to

the general public", and this may lead to the start of a movement that is being created, which creates also new norms. A theme close to communication, was the fact that continuous attention seems essential for success. Again, this refers to attention in the internal organisation or team, but also to the external world and stakeholders. Respondents explained that this continuous attention is needed to maintain motivation, awareness and commitment of employees, management and other stakeholders.

With regard to the context, also the availability of resources was mentioned frequently as a success factor. By providing resources or unburden participants, it could be made easier to work on FLW reduction. Sometimes, there was financial support, or help was in the form of manpower from other parties. For example, participation in the FW Challenge was made as easy as possible by providing a free-of-charge intake at their own location, providing manpower support for measuring food waste and developing the interventions at location, having an helpdesk available, and a toolbox with tips on a website. Brewbar Voucher benefitted from the STV 'Verspillingsvoucher'. Through this subsidy voucher, expert help in the form of manpower (hours) was made available to work on optimizing the technical process.

Momentum was mentioned as a success factor several times. Participants indicated that the topic of food waste is becoming more prominent on the agenda, and this helped to develop and execute initiatives on this topic. In this sense, participating in an initiative with a strict deadline worked stimulating.

Finally, flexibility came up as success factor for one initiative. On the one hand, this referred to a personal attitude of being flexible to each other, in the sense of each person is doing his/her best and things can go wrong when you start new activities. On the other hand, it referred to a targeted approach with regard to a solution. Flexibility in the activities or solutions that were implemented ensured that the solution was relevant and fitted the situation.

Table 7 Barriers in the five initiatives based on the responses of the respondents.

Barriers	FW Challenge	B&D Session	MBO Challenge	BrewBar Voucher	Retail Zelfmonitor Voedselverspilling
Personal level					
Being a frontrunner	X		X		
New initiatives brings challenges	X	X	X	X	
Difficult to change behaviours	X				
Context level					
Stakeholders have different interests, expectations and priorities	X	X			X
Getting commitment	X	X	X	X	
Availability of resources: time (too short + too long), money, capacity/ manpower	X	X	X		X
Changes in the team		X			X
One size does not fit all	X	X			

Table 7 shows the identified barriers that were distracted from the responses of the participants (See Table 12 in Annex 3). At a personal level, respondents mentioned that it can be though to be the frontrunner. It is not always easy to make all decisions (sometimes pushing them through), and it can be exhausting. One participant also mentioned the vulnerability of being the only one with the total overview.

Starting up new initiatives and working in new partnerships, brings challenges and uncertainties due to the newness. Sometimes, there was a lack of clear roles and responsibilities or it was difficult what could be expected beforehand. Respondents formulated these aspects as *"The Challenge was new with lots of uncertainty"*, *"Starting phase was inefficient due to various people and various stages at the same time"*, *"New partnerships not yet strong enough to have sufficient trust and clarity"*, *"We spent too much money on design as it took time before we found the right designer"*, *"A market for this new ingredient did not exist yet, so it had to be created"*, *"Difficult to process this new ingredient into a final product as it behaves differently"*.

Respondents also acknowledged that it is difficult to change habits and behavioural patterns of people. Breaking normal routines and habits takes lots of time and effort.

At the context level, the different interests, expectations and priorities of partners were experienced as a barrier. This was framed as *"Lots of different views, making it more time-intense and costing more effort"* or *"Not all stakeholders wanted to share their data due to reputation risk"*, or *"Stakeholders do not yet measure FW data, so it will take a lot of time and effort to collect"*, or *"Resistance from other actors in the chain for a transition towards a sustainable chain"*, *"Although the topic is regarded as important, it does not always have priority"*, *"Not all supermarkets prioritize sustainable activities"*. This closely relates to another barrier. Respondents indicated that it can be difficult to get commitment from for example the management or from partners, which was sometimes due to a lack of priority on the topic. This was verbalized as *"Management gave first a no-go"*, *"No support from own organisation when starting the initiative, as they were not yet ready"*, *"Insufficient internal stakeholder management"*.

Lack of availability of resources was also mentioned as barrier. Often this referred to lack of money: *"We have only a small marketing budget available"*, *"FW activities require investments: manpower and money, our sector has only small margins, so little room for investments"*. Concerning time, a short as well as a long duration were mentioned as barriers. In one initiative, the duration was too short to make a change, there was no follow-up planned and the timeframe was too short to really form new partnerships. In another initiative, the timeline was too long (2 years), since there was no strict deadline, and participants felt that it took too long before they could communicate on this. A few times, changes in the team were experienced as barrier. For one initiative, this referred also to changes in participating partners. In the other initiative, the key person went with maternity leave, the involved intern was finished, Covid-19 came along; these unfortunate combination of events did not help.

Finally, the solution should fit with the organisation or stakeholders at hand. If there was a lack of fit, it will not work. In the B&D Session, this was illustrated by a participant: *"Examples during the session were less applicable to large scale bakeries"*.

3.6 Changes during execution

Respondents answered questions about any side-effects or changes that occurred during the execution of the initiatives. More specifically, these questions were related to priorities that have changed within the own organization, unexpected effects (either positive or negative) and changes with regard to the larger environment. The main themes are summarized here. In Table 12 of annex 3, a complete overview can be found per initiative.

Priorities in the organization became more clear and changed in a good direction for some of the initiatives. Provided examples are: *"The key person paid more attention to the topic of food waste"*, and *"The team sees more chances, because the final product is available in the store now"*. One respondent mentioned that the priorities did not change, but it was mentioned that the support base at the company decreased as the time investments made, did not pay off. For other initiatives, there were no clear changes in priorities, or the question was not asked during the interview (due to time/irrelevance).

Some unexpected side-effects occurred during the initiatives, either positive or negative. The respondents mainly mentioned positive side-effects, such as publicity and positive advertisement (FW Challenge -I and -P), new collaborations or customers (FW Challenge -I and -P, MBO Challenge). Another positive effect was the unexpected large success of the initiative itself (MBO Challenge), because it was bigger than expected. This led to new customers and new connections. Also, the collaboration with new partners or expanding networks was mentioned several times as a positive side-effect. A specific negative side-effect came forward in the Brewbar Voucher initiative, namely that the upgrading of brewer's grain to an ingredient for the food industry, leads to feed-food competition, as this product is originally used to feed cattle. The initiator also works on exploring how to solve this issue.

With regards to changes in the environment, all initiatives mentioned the increased awareness for the topic of food waste, sustainability and circular economy. This increased awareness was noticed in the retail sector, companies, the government, the bread sector and also at the consumer level. Examples: "There seems to be more attention for food waste in the bread sector", "Stakeholders find sustainability an increasingly important topic", "More urgency from the government to work on this topic" and "Also the consumer is increasingly active on the topic of FW". However, it was mentioned that the behavioural changes in order to reach this reduction in food waste, are progressing (too) slow sometimes.

3.7 Suggestions for improvement

To get insight into respondents own learning experiences and what they would recommend to others for setting up or upscaling FLW initiatives, respondents were asked various questions. Responses are shown in Table 13 in annex 3.

It became clear that most of the initiators were building on previous experiences when they started the initiative. The experiences that were mentioned were: entrepreneurship, creating partnerships, project management and experience as sustainability manager. For the FW Challenge, a pilot was performed before the actual initiative started. The respondent would recommend doing a pilot first to others, before actually starting the initiative.

During implementation, several adaptations were made. Some adaptations were rather small and were for instance related to communication or logistics (in the MBO Challenge: "the frequency of communication towards the stakeholders was increased" and in the FW Challenge: *paper cards to encourage consumers to work on FWR at home were omitted due to resistance*). Other adaptations were more substantial, such as the way of registering the amount of food waste. In the Retail Self-monitor, the participant realized they were not measuring in the correct period, due to a difference in a financial year and a calendar year. Therefore, the participant had to adapt the numbers along the way. In the FW challenge, it was decided to take photos of the food waste in the garbage bins, in order to get insight in what was wasted. In the B&D Session, more often estimations had to be made about the amount of FW, since they did not manage to get data from all companies. Another adaptation was related to the main message of the initiative, for the FW Challenge: "Instead of focusing only on saving money, also focus on a low time investment", because this seemed to be more relevant/ important for potential participants.

Based on the responses of the initiators and participants on what they would advise others in starting a similar initiative, upscaling the initiative or which adaptations they would propose (last two columns of Table 13), main themes were defined and summarized in Table 8 below.

Two suggestions came up for three initiatives. Firstly, work together was mentioned several times, and respondents mentioned several levels in this collaboration: “do it together”, “work with ambassadors”, “instead of working from an individual level, work together also on a strategic level” and include “people from the work floor”. Secondly, respondents frequently suggested to broaden the initiative by involving other sectors or other actors. Suggestions under this theme were “Involve the suppliers”, “a logical next step would be to do the same for another sector” and “connect with the rest of the food value chain”.

Various themes emerged two times, such as keep it simple and work on it for a longer period to ensure continuity and use the energy of the people (created movement) for example by embedding the initiative in a larger structure. Furthermore, for two initiatives, it was mentioned that it is important to be clear about expectations and roles towards participants and collaborators in the initiative. The importance of measuring to assess impact of the initiative was also suggested two times. For example, the initiator of the MBO Challenge gave the advice to “include a follow-up measure in order to assess if the solutions of the respondents were actually implemented and whether awareness amongst participating students actually increased”. In the Retail Self-monitor, measuring referred to “having a baseline and knowing the starting point”. This was recommended as first step to others as well. It is important to know the starting point in order to start planning actions to reduce FW. Two of the initiators also recommended to have a concrete action plan ready both at the start of the initiative (Retail Self-monitor) as for the next steps (FW Challenge). One initiator mentioned that it is important to keep some flexibility and room for creativity, and not have a too strict protocol.

Table 8 Proposed tips and adaptations from the initiators and participants of the five initiatives for upscaling or repeating the initiative.

Suggestions and tips from the initiators and participants	Food Waste Challenge	Bread & Dough session	MBO Challenge	Brewbar Voucher	Retail Zelfmonitor Voedselverspilling
Work together (also on strategic level); including work floor people	X	X	X		
Broaden it: involve other fields, actors and/or sectors	X	X			X
Keep it simple	X				X
Be clear about expectations and roles towards participants and collaborators		X			X
Ensure (follow-up) measurement(s) to assess the impact of the initiative			X		X
Work on it for a longer period – continuation/ regularity/ embed	X	X			
Make it your own, adapt to own context	X	X			
Have a concrete action plan ready		X			X
Hands-on mentality (go!)	X				X
Learn from others: make use of existing knowledge, inspiring examples	X				
Be market-ready				X	
Keep some flexibility + room for creativity	X				

Whereas it was suggested once to be market ready with multiple products and also once to learn from others, it was advised two times to ensure fit to the context. For the FW Challenge, it was stated “to never copy things one-by-one, be inspired by the international examples, but always adapt it to your own (Dutch) context”. For the B&D Session, it was stated that it is important to show examples that are applicable to the scale of the participants. Finally, the importance of a hands-on mentality was mentioned twice, in the sense of “just start at 75% and extend and improve from there on”, but also that various actors are at this level and communication should fit this pragmatic and hands-on mentality.

3.8 Role of STV

Figure 5 shows that the foundation STV played different roles in the initiatives, and these different roles resulted in different benefits (gains). Their role was very prominent in the Retail Self-monitor and Food Waste Challenge, and more in the background for the MBO Challenge (in the next version of the MBO Challenge, the role of STV will be much more prominent). Their role was very prominent in setting up the Retail Self-monitor, because it was part of action 1 of the STV on monitoring FW numbers. The role of STV seemed less clear for participants of the initiatives, as two of the three participant respondents mentioned that they did not know whether and which role STV had.

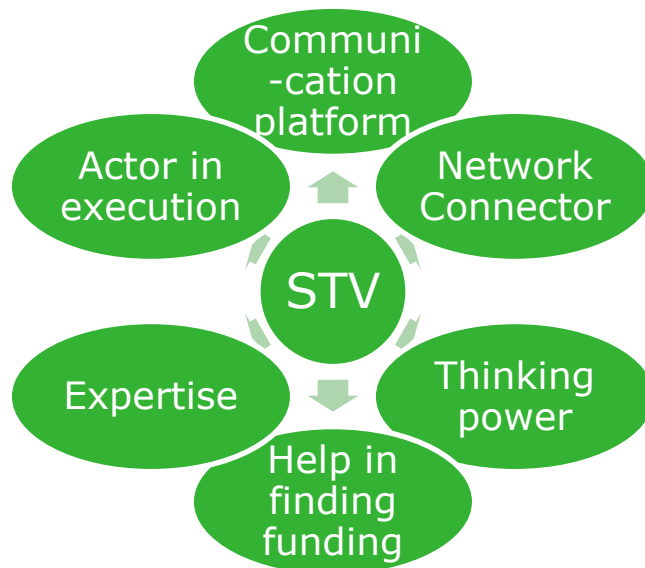


Figure 5 Role of STV in the initiatives.

Concerning the connecting role, respondents mentioned that the STV provided network connections or there was a shared colleague. This resulted in new connections, or a new partner. STV also played a role in communication, such as that they were also sender of the information that the initiative spread or STV promoted the initiative on their website. One respondent mentioned that it was beneficial to ‘make use of their name’ as the STV is a trustworthy sender. Sometimes, the STV had an actor role in the execution of the initiative, such as “they organized a session”, “they were present and gave a talk about the STV” or “participation in the professional jury of the final event”.

The STV provided also help in the sense that they assisted in finding additional funding - which was successful (FW Challenge, Brewbar Voucher) - and they provided expertise in research (often partly via the WUR - B&D Session, Brewbar Voucher) or project management (MBO Challenge). Finally, the STV provided thinking power (FW Challenge). They thought along and provided suggestions. For example, they proposed the initiative to a participant, they provided inspiration, brought in research results, proposed new possibilities, and they brought in the broader picture of government and innovation.

The collaboration with STV provided energy, additional enthusiasm, and feelings of being connected. A few respondents formulated this very illustrative:

- “It is great to exchange ideas, improve and discuss the barriers with like-minded people. A shared mission gives a feeling of connection”.
- “It is useful to discuss new ideas with the STV. It is really a platform to bring the right stakeholders and right people together”.

Two main themes came forward when respondents were asked to provide suggestions for improvements or future expectations. The first one had to do with the role and scope of the STV. One respondent mentioned that more clarity is needed what it means to be a partner of the STV, what will they get in return? Being clear about expectations and the role of STV during the initiative was mentioned by another respondent. The second theme was ‘an even more connecting and facilitating role’. Respondents mentioned also examples how this could be achieved: “*Stimulate face to face meetings and accidental meetings, instead of planning and organizing*”, “*Events to also understand other chains*”, “*Their role could be more facilitating, organize something for other schools that are interested*”, “*Have a more permanent role in connecting different stakeholders to each other*”, and “*Be closer to the companies as they are very different, STV should keep the conversation ongoing with all of their stakeholders*”. Two respondents mentioned that STV could make more use of the energy of people when it is there: “*When a pre-phase results in interest, inspiration and possible solutions, it would be good if STV then facilitates active collaboration*”. One respondent proposed that STV should have a close look to the market, and not look only at what is technically needed to reduce food waste.

4 Main findings and conclusions

4.1 Main findings

Motivation and opportunity most observed MOA aspects in the initiatives

Within the initiatives, there was a large focus on Motivation and Opportunity aspects, and there was less focus on Ability. Whereas the initiators' or participants' motivation to reduce FLW was regarded as a driving force, it was also recognized that individual motivations can differ and it is important to push the right button to motivate others to join or participate in the initiative. Earlier research confirms that people can have different motivations to engage in sustainable behaviour (Hoem, 2017; Lindenberg & Stek, 2007; Richter & Bokelman, 2018). These can be more hedonic oriented (a good feeling), a personal gain (saving money, lowering work load, status) or more normative related (Corporate Social Responsibility, a passion for food so you should not discard food, a better world, footprint achievement). In our case study, creating awareness on the topic of FLW was often mentioned as a way to motivate people, and some initiatives aimed at changing the social norm. The third aspect of motivation according to the MOA-model – attitudes – were as such not mentioned. If actors have a high motivation, their attitude towards FLW reduction may also be positive, whereas for actors who are less motivated, it could be useful to have a look at underlying attitudes. This may be especially valuable, since food waste is the result of multiple behaviours (Aschemann-Witzel et al, 2015; Zeinstra, van der Haar, 2020) and the attitudes towards these different behaviours may not all be positive.

A high motivation alone will usually not induce behavioural changes (Stefan et al, 2013; Vermeir & Verbeke, 2006), the environment needs to be supportive as well (opportunity). Quite often, the initiative itself enabled participants to work on FWL reduction via the provision of resources (such as help, lowering cost) which facilitated and accelerated action. The initiative often also encouraged collaboration in the area of FWL reduction, which provided a facilitating infrastructure. Also the fact that food waste is on the agenda nowadays, facilitated and accelerated action. Whereas technologies were hardly mentioned, the aspect of time and schedule come forward a few times in relation to a barrier (too little time, duration too long) or as facilitator (time schedule and deadlines of initiative worked stimulating).

The fact that there was less focus on ability can imply that new knowledge or skills were not needed in these initiatives – because activities are easy to execute (which was the case a few times) – or that external expertise/ skills was added to the main team (which occurred a few times) or that this is an underestimated factor when FLW reduction initiatives are set up. Probably, all these reasons are true to some extent and the mixture explains the lower attention for this aspect. Only a few initiatives focused on acquiring knowledge or skills, such as the provision of FLW reduction tips via films and nudges (FW Challenge-I), developing skills for FWL reduction in practice (MBO Challenge), or acquiring skills on FW data collection in one's own supermarket (Retail Self-monitor-P).

Motivation and opportunity most important factors to start the initiative

Personal motivation and opportunity appeared also crucial factors when starting the initiative. A high (internal) motivation seems logical for frontrunners and has been acknowledged as a key factor in food waste prevention behaviour (Aschemann-Witzel et al, 2015; Rohm et al 2017) but as mentioned above, this may not be enough. Opportunity to bring the motivation into practice needs to be there as well, and this was formed most often the initiative and/or by coincidence. Looking for a win-win and actual FLW numbers helped to motivate others by showing the problem and convincing others (measuring = knowing).

Enablement and Education most used intervention strategies in the initiatives

All initiatives contained multiple intervention elements. This is a positive aspect, since various behaviour change studies indicate that multiple-component interventions are usually more effective than single component interventions (Gittelsohn et al, 2018; Michie et al, 2009; Schoeppe et al, 2016). 'Enablement' was applied in all initiatives and 'Education' in almost all initiatives. According to

the intervention wheel of Michie, enablement could be used to enhance (automatic/ internal) motivation; regulation or service provision would be the policy interventions to organize enablement. In the STV initiatives, enablement seemed to be in the form of service provision (providing time, manpower or other resources directly or indirectly via collaboration). Education aims to increase knowledge or understanding, which was most often brought into practice via creating awareness or providing tips. Applying 'Enablement' as intervention strategy seems particularly suitable in FW initiatives, since this helps to convert motivation into practice by reducing barriers or increasing means. In addition, 'Education' is also a logical intervention strategy, as it focuses on increasing knowledge and awareness. Whereas this is usually the first step in behaviour change, knowledge of and awareness on the FLW problem on its own is usually not sufficient for behaviour change. Using both these two intervention types (Enablement + Education) seems a powerful combination.

'Persuasion', 'Modeling' and 'Environmental restructuring' were applied in three of the five initiatives and 'Training' and 'Incentivization' were used in two initiatives. 'Restrictions' and 'coercion' were not applied in the initiatives. This makes sense as currently, there are no official regulations with regard to FLW reduction, such as specific rules or punishments for high food waste levels. All actions and initiatives are voluntary. This observation has also been made by Priefer et al (2016) who concludes that most FWL prevention measures are soft instruments like awareness campaigns, round tables, networks and information platforms. More rigorous approaches have not yet been implemented, the effectiveness is also unknown, and such approaches may lead to protest and lack of acceptance. On the other hand, it is proposed that economic instruments could be a key lever for behavioural changes in industrialised countries (Priefer et al 2016).

Key success factors were motivated individuals, awareness of the problem, collaboration, presence of resources, capabilities and sufficient communication.

Six key success factors were distracted from the interviews:

- **Motivated individuals:** This success factor was observed for all the initiatives. These motivated individuals were already aware of the problem, intrinsically motivated to do something about it, and they can be considered the frontrunner. They were also able to motivate others, for example through personal enthusiasm or by convincing the management of their organization. The presence of motivated individuals in all initiatives seems a logical finding, since the interviews were mostly held with the initiator, or in case of a participant, with a person being enthusiastic and in the lead on the topic of FLW or sustainability within their organisation.
- **Awareness of a societal problem:** While some initiatives tried to create awareness among participants, for other initiatives a 'pre-awareness' already existed in a form of a theme in the agenda of various actors. Awareness of the problem was clearly present among the motivated individuals. The right momentum - mentioned a few times as driver for starting the initiative - referred to a societal awareness of the problem, which facilitated to work on FLW reduction.
- **Collaboration:** Doing it together was a success factor in all initiatives. Whereas a frontrunner (one driving force) can be considered as an important factor, partners and collaborations are needed in order to actually succeed. Overall, it can be observed that having the right partners and collaboration was a key aspect for making initiatives happen. Many researchers in the field of circular economy suggest that collaboration is a key component for succesful practices (Aschemann-Witzel et al, 2017; Dora, 2019; Bhattacharya & Fayezi, 2021). Having a shared goal helped to find the right partners, just as making use of internal and external networks. The network of the different actors participating in the initiatives made it possible to cooperate with a wide range of actors. This led to the availability of resources as explained in the next point. Next to external collaboration, internal collaboration was perceived a key requirement as well.
- **Availability of financial and/or operational resources:** The initiatives often provided resources, which were of financial and/or operational nature. The availability of these resources were sometimes facilitated by collaboration. For instance, in one of the initiatives, collaboration with the right partners enabled the initiator of the initiative to offer the participants capacity (manpower) for guiding on specific interventions that could be implemented at the hotel locations and making food waste measurements possible, which meant less effort for participants. Another initiative made use of the STV 'Verspillings-voucher'. Through this voucher, help in the form of manpower and hours were made available to work on optimizing the technical process of

upgrading a residual stream. Hence, the participants avoided investment costs and the uncertainty related to it. Due to the availability of manpower and/or financial support and organisations' willingness to collaborate, some initiatives were able to be executed on a larger scale than others. A large scale of operations was also identified as a key success factor for FW initiatives in a study of Aschemann-Witzel (2017). They recommend for future initiatives to aim at achieving a large scale soon.

- **Capability:** Owning the right skills for the task, was seen as a facilitating factor for success. Most of the initiators had to deal with different stakeholders and a team in order to make the initiative a success. This was also the case for some participants. Organising a well-functioning team and keeping a good relationship with the stakeholders requires certain capabilities such as the right management skills. Capabilities such as knowledge (e.g., in product development), specific expertise (e.g., entry to the market, technological skills), entrepreneurship (e.g. showing courage + problem-solving skills) and a hands-on mentality were also considered as important factors for initiatives to succeed. Aschemann-Witzel et al (2017) also identified competencies and an entrepreneurial spirit as potential success factors for market and stakeholder suboptimal food initiatives.
- **Sufficient communication:** Continuous attention for the initiative is needed to achieve impact. Therefore good communication and marketing, both internal as to the outside world was considered as a success factor. Several previous studies have already pointed out the importance of communication and marketing in food waste reduction (Pearson et al, 2017; Pearson & Perera, 2018; Calvo-Porall et al, 2017). Communication and media attention will help to have FW more prominently on the agenda of various stakeholders, creating new norms and facilitating the societal awareness of the problem. Sufficient communication was also mentioned as a key success factor for collaboration.

Key barriers were different interests of stakeholders, a lack of resources, challenges of new initiatives, and the vulnerability of initiatives that flourish on motivation:

Four key barriers were distracted from the interviews:

- **Different interests, expectations and priorities of stakeholders:** Since multiple parties are needed in order to succeed, this barrier relates to the difficulties in forming these collaborations. Reaching internal and external consensus on interventions is not always easy, since different stakeholders have different interests and different priorities. Although the topic of FW was often acknowledged as important, working on the topic does not always have priority. In addition, it was recognized that some parties are reluctant to share data/ participate, as they may not yet do so well on the topic of food waste. Because not all stakeholders are directly committed to work on food waste as their priority, some initiators first had to prove that the initiative could work. Therefore, a pilot was sometimes used in order to convince the board or managers to give permission for the initiative.
- **Lack of resources:** The lack of manpower, time and/or financial support were frequently mentioned as a barrier for execution or scale up. It was interesting to see that both a short time as well as a (too) long duration could act as a barrier. In this respect, it is interesting to mention the observation of Aschemann-Witzel et al 2017. They identified that a good timing of an initiative is a key success factor, implying that a bad timing can act as barrier. Changes in the team, with a loss of manpower as a consequence, could form a barrier as well. Furthermore, in one initiative, it was mentioned that their investment margin was too small to make large investments.
- **Challenges of new initiatives:** Most FLW initiatives are novel ideas which brings challenges for the person in the lead, for example reaching consensus between different partners, getting commitment to work on the initiative and the lack of clear roles and responsibilities. Furthermore being a frontrunner brings insecurity, which makes it harder to find collaborations, as it is uncertain on beforehand what can be expected as a result. Besides, when an initiative is related to the development of new products, market entry barriers exist related to a non-existing market for a new product.
- **Vulnerability of initiatives that flourish on motivation:** All initiatives were initiated by highly intrinsically motivated people. The disadvantage is the fact that the initiative might become very dependent on this/these person(s), which can lead to a failure of the entire initiative when the person stops to be involved in the initiative due to unexpected circumstances. In line with this,

changing habits and patterns of employees proves to be challenging, and this requires a long breath of the motivated initiator to work on this topic, spending time and energy on motivating others.

Learnings to support future initiatives

Several learnings to support future FLW reduction initiatives could be identified:

- **Integrated sector approach:** Whereas certain initiatives involved already several parts of the chain, others did not. In order to move towards more sustainability and FWL reduction, commitment and behavioural action of actors in the whole chain is needed. Therefore, an integrated sector approach is required, in order for an initiative to take place on a large scale. It is important to have partners on board who can finance the initiative, instead of focusing on small-scale entrepreneurs only, who do not have access to the financial resources that are needed.
- **Stimulate collaboration and partnerships:** Collaboration is one of the most important aspects for the success of the initiatives, and links closely to an integrated sector approach. The success of an initiative depends on collaboration with the right stakeholders. Thus, creating and enabling an ecosystem of companies and public organisations that join forces to achieve a common goal (what STV already does), and that can help to create the right supporting enabling environment, is of key importance for future initiatives. Collaboration with others also helps to learn from other, and make use of existing knowledge and inspiring examples, instead of reinventing the wheel. Within these collaborations, it is important to be clear on roles and expectations of each partner.
- **Ensure continuity via constant attention and agenda setting:** Continuous attention for the topic within the organisation, the collaborations and the outside world was seen as an important point. Working on it for a longer period is needed to ensure continuity by embedding the initiative in a larger structure. Using the energy of people who are motivated can help to create a movement and facilitates agendasetting and a shift of social norms in a wider population. Creating public awareness and concern for the food waste problem, for example by attracting publicity, can help to influence public opinion on the topic the initiative wants to address. Some initiatives in this study received unexpected positive publicity, resulting into momentum, motivation or more customers.
- **Start small and simple and keep some flexibility:** It was recommended to start small, and make it as easy as possible with practical and easy solutions. Some initiatives started with a pilot, which had a twofold aim: 1) showing that food waste reduction can be achieved and 2) showing the food waste reduction activities can be easily implemented. From behavioural change theories (Abraham & Michie, 2008), it is known that small successes motivate to continue. Whereas the initiative can provide guidance with regard to best practices and inspiring examples, it should not be a strict blueprint. Some flexibility to adapt to the own situation of the stakeholder was seen as important and this is in line with implementation studies regarding healthy lifestyle interventions in for example school settings (Day et al, 2019). This is also in line with the self-determination theory, which sees autonomy as an important psychological need that is essential for motivation (Ryan & Deci, 2000). This would also leave some room for creativity and new ideas that support or strengthen the initiative. Some flexibility in the approach or communication is also needed to find the right motivations that fit and trigger the different actors.
- **Assess the impact:** Showing numbers on actual or potential FLW reduction was identified as an great motivator to start the initiative, to convince others to participate or to start action, and to stimulate next steps. If it can be shown that the initiative actually reduces food waste, this can be beneficial in itself (motivating, saving money, positive communication) or it can help in finding funding to sustain the initiative. In our study, only one initiative actually assessed the effects of the intervention on FLW reduction, and this initiative showed very positive results. Nevertheless, the other initiatives showed also other gains or results. Almost all initiatives obtained a lot of attention, which can in turn stimulate others for action or led to new collaborations. Sometimes the initiative was such a success that it was decided to repeat the initiative in the year there-after, with even more participants (scale-up). Showing and sharing the results on food waste and the other gains works 'connecting', helps setting new (social/company) norms and acts as a motivator for action. According to the self-determination theory, relatedness is an important psychological need that enhances intrinsic motivation (Ryan & Deci, 2000). Having the gains clear will also help

in making a cost-benefit analyses which helps to compare and prioritize FWL interventions (Muth et al, 2019).

- **Stimulate initiators to check on motivation, opportunity and capability within initiatives:** Whereas practically all initiatives payed attention to motivation and opportunity, less focus was on capabilities. It is recommended to check on all three aspects, in order to make sure that behavioural change can happen, because besides a motivation and opportunity to act, but it is important that they also have the knowledge and skills to be able to execute the desired behaviour. A behavioural framework – such as MOA – may form a structure or checklist as guidance in developing and strengthening behavioural initiatives in the area FLW prevention and reduction. A recent review indicates that until now, very few food waste reduction initiatives have used a theoretical basis (Reynolds et al, 2019), whereas theoretical understandings could be used to help develop more effective interventions.

Role and learnings for STV

STV had a role in all of the five initiatives, resulting in different benefits and gains, such as more visibility for the initiative or new network connections. All initiatives made use of STV in the start-up or in the execution of the initiative. Their role covered various domains, such as being a network connector or an actor in the execution, providing expertise and help in finding funding or thinking power. Their role was in some initiatives more prominent than in others and especially for participants, it was not always clear what they could expect from STV. Therefore, the learning for STV is to be more clear about their role, and scope. This means, in the first place, being clear towards their stakeholders on what it means to be part of STV and secondly, about their role during the initiative. In addition, their connecting role was highly valued, and they could facilitate this even more by connecting different stakeholders to each other.

4.2 Reflection

A strength of this case study was the focus on initiatives that were actually implemented in practice, giving insights in behavioural experiences in the real world. The initiatives were of a very different order: two focused on an assessment of the current situation, two were challenges and one was more technologically oriented. This led to a broad overview and deep insights from various actor perspectives. On the other hand, comparisons between the initiatives were sometimes difficult to make due to this varied character of the initiatives. The fact that for three initiatives, both the initiator and a participant were interviewed led to a richer view on the initiative.

A limitation of the case study, is that the guide was developed for initiators; during the interview, some questions seemed less relevant or applicable for participants. Whereas the initiators knew the origin of the initiative as well as the intentions behind the initiative, this was not always clear or known by the participants. Furthermore, a maximum of five initiatives could be included due to budget restrictions. Finally, the categorization has been done by two researchers. A structured approach has been used (tabulation of answers ~ audit trail) and two other researchers cross checked the data to diminish subjectivity. Nevertheless, some subjectivity cannot completely be ruled out.

The behavioural findings in this case study are specific for the context of FLW behaviour, relating to pro-environmental and sustainable behaviours. This is different from behavioural change in the context of healthy eating. Healthy eating usually leads to benefits for the individual, even though these benefits mostly occur or become visible on the long term. This personal gain can be an important motivator for behavioural change. However, with regard to food waste behaviour, the direct benefit or reward for an individual is more difficult to identify, since the individual is contributing to a 'greater good'. Therefore, the motivations for pro-environmental or sustainable behaviors are often different than for eating healthy, and require individuals to go against egoistic values. Lindenberg and Steg (2013) describe that the stronger individuals endorse values beyond their own interests, the more likely they are to have pro-environmental beliefs and to engage in pro-environmental behaviour. This influence can be direct, but mostly it is indirect via activating a feeling of joint production, which can be considered a normative goal-frame. This was achieved in most of our initiatives by the motivated frontrunner(s). Therefore, the normative approach seems relatively more applicable to the

topic of FW, and the personal gain approach more applicable for changing individuals eating behaviour. Still, all three goal frames - hedonic, personal and normative - of Lindenberg & Stek (2007) were identified in some of the interviews in our case study. This points out that it seems important to emphasize multiple goal frames (motivations) in order to engage a broad public in food waste reduction activities.

4.3 Conclusions

The main aim of this case study was to explore how behavioural change insights were included in FLW initiatives and what could be learned from this analysis to support future food waste reduction initiatives. The results showed that multiple aspects of the MOA framework were included in the different initiatives, but in a variety of ways and the intensity per initiative differed, indicating that there is room for improvement in certain initiatives. Overall, the focus was mainly on motivation and opportunity, whereas ability received relatively less attention. The intervention strategy 'Enablement' was applied in all initiatives and 'Education' in almost all initiatives, focusing on a kind of service provision (providing time, manpower or other resources directly or indirectly via collaboration) or increasing knowledge or understanding via creating awareness or providing tips. The combination of these two intervention types seems particularly suitable to strengthen FW initiatives. STV supported all initiatives via various roles, which resulted in different benefits.

Six key success factors were distracted from the interviews. These were motivated individuals, awareness of the FW problem, collaboration, presence of resources (time, money, manpower), capabilities (skills, expertise and entrepreneurship) and sufficient communication within one's own organisation, within the collaboration and towards the outside world. Four key barriers were identified. These include the different interests of stakeholders (also different expectations and priorities), a lack of resources (time, money, manpower), the challenges of new initiatives such as uncertainty and getting commitment, and the vulnerability of initiatives that flourish on motivation).

By taking all results into account, several key learnings came forward to support future initiatives. Firstly, use an integrated sector approach and stimulate collaboration and partnerships. Ensure continuity by continuous attention, agenda setting and having a long-term vision. Furthermore, it is important to start small and simple, and keep some flexibility to adapt to the situation at hand. Assess the impact by measuring the effects on food waste reduction as well as other gains. Showing and sharing these successes works 'connecting', helps setting new (social/company) norms and acts as a motivator for action. Finally, because the focus of the initiatives was on motivation and opportunity, it is recommended that developers also check whether (c)abilities (knowledge and skills) of actors are sufficient for the required behavioural change. The key learning for STV is to be as clear as possible towards her stakeholders on what it means to be part of STV and what can be expected from them during the start-up and execution of initiatives.

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Annex 1 Ethical approval

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To whom it may concern

The following project proposal has been reviewed by the Social Sciences Ethics Committee (SEC):

Title: Case study United Against Food Waste
Project team: Sandra van der Haar, Gertrude Zeinstra
Funding: LNV (KB programme 'Governance in Transitions') and Stichting Samen Tegen Voedselverspilling (STV)
Period: June – December 2020
Location: Online interviews

The Committee has concluded that the proposal deals with ethical issues in a satisfactory way and that it complies with the Netherlands Code of Conduct for Research Integrity.

With kind regards,



Professor Dr Marcel Verweij
Chair Social Sciences Ethics Committee

DATE
25-08-2020

SUBJECT
Ethical approval of research project

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Annex 2 Interview guide

FINAL Interview Guide STV Initiatives

Intro: Bedankt dat wij u mogen interviewen en dat u de tijd wilt nemen om met ons te praten. Wij zijn bezig met een onderzoek naar verschillende initiatieven die gedaan zijn om voedselverspilling tegen te gaan en vandaag zitten we bij elkaar om te praten over jullie initiatief. We hebben een aantal vragen opgesteld om te weten te komen hoe het initiatief ontstaan is, hoe jullie het aangepakt hebben, hoe jullie bedrijven en/of consumenten hebben gestimuleerd tot minder voedselverspilling, en wat er goed of minder goed ging. We doen dit voor meerdere STV initiatieven, om te onderzoeken welke kernelementen en leerpunten we hier uit kunnen halen.

Heeft u hier nog vragen over?

Wij zijn vandaag in een tweetal. Eén van ons zal de vragen stellen en de ander zal notuleren.

We willen graag eerst kort een paar vragen stellen over uzelf en welke activiteiten u nog meer onderneemt en daarna gaan we inzoomen op het initiatief.

VOOR

- 1) Zou u kort toe willen lichten wie u bent en wat u doet rondom het verminderen van FW? (functie en FW activiteiten geïnterviewde)
- 2) Dan willen we nu graag inzoomen op initiatief [XXX]. Vertel eens, hoe is het initiatief begonnen? (ontstaansgeschiedenis)
 - Alternatief: Hoe is het ontstaan?
 - Check: Wie heeft het bedacht/ontwikkeld?
- 3) Wilt u in uw eigen woorden het initiatief eens uitleggen? (Omschrijving initiatief: wie, wat, waar, hoe en waarom? + betrokken actoren)
 - **Wat** houdt het in?
 - Alternatief: Waar bestaat het uit (1 onderdeel of een scala aan activiteiten)
 - **Hoe** werkt het: Hoe zou het leiden tot minder voedselverspilling?
 - Alternatief: Wat is het werkingsmechanisme? (welke elementen/BCT erin)
 - Check: Welke aspecten/ factoren in de omgeving helpen bij de gewenste gedragsverandering? (context)
 - Check: Hoe wordt er ingespeeld op de motivatie van de persoon(en) die veranderen moet?
 - **Waarom** is er gekozen voor dit initiatief? (motivaties, potentiële kansen)
 - Alternatief: Hoe bent u tot dit specifieke initiatief/deze specifieke aanpak gekomen? (selectiecriteria/keuze)
 - Check: Wat was uw motivatie? (intrinsieke factoren)
 - Check: Welke omgevingsfactoren (bijv. bestaande bedrijfsstructuren, financiële constructies, samenwerking, politiek, markt) speelden een rol? (contextuele factoren)
 - DOEN: Heeft u ook andere aanpakken overwogen om voedselverspilling tegen te gaan? Zo ja, wat? Welke afwegingen maakte u hierbij?
 - DOEN: Hoe hebben uw eerdere ervaringen een rol gespeeld (welke learnings)?
 - **Wie** zijn erbij betrokken? (o.a. waar in de keten --> noteren voor latere vraag)
 - Check: Initiators: *degene die het bedacht /opgestart hebben (overlap vr2)*
 - Check: Implementeerdere: *wie voerde het uit/ bracht het in praktijk/ rolde het uit?*
 - Check: Eindgebruikers: *degen die er gebruik van maakte?*
 - Check: Overige betrokkenen (financiers/overheid/kennisinstelling)

Op antwoordvel: Aangeven actoren en categorisatie interventie

- 4) Als we het hebben over die opstart. Wat ging er goed in die voorfase? (succes/kansen)
- Waar lag dat aan?/ Hoe kwam dat?
(Indien nodig voorbeelden: *technisch, financieel, menselijk gedrag, politiek, markt, wetgeving, samenwerking*)
- 5) Wat ging er niet goed of minder goed in die voorfase? (barrières)
- Waar lag dat aan?/ Hoe kwam dat?
(Indien nodig voorbeelden: *technisch, financieel, menselijk gedrag, politiek, markt, wetgeving, samenwerking*)
 - Hoe bent u hiermee omgegaan?

TIJDENS

- 6) Waar is het initiatief uitgerold (geïmplementeerd) in de praktijk? (succes + faalfactoren/ barrières)
- DOEN: Hoe ging dat?
 - CHECK: Wat ging er goed en wat ging er niet/minder goed?
 - DOEN: Wat waren volgens u factoren voor succes?
 - DOEN: Welke belemmeringen ervaarde u/jullie?
(Indien nodig voorbeelden: *technisch, financieel, menselijk gedrag, politiek, markt, wetgeving, samenwerking*)
- 7) Zijn er nog aanpassingen gedaan tijdens de uitrol? (Alternatief: is er bijgestuurd?) (implementatie-aspecten)
- Doorvraag: Zo ja, wat? Waarom? Hoe ging dat?
 - Doorvraag: Zo nee. Was dat niet nodig of niet mogelijk?
 - DOEN: Zijn de prioriteiten in de organisatie anders geworden tijdens de uitvoer van dit initiatief?

NA - reflectie

- 8) Kunt u vertellen op welke onderdelen het initiatief effectief was en op welke onderdelen het initiatief minder effectief was? (effect – gemeten/ perceived)
(+ succes + faalfactoren)

Doorvraag:

- a) DOEN: Waar leidt u dat uit af? (Alternatief: Waar ziet u dat aan?)
 - b) DOEN: Zijn effecten gemeten? Zo ja, hoe is dat gedaan?
 - c) DOEN: Wat zorgt er volgens u voor dat het effectief is op xxxx?
 - a) DOEN: Waar komt het volgens u door dat het niet/minder effectief is op xxx?
 - d) DOEN: Zijn er ook onbedoelde effecten opgetreden die gerelateerd waren aan het initiatief?
- 9) Hoe heeft u de omgeving zien veranderen gedurende looptijd van het initiatief? Met omgeving bedoelen we bijvoorbeeld de markt, consumentenvoorkeuren, overheidsbeleid rondom voedselverspilling, andere initiatieven in de sector?
[Note: Vraag als 1 stellen, kijken waar men mee komt, niet alles langsgaan]

Toekomst - vooruit kijken

- 10) Stel u gaat het initiatief nog eens doen - u gaat het herhalen, opschalen of uitbreiden - wat zou u willen toevoegen of anders willen doen om het initiatief 'beter of succesvoller' te maken?
(succes + faalfactoren + werkzame elementen)
- 11) Stel iemand anders wil een soortgelijk initiatief gaan doen, wat zou u zo iemand aanraden?

Nog een paar algemene vragen

12) CHECK of je nog iets wilt weten/ doorvragen over **motivatie** (Attitude/houding – individuele/ sociale normen – bewustzijn probleem/oplossing), **kennis en vaardigheden** (procedures, werkwijzen), of **omgeving** (belemmerend, faciliterend: tijd – kosten - materiaal – ondersteuning – beschikbaarheid – infrastructuur – beleid/ wetgeving). Hoe is dat gedaan? CONCREET voorbeeld laten geven.

DOEN: Altijd navragen (indien niet aan de orde geweest):

13) Welke rol speelde STV (Stichting Samen Tegen Voedselverspilling) bij dit initiatief?

- Check: Wat deden zij?
- Check: Op welke manier gebeurde dat? (Hoe werd dat vorm gegeven)
- Check: In welke fase? ... opstart, uitvoer, na afloop...

14) Hoe is deze rol van STV ervaren?

- Check: Wat heeft dat gebracht? (*Alternatief: Wat was het voordeel?*)
- Check: Wat kan er verbeterd worden? (*Alternatief: Waren er mindere punten?*)
- DOEN: Wat verwacht u van STV voor de toekomst? (*bijv.... qua activeren en ondersteunen bij initiatieven/ interventies?*)

Eind

Dat waren onze vragen. Heel erg bedankt.

15) Heeft u nog toevoegingen/ aanvullingen op het gesprek? Of vragen voor ons?

Heel erg bedankt voor het gesprek en uw tijd. In het najaar zullen we een workshop organiseren. In deze workshop worden de resultaten van deze gesprekken teruggekoppeld en bespreken we met elkaar welke leerpunten we hier als STV stakeholders uit kunnen halen. We nodigen jullie van harte uit om hierbij te zijn.

Annex 3 Supplemental tables

Table 9 *Origin history of the initiatives (How did the initiative start?).*

Initiative	How did it all start + considerations
Food Waste Challenge (I)	<p>STV had roadmap with FW hotspots in NL, where can we make the difference? We wanted to take the lead to ensure action. Considerations:</p> <ul style="list-style-type: none"> • Specific choice for hospitality sector, because they form 50% market share at Rabobank + there are low margins. • Research showed that all companies (small/ large) in all sectors can save money when reducing FW. • From Champions 12.3/ WRI, we received input for proven approach with 5 steps: 1) Build a coalition; 2) Mention the advantages; 3) Do a pilot; 4) Challenge by peers; and 5) Showcase peers • Coincidence played a big role in forming of partnerships, via our own inter(national) network contact with people who had energy to work on this. Key points: motivation, energy, involvement and coincidence. Momentum is needed to arrange budget and human capacity: start small, think big.
Food Waste Challenge (P)	<p>Respondent had an internal drive (passion) to prove that it is important and urgent to tackle FW. STV gave the suggestion to start a pilot, because 'meten=weten' (Measuring=knowing). Impossible to size up without help, so the tip of STV about the Food Waste Challenge came at the right moment. The FW Challenge provided help in form of expertise, knowledge, manpower for measuring and reporting.</p>
Bread & dough Session (I)	<p>Our philosophy is that when you make clear how much raw materials are unused for human consumption in a particular sector, you can offer the sector something to start collaborating and use a systematic approach to work on this. We started this trajectory with MVO for the sector bread and dough. After initial brainstorm, we decided on a two-step trajectory with a focus on action and trying out to learn. 1) doing desk research and talk to different stakeholders in order to make clear how much is wasted, which streams and reasons for waste 2) Discuss results and work out possible solutions.</p>
Bread & dough Session (P)	<p>Sustainability has our attention. Our organisation focusses on creating awareness around food waste and losses, trigger our members to work on this topic and stimulate them to achieve 'individueel onderscheidend vermogen (individual distinctiveness)'. We heard about the initiative and thought that it would be good to participate in the session. We communicated this via our regular channels to our members. Interviewee and members of NVB were present at the session. NVB reported about the session in their monthly newsletter.</p>
MBO Challenge Clusius College (I)	<p>The initiator is a project manager and education innovator at Clusius College, a 'green' MBO school. She was following a masterclass on food waste, and had a high internal drive to do something on this topic. She was working together with the quartermaster 'Food' in the Netherlands, from the organization Katapult. They were talking about how they could incorporate a hot topic theme in their curriculum. It was a time where a lot of 'hackathons' were organized, cooperation DOON was initiating these hackathons. And this is how the idea for a food waste challenge started. The initiator and the quartermaster 'Food' collaborated with cooperation DOON and the STV to further develop and start this initiative. The initiators did not consider starting another initiative, it was clear that they were going to develop a challenge.</p>
Verspillingsvoucher BrewBar (I)	<p>The initiator (an entrepreneur) was approached by the supply officer circular entrepreneurship of the municipality The Hague. The supply officer made an inventarisation of residual streams in the Hague, and one of these streams was brewer's grain. The initiator was approached to do something with this stream, so she wrote a prototype business case for it. And this is how MaGie Creations was born. They developed a process to stabilize the brewer's grain and make a dry end-product out of it. The BrewBar was one of the products that was eventually developed as one of the first products in the supermarket with the brewer's grain in it. MaGie Creations also applies their brewer's grain in other products, such as bread and flour. The initiator did not consider other initiatives, although she mentions that there are more ideas arising of how to apply the brewer's grain in alternative products. MaGie Creations is currently working on these applications.</p>

Initiative	How did it all start + considerations
Retail Zelfmonitor Voedselverspilling CBL (I)*	It started with conversations between the STV and CBL. Already for a long time the STV had a desire to investigate food waste numbers in the retail sector. So about 2 years ago, CBL picked up this agenda point of the STV by setting up this initiative. They received finance from the Ministry LNV to start this initiative, together with scientists from Wageningen Food & Biobased Research (WFBR). Retailers joined to provide their data to the researchers of WFBR, in total 5 large supermarket chains in the Netherlands (Jumbo, Albert Heijn, Plus, Aldi and Lidl). Over a period 2 years, there were multiple moments where they submitted their food waste numbers to the scientists from WFBR.
Retail Zelfmonitor Voedselverspilling Lidl (P)	Lidl was asked to participate in this initiative by another organization, presumably CBL. For Lidl, participating in the Retail Zelfmonitor Voedselverspilling was considered a starting point, from there on more and more food waste related activities started. For them, it was also a bit scary, since they had to share a lot of their data. However, they decided to participate. At the time this initiative started, the only food waste reducing activities they had carried out was collaborating with the Food bank. Currently, they actively work on making their assortment more sustainable by several activities, such as offering Too Good To Go boxes for leftover fruits and vegetables and "Verspil mij niet": reducing the price of foods that have no remaining shelf-life to €0.50 or even €0.25.

**The CBL (initiator) we interviewed for the Retail Zelfmonitor Voedselverspilling was not involved in the starting phase of the initiative, since she only work for CBL since one year. She checked documents from colleagues to be able to provide us with an answer on who was the initiator. However, she could not find any information on the process (how it exactly went).*

Table 10 *Mentioned success factors during pre-phase and execution of the initiative, categorized according to the individual level and the context level.*

Initiative	Success factors at person level	Success factors at context level (enabling)
Food Waste Challenge (I)	<ul style="list-style-type: none"> • Small group of people believing in the success with small budget, no heavy financial arrangements • Two team captains who take the lead and decide (Both were specialized, one in sector + one in food waste) • Support from other team captain (partner in crime) • Showing courage • Making use of international and national networks • Flexible attitude towards each other partners • Go for something that works instead of something perfect • Regular contact and aligning with each other • Shared goal with same internal story • Awareness among employees, this also helps the entrepreneur 	<ul style="list-style-type: none"> • Bringing knowledge and expertise together • Work sessions together with different stakeholders • Proper working website for the registrations • Measuring the effects gives awareness and insight in financial potential, which encourages action • Share the individual and national data + best practices in a nice infographics; this will convince others to participate/ work on FWR • Unburden: intake at location, free of charge, helpdesk available, toolbox and tips on the website: make it as easy as possible for participants • Whole sector approach, having partners on board who can finance this, instead of focusing the small-scale entrepreneur who does not have the financial resources • Creating momentum: give it priority now: Strict deadline worked stimulating • Competition form makes it challenging • Peer-to-peer: being equal and learning from each other • Nudges/ activities could be directly implemented in practice • Start creating a 'movement': show what is possible, campaign for whole sector, show it to the general public • Create new social norms: 1) From "customers have always an abundance food" towards "customers should have just enough food"; and 2) "You would be crazy if you don't work on FWR"
Food Waste Challenge (P)	<ul style="list-style-type: none"> • Focus and attention from inside the organisation (key person) • Individual contact when more attention is needed regarding motivation of employee. • Intense preparation phase in order to motivate all employees; this facilitated the contact with data collectors of Hotelschool. • Lot of internal communication to motivate and maintain awareness • Coming together with employees to discuss and inspire each other (get out of daily routine) • Collaboration – working together results in feeling connected 	<ul style="list-style-type: none"> • Support of Hotelschool • Wastewatchers who measured food waste • Support & flexibility in activities (personalized approach) • Focus and attention of outside organisation (Rabobank) • Students Hotelschool collected the food waste data and checked whether these were complete (less time and effort).
Bread & dough Session (I)	<ul style="list-style-type: none"> • We showed the need for having insight in how much FWL there is and at which hotspots this occur 	<ul style="list-style-type: none"> • In name of STV (authority), so taken seriously by outer world

Initiative	Success factors at person level	Success factors at context level (enabling)
	<ul style="list-style-type: none"> • Discussion session worked well: coming together with different stakeholders within a sector that are part of the problem and/or of the solution, attendants were positive, enthusiastic • Two-step approach was successful • Showing examples was inspiring 	<ul style="list-style-type: none"> • We could make use of the media attention around the concept 'Vriesvers' of Jumbo and MVO • Speed: Session was quick, flow, relevant information shared, sharing business cards, appointments made • Having a network drink at the end of the session
Bread & dough Session (P)	<ul style="list-style-type: none"> • Interactive part of session worked well • Physically presence of participants (in contrast to online meetings) • The session was inspiring for some members • When individual person is motivated, they will make priority of FWR in their bakery (arranging manpower and finance) • Many bakeries are aware of the fact that bread is in top list of products in relation to food waste, which is an unpleasant situation for them 	<ul style="list-style-type: none"> • When supermarket has a green profile, it is easier for bakery to work on FWR • Coaching of supermarket personnel regarding how to market and sell bread from the bakery division can be part of this green profile • Proper information for consumers how to handle bread at home (storing, freezing)
MBO Challenge	<ul style="list-style-type: none"> • Hands-on mentality • Project management skills of the initiator • One person in charge and in the lead (complete overview) • Motivation of the teachers (pioneers) • Knowledge of the topic amongst the teachers • Connections that teachers have in the field was really helpful for finding business cases • Increasing number of online meetings during the challenges, and thereby making it more accessible for everyone to join • Both the initiators were enthusiastic and spread the word of how valuable this initiative is everywhere 	<ul style="list-style-type: none"> • Doing it together • Spreading the word, making everyone excited for this challenge. • Communication played a big role, having a solid and professional communication department helped. • That business actually submitted their cases for the challenge - thereby the possibility to apply knowledge on food waste reduction in practice • Commitment of other MBO schools in the Netherlands, we never expected it to become so big and popular • Financial support from partners to make the challenge possible • Network connections through STV
Verspillingsvoucher BrewBar	<ul style="list-style-type: none"> • Collaboration – Good and creative team with problem-solving abilities • Experience in entrepreneurship: positioning of a new food ingredient in the market • Skills and knowledge of the food technologists in the team, to process and upgrade by-products to a new food ingredient • The fact that the technical process was optimized and under control • Brewbar: tasty and sustainable product for a fair price. • The wrap and storytelling of the Brewbar 	<ul style="list-style-type: none"> • Being a start-up helps in being endorsed by others • Participating in an initiative such as 'the Future Goods' week of Lidl creates a lot of publicity • Being part of accelerator programs, such as Climate Kick and market readiness Oost NL, gave sufficient help and accompaniment • The help of WUR experts to optimize the technical process
Retail Zelfmonitor Voedselverspilling (I)	<ul style="list-style-type: none"> • Highly motivated 'sustainability managers' and 'sustainability teams' of the participating supermarkets 	<ul style="list-style-type: none"> • The financial help was there, in-kind and cash contributions

Initiative	Success factors at person level	Success factors at context level (enabling)
	<ul style="list-style-type: none"> • High motivation from branch organization retail itself (CBL) for making this work 	<ul style="list-style-type: none"> • Right momentum/timing: supermarkets do more on FW + more is possible regarding supermarket data
Retail Zelfmonitor Voedselverspilling (P)	<ul style="list-style-type: none"> • Communication between us and person in the lead for data collection. Routes for communication were very short. 	<ul style="list-style-type: none"> • In general the collaboration with WUR scientists during the data collection in this project • The attitude of WUR scientists, very willing to help in the data collection • The feedback we received from WUR on our numbers, for example on certain categories that were not doing so well

Table 11 Barriers during pre-phase and execution of the initiative.

Initiative	Barriers at person level	Barriers at context level (disabling)
Food Waste Challenge (I)	<ul style="list-style-type: none"> • Sometimes hard to be the captain (and make decisions) • Inefficiency in beginning due to different stages and different involved people • Difficult to change habits and patterns of employees 	<ul style="list-style-type: none"> • Sufficient capacity and budget to have internal attention • Time pressure • Newness of the FW Challenge with lots of uncertainty • Although the topic FW is regarded as important, it often does not have priority • Different interests of partners
Food Waste Challenge (P)	<ul style="list-style-type: none"> • Time consuming to enthuse employees + pay attention to the FW Challenge (key person). • Not every employee was enthusiastic from the start. 	<ul style="list-style-type: none"> • Changing existing patterns and culture is time consuming (breaking normal habits). • Management gave first a no-go. • If all hotels are seen as similar participants, this will not work.
Bread & dough Session (I)	<ul style="list-style-type: none"> • We did not have a follow-up/ rollout, so the energy that was created during the session had no succession • Insufficient attention was payed to internal stakeholder management • During session, WUR went too much into detail about analysis 	<ul style="list-style-type: none"> • Active participation of STV was low • Timeframe of initiative was too short to really form strong new partnerships • Duration of session was insufficient to bring energy for data exchange/ predictions into practice • Unfortunate combination of events when 'trainee' was finished, key person went with maternity leave and 'project' was not sufficiently handed over to STV (Covid-19 did not help) • Not all stakeholders wanted to share their data about FLW, especially when there was no relationship yet (trust/ ashamed/ reputation risk + difficult to get the data) • Not all stakeholders do already measure FLW, so it will take a lot of effort (costs) to get these data available • Partnership new + not yet strong enough between Milgro, MVO and STV to have sufficient commitment and work all actively

Initiative	Barriers at person level	Barriers at context level (disabling)
Bread & dough Session (P)	<ul style="list-style-type: none"> Part 1 of session was less inspiring: 'just execution on a script' If entrepreneur does not give priority to FWR, no activities will take place 	<p>on it (trust, clear appointments on roles and tasks, relevant for all, fitting the mission and vision).</p> <ul style="list-style-type: none"> Duration: Session of about 2 hours cannot lead to FWR Absence of retailers during session In retail: sustainability conflicts with availability bread for consumers Examples during session were less applicable for large scale bakeries Not all supermarkets have a green profile and stimulate sustainable activities of bakery partner Sustainable approach may make bread more expensive FWR activities require investments: manpower and money Small margins (2%), so little room for investments in bakery sector
MBO Challenge	<ul style="list-style-type: none"> Being the organizer and the captain can sometimes be tough and exhausting Organizing events (such as the end event) by yourself is challenging It felt a bit 'vulnerable' sometimes, since the initiator was the only one with the total overview The teachers needed more support on the content of cooperation DOON (food waste) 	<ul style="list-style-type: none"> When the initiator started the initiative ('voorloper'), she did not receive much support from her own MBO school – she felt like they were not ready Not all business cases could be matched to a student team, so not all submitted cases were eventually worked out.
Verspillingsvoucher BrewBar	<ul style="list-style-type: none"> We spent too much money on design, since we did not directly go to the right designer 	<ul style="list-style-type: none"> The fact that a market for this new ingredient did not exist yet, so it had to be created by the founder of MaGie Creations. Resistance from other actors in the chain for a transition towards a more sustainable chain. Sustainability and transition is often not the highest priority Difficulty of processing this new ingredient into a final product, it behaves differently than normal flour Only a small marketing budget available The commercial battle of putting a new product on the market. Shelf-spaces in supermarkets are limited
Retail Zelfmonitor Voedselverspilling (I)	<ul style="list-style-type: none"> The communication and management of expectations towards supermarkets and WUR Not all supermarkets received the results + feedback 	<ul style="list-style-type: none"> The interest of the participating supermarkets was mainly in how they performed on food waste in comparison to other supermarkets (benchmark). That was missing in the first monitor. It took a long time (2 years in total). The timeline of this initiative was not so strictly defined Changes in the team and participating parties.

Initiative	Barriers at person level	Barriers at context level (disabling)
		<ul style="list-style-type: none"> • Lot of different views, making it more time-intensive and costing more effort
Retail Zelfmonitor Voedselverspilling (P)	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • It took a lot of time (too long) before we could communicate about the results, it felt like the numbers could have been processed sooner • Varying numbers to measure FW for the different participating supermarkets: kilo's, euros, numbers, purchased vs. sold, so that made it difficult in the beginning The definition of food waste is not unambiguously. We need an international definition in order to be able to compare our FW numbers to our colleagues in other countries (our supermarket is international)

Table 12 *Side effects and changes due to the initiative with regard to priorities in the organization, unexpected effects and the larger environment.*

Initiative	Priorities in organization	Unexpected effects +/-	Changes in environment
Food Waste Challenge (I)	<ul style="list-style-type: none"> Priorities in organization became more clear due to shared goals and shared story repeatedly (internal commitment). 	<ul style="list-style-type: none"> A lot of publicity, asked for presentations, which led to different position in sector (+) Partners came to us for collaboration (+) 	<ul style="list-style-type: none"> Food waste topic has received more attention which results in more commitment to work on it.
Food Waste Challenge (P)	<ul style="list-style-type: none"> Key person payed more attention to food waste topic. More attention from management and other divisions for this topic: change from little attention to more attention for food waste. 	<ul style="list-style-type: none"> We got a lot of positive attention from outside world, which leads to enthusiasm among the employees (+). Positive advertisement for Event Hotels organisation, leading to new customers (company guests) (+). Interest from German hotels to work on this topic (+). 	<ul style="list-style-type: none"> Slow changes in whole sector: food waste on agenda, focus on more local and norms start to change. More companies (a.o. supermarkets) started to work on this topic. The combined profit for planet and financial helps in this respect.
Bread & dough Session (I)	<ul style="list-style-type: none"> Priorities have not changed, but support base at company became less as our time investment did not pay off (f.e. in new clients) 	<ul style="list-style-type: none"> Difficult to say I saw no next steps, but evaluation showed a few next steps (+): activities to reduce or prevent food waste, internal discussion about next steps to reduce FLW, meeting (new) contacts to (start) collaborating, sharing insights with colleagues, increase communication towards customers and consumers 	<ul style="list-style-type: none"> In recent period, there seems to be more attention for food waste in bread sector
Bread & dough Session (P)	<ul style="list-style-type: none"> Not asked/ not applicable 	<ul style="list-style-type: none"> Not asked/ not applicable 	<ul style="list-style-type: none"> Sustainability is becoming a more prominent point on the agenda, including the bakery
MBO Challenge	<ul style="list-style-type: none"> Not asked 	<ul style="list-style-type: none"> This challenge was an unexpected event in itself. It became way bigger than we expected beforehand (+) Everyone who participated was able to build or expand his/her network (+) 	<ul style="list-style-type: none"> Stakeholders find sustainability an increasingly important topic A lot of MBO schools have the food waste challenge in their curriculum now, which also shows the increasing importance of the topic
Verspillingsvoucher BrewBar	<ul style="list-style-type: none"> Priorities have changed a bit, but in a good way. The team sees more chances also because the Brewbar is available in the Lidl now. There are some technical dimensions that make it that the team would choose one product over the other (learned from the Brewbar process). 	<ul style="list-style-type: none"> A side-effect of our story is that the residual brewer's grain was normally used as fodder/silage, so this cattle now has to be fed from other sources. The company is also working on this question, how to best substitute (-). 	<ul style="list-style-type: none"> Increasing number of projects on upgrading residual ingredients in the food chain. More urgency from the government to work on this topic The behavioural changes in order to do this are progressing slow High expectations regarding consumers to make sustainable food choices nowadays. Not fair, the food

Initiative	Priorities in organization	Unexpected effects +/-	Changes in environment
Retail Zelfmonitor Voedselverspilling (I)	<ul style="list-style-type: none"> Respondent did not know 	<ul style="list-style-type: none"> Respondent was not aware of any side-effects 	<p>industry should take responsibility to produce products in a more sustainable way.</p> <ul style="list-style-type: none"> Increased attention to the topic of FW in the retail sector. Government pays more attention to the topic of FW Retail sector made huge improvement on FW numbers. Purchase and sale are being matched more effectively. In retail the last steps to reduce FW are being made, but towards the consumer there is still a lot to gain. Increased need for actual numbers (data). The more factual the better
Retail Zelfmonitor Voedselverspilling (P)	<ul style="list-style-type: none"> Different priorities than the other participating supermarkets, since we are an international organization. More attention to FW during the initiative. Other initiatives around this topic started as well. 	<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Market changes: it seems like everyone is increasingly aware of food waste. More and more initiatives. Important to avoid food waste and to 'upgrade' residual streams/products. Consumer preferences: also the consumer is increasingly active on the topic of FW. More awareness and nobody wants to waste food (but still it happens) Government: more attention for the topic of FW, also internationally. Focus on a more circular agricultural system.

Table 13 *Lessons learned, suggestions or adaptations to improve or upscale the initiative.*

Initiative	Previous lessons	Adaptations during implementation	Proposed additions	Suggestions/tips
Food Waste Challenge (I)	<ul style="list-style-type: none"> Start with a pilot Hospitality sector seems most interested in FW Focus on sector instead of individual entrepreneur Try to change a norm (All from previous regional pilot) 	<ul style="list-style-type: none"> Main message adapted: instead of focusing only on saving money, also focus on little time investment Less participants (initial aim 300 not possible): focus on quality instead of quantity Paper cards to encourage consumers to work on FWR at home were omitted due to resistance (paper + logistics) 	<ul style="list-style-type: none"> Commitment letter now also for entrepreneur (added in next version^a) Poster per company where shared goal is written down + signed by all (added in next version^a) Master classes (added in next version^a): more content + deepening Continuous availability of FW Challenge instead of one timeline + fixed moments (added in next version^a: This addition may be less obligating) More focus on preventing FW instead of reduction via the use of predictions (added in next version^a) Besides company also city challenges (added in next version^a) Additional session together in order to share and learn from each other (added in next version^a) 	<ul style="list-style-type: none"> Don't copy one-by-one but adapt to own context Be inspired by examples, but use Dutch/ own 'sauce' Just start: don't go for 200%, but go for 75% and extend and improve from there. Do it together Ensure positivity and creativity, keep room for creativity and flexibility, broad lines should be clear, but don't have a too strict 'protocol', as it is all human behaviour Make use of where the energy is Work on it for longer-term/ continuation in order to maintain enthusiasm and maintain 'the created movement'
Food Waste Challenge (P)	<ul style="list-style-type: none"> Pilot: focus and attention of all actors needed, otherwise no success. 	<ul style="list-style-type: none"> Decided to make photos of the food waste in the garbage bins in order to get clear what was wasted (instead of only how much) 	<ul style="list-style-type: none"> Own next step, not yet executed due to corona: inspiration session on attractive location by chefs to show what can be done with all parts of food: focus on knowledge and technical skills of employees to inspire employees for the next step and continuous actions on this topic (in relation to our goals) 	<ul style="list-style-type: none"> Food waste challenge per type of operation (hotel-specific); coming together in these groups to find solutions for similar issues. Easy to do and to join: the easier, the better Not big investments in time and money Start small if doing it on yourself Use knowledge that is already there Work with ambassadors: key

Initiative	Previous lessons	Adaptations during implementation	Proposed additions	Suggestions/tips
			<ul style="list-style-type: none"> • Other next step for them: Involve the suppliers • Visit individual entrepreneurs – not only hotel chains – to exchange knowledge and experiences to solve the problem together 	<p>persons who really stick to and work on this topic</p>
Bread & dough Session (I)	<ul style="list-style-type: none"> • Previous experiences on creating partnerships 		<ul style="list-style-type: none"> • Logical next step would be to do the same for another sector, such as dairy • Have a plan of action ready for next steps and organize succession 	<ul style="list-style-type: none"> • Incorporate the session in a larger structure/ trajectory • Instead of working from individual position, working together also on strategic level • Outsource the research part, less time own organisation • Discuss roles and task clearly with collaborators
Bread & dough Session (P)	<ul style="list-style-type: none"> • Participated in previous meetings as individual or as sector: ensure interactivity and share with each other 	<ul style="list-style-type: none"> • Not applicable 	<ul style="list-style-type: none"> • Next session with bakeries and initiator to give follow-up to ideas from the session (is on agenda, but corona not helpful) 	<ul style="list-style-type: none"> • Frequent update in regular sessions • Show examples that are relevant for and applicable to large scale of industrial bakeries • First part of session should be more inspiring: how to trigger individual bakery to action?
MBO Challenge	<ul style="list-style-type: none"> • Previous experience on project management of the initiator 	<ul style="list-style-type: none"> • The frequency of communication towards the stakeholders was increased 	<ul style="list-style-type: none"> • For the next MBO challenge: <ul style="list-style-type: none"> - Follow-up measurement at the business that participated, to see if they actually implemented the solutions of the students - Measure change in awareness amongst participating students - Initiator not the contact person anymore between the submitted business cases (companies etc.) and the students. Contact 	<ul style="list-style-type: none"> • If you want to initiate something like this, it helps to increase support from others when you are coming from the workplace itself ('werkvloer'), instead of being someone higher up.

Initiative	Previous lessons	Adaptations during implementation	Proposed additions	Suggestions/tips
			<p>details will be put on the website to have a more smooth process</p> <ul style="list-style-type: none"> - Work on making our network more solid - The teachers need more support on the didactic content of cooperation DOON. A webinar is developed for that purpose 	
Verspillingsvoucher BrewBar	<ul style="list-style-type: none"> • Previous experience in entrepreneurship of the initiator 	<ul style="list-style-type: none"> • The flavour of the bar is improved along the way 	<ul style="list-style-type: none"> • Develop more end-products in a sooner stage, since it is easier to sell products instead of a new ingredient. This is also the fastest way to go to the market, you have to be able to show what is possible with new ingredient 	<ul style="list-style-type: none"> • If the market does not yet exist for a new side-stream: develop several end-products first before you go to the market.
Retail Zelfmonitor Voedselverspilling (I)	<ul style="list-style-type: none"> • Respondent could not say, since she was not involved from the start 	<ul style="list-style-type: none"> • Respondent did not know 	<ul style="list-style-type: none"> • More individual feedback on the numbers of the participating supermarkets • Connect with rest of the food value chain in reducing FW: manufacturers, transport, the farmers etc. • Make a more concrete plan and manage expectations up front 	<ul style="list-style-type: none"> • Be clear about your expectations towards the participating supermarkets. • Be aware of the fact that retailers are practical, pragmatic and have a hands-on mentality. This sometimes requires adapted communication: not too complicated, not too long
Retail Zelfmonitor Voedselverspilling (P)	<ul style="list-style-type: none"> • Previous experience as manager sustainability for Lidl 	<ul style="list-style-type: none"> • FW numbers of 2018 and 2019 were shared and we realized we were not measuring in the correct period, since there is a difference between a 'financial year' and a 'calendar year'. For the Zelfmonitor we were asked to provide numbers of calendar years, while we work with financial years. We had to adapt the numbers along the way. 	<ul style="list-style-type: none"> • Nothing, the initiative is good as it is. We should all be transparent about FW within our own organization 	<ul style="list-style-type: none"> • This baseline measurement is a logical and necessary first step. Also, the environment is asking for it. Otherwise the risk is that we start planning actions to reduce FW, but we do not know our starting point. • So: definitely recommendable for everyone to participate in such a baseline measurement.

^a Next version has been made Corona-proof; certain adaptations were done because of Covid-19

Table 14 **Role of STV in the initiatives.**

Initiative	Role STV (pre/ during/ post)	Gains	Could be improved	Future expectations
Food Waste Challenge (I)	<ul style="list-style-type: none"> • STV was also sender of the information • Shared colleague (STV + Rabobank) • Helped with additional funding • Organized session • Think along in monitoring part • Think along where consumers fit in (Netherlands Nutrition Centre) 	<ul style="list-style-type: none"> • Session resulted in new partner • STV focused broader than sector (government, innovation, solutions) • Additional funding • Pleasant collaboration 	<ul style="list-style-type: none"> • We were focused on action, so when collaboration became political or too abstract, this worked less well • Energy that people bring is not always used 	<ul style="list-style-type: none"> • Making more use of energy that people bring • Stimulate face-to-face meetings and accidental meetings, instead of planning and organizing
Food Waste Challenge (P)	<ul style="list-style-type: none"> • Knowledge: research results • Provided network connections • Inspiration: making options concrete • Provided the Food Waste Challenge as suggestion 	<ul style="list-style-type: none"> • STV support helped in starting to act • Keeping speed • Sharing learning experiences • Additional enthusiasm • New connections found • New possibilities (f.e. pilot Orbisk) • It is great to exchange ideas, improve and discuss the barriers with like-minded people. Shared mission gives a feeling of connection. 	<ul style="list-style-type: none"> • More clarity needed on "What will partners of STV get in return for their partnership?" 	<ul style="list-style-type: none"> • Events to also understand other chains and help in the process of finding solutions.
Bread & dough Session (I)	<ul style="list-style-type: none"> • Provided network connections • Promoted our session on their website • Were present at session and gave a talk about STV • Small research from Wageningen (WUR), results were shown in part 1 	<ul style="list-style-type: none"> • Connecting role • Making use of their name and their network 	<ul style="list-style-type: none"> • Clearer expectations and roles: Had hoped that they provided more resources (manpower + knowledge) and worked on events and projects themselves 	<ul style="list-style-type: none"> • That STV will facilitate active collaboration when a pre-phase (like the session) results in interest, inspiration and possible solutions against food waste.
Bread & dough Session (P)	<ul style="list-style-type: none"> • Involvement in the initiative (not sure) 	<ul style="list-style-type: none"> • For their own organisation, nothing yet: they are exploring collaboration with STV 	<ul style="list-style-type: none"> • Not applicable 	<ul style="list-style-type: none"> • We are now in process of looking whether we can collaborate with STV; we aim to assess and reduce food waste in bakery's (via collaboration and scaling up) and encourage bakeries to share their

Initiative	Role STV (pre/ during/ post)	Gains	Could be improved	Future expectations
				<p>data, and are looking which role STV can play.</p> <ul style="list-style-type: none"> Finding new connections for new initiatives
MBO Challenge	<ul style="list-style-type: none"> In the first version of the MBO Challenge, STV was more on the background. For the upcoming MBO challenge they are the main sponsor + owner of the challenge Participation in the professional jury for the final event of the challenge Their role is not very steering, but that is a good thing 	<ul style="list-style-type: none"> They actively think about which improvements can be made in the next MBO challenge Helpful in project management 	<ul style="list-style-type: none"> Sometimes their role could be more facilitating 	<ul style="list-style-type: none"> There are also HBO schools that are interested to participate in the challenge. STV could maybe facilitate/organize something here in the future (possibly even in a project manager role)
Verspillingsvoucher BrewBar	<ul style="list-style-type: none"> Mainly at the start: helped financially with the Verspillingsvoucher arrangement Provided the WUR experts that helped to verify and optimize the process 	<ul style="list-style-type: none"> Very helpful that they supported in optimizing the process 	<ul style="list-style-type: none"> Be more facilitating and/or have a more permanent role in connecting different stakeholders to each other (this now only happens in the one-yearly meetings) 	<ul style="list-style-type: none"> Have a more facilitating role for parties that are actually reducing FW Be a connector ("makelaar-schakelaar") Have a closer look at the market, not only looking at what is technically needed to reduce food waste.
Retail Zelfmonitor Voedselverspilling (I)	<ul style="list-style-type: none"> Prominent role, especially in starting the initiative. Without the STV this initiative would not have been there 	<ul style="list-style-type: none"> Good communication through STV with our own members (supermarkets) Because there is such good contact between STV and our members, it is not always necessary for us to facilitate this 	<ul style="list-style-type: none"> They could be closer to the companies. The stakeholders are very different, so it is important that STV keeps the conversation going with all of their stakeholders to check if everyone still supports their vision. 	<ul style="list-style-type: none"> Continue like they do now
Retail Zelfmonitor Voedselverspilling (P)	<ul style="list-style-type: none"> Unsure of what was the role of STV during this initiative, but normally our contact with the STV is very good 	<ul style="list-style-type: none"> Useful to discuss new ideas with STV. It really is a platform to bring the right stakeholders and the right people together 	<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> They could make an effort to even more 'connecting' - in bringing stakeholders together.

To explore
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The mission of Wageningen University and Research is "To explore the potential of nature to improve the quality of life". Under the banner Wageningen University & Research, Wageningen University and the specialised research institutes of the Wageningen Research Foundation have joined forces in contributing to finding solutions to important questions in the domain of healthy food and living environment. With its roughly 30 branches, 6,500 employees (5,500 fte) and 12,500 students, Wageningen University & Research is one of the leading organisations in its domain. The unique Wageningen approach lies in its integrated approach to issues and the collaboration between different disciplines.

