THÜNEN

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Reducing Food Losses & Waste: success stories, barriers, strategies for action

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This protocol gives a brief overview of expert discussion and outcomes in the course of the MACS-G20 workshop and serves as a stock-taking for further activities. For a detailed program, key note presentations, list of participants, etc., please see the workshop website at www.macs-g20-flw-workshop.de.

Working in subgroups 1: Current success stories, persisting barriers, challenges

The subgroup discussion was divided into three parallel groups, each with one moderator (Tim Benton/Barbara Redlingshöfer/Steven Lapidge) and provided with the same questions to complete. The results of each group were presented separately afterwards. The following summarises the outcomes:

a) **Which FLW prevention measure do you know from your own country which could be used as best practise model due to its good acceptance/broad impact?**
E.g.: special consumer campaign was recognised by 60 % of target group; retailers could save 15 % of FLW due to a new ordering system

b) **What was the main barrier for planning/implementation of FLW prevention measures in your country?**
E.g.: dumping of surplus food is cheaper than donating food to charity; no acceptance of doggy bags in society for cultural reasons

c) **Which experiences have been made with already implemented FLW prevention policies in your country?**
E.g.: successful/failed fiscal incentives, industry did not respond to voluntary FLW prevention measures; legal requirements are evaded by target group etc.

The discussion showed that strategies against Food Loss and Waste (FLW) in the G20 countries are present on various levels. Some countries (UK, Spain, France, NL) already implemented national strategies along the entire Food Supply Chain (FSC) while others just started with some food products or target groups (e.g., Turkey, China, Canada); currently work on the topic for national strategy roll-out (e.g., Australia, Brazil, Germany), or face a lack of activities on national basis (e.g., Russia).

a) Success stories

Success stories were reported from several countries and the common issue is that integrated campaigns should not only target FLW but also other related topics such as food packaging, food safety, food origin, impact on environment due to food production, etc. In addition, several stakeholders along the FSC should be actively included into FLW prevention activities in order to reduce conflicting messages and to have a broader commitment from the beginning. Some states implemented voluntary agreements (e.g., UK Courtauld Commitment, Spain, US, Turkey, Argentina), others have legal requirements set into force (e.g., France, South Korea). Both approaches are successful and embedded in a bundle of accompanying activities.

Successful awareness-building campaigns used many different information channels and media (e.g., TV, press, events for example the food waste reduction weeks in Spain). Different countries also used social media, educational organisations, posters, and/or music jingles to reach a broad range of target groups (e.g., households, businesses, municipalities, NGOs, digital natives, senior citizens). Cooperation of various stakeholders is essential for success.

Information was offered for different types of stakeholders using tailor-made formats (e.g., Spanish practical guidelines for households, retailers, restaurants and educational centres which provide many tips. Activities included: an auditing sheet for households to measure their food waste; projects with school children; tips on storing and keeping food and recipes using leftovers - for example; in Turkey a cook book on stale bread was produced among others). Information shared indicated that a shift in cultural behaviour can be achieved, even within a short time frame. These include, for example, the use of doggy bags and a reduction in ordering behaviour in Chinese restaurants (approx. 30 % less FLW). In Turkey, there has been a shift to other bread types and within two years, a reduction of about 18 % in household bread waste has been reached.

The messages towards FLW prevention are simple and easy to understand and remember, e.g. “Love Food Hate Waste” (UK; Australia [New South Wales, Victoria, Brisbane]), “Empty plates are happy plates” (China), “Do not waste your bread” (Turkey), “Food Value Boosting!” (Argentina), “Too good for the bin” (Germany), “Save Food Brazil”, “More food, less waste” (Spain), and are mostly accompanied by a corresponding logo. Successful campaigns can last for several years, for example the program in the UK has been running since 2007, China since 2013, Argentina since 2013, and in Spain since 2013. In Sub-Saharan Africa (SSA) the Sustainable Development Goals and the Malabo Declarations were transformed into National investment plans (NIPS) and set clear targets for PHL/FLW reduction.

The *Economic benefits* of FLW prevention can be demonstrated and are an important incentive for participation for businesses/restaurant owners, etc. There are also a lot of private start-up initiatives with innovative ideas on how to market/utilise surplus food or leftovers (e.g., promotion of doggy bags at restaurants) and new apps (e.g., Check Food), e.g. Australia (Yume), France. One example from Japan was mentioned where penalties were established in all-you-can-eat buffet/self-service restaurants if you do not finish your meal. The money is used to manage the left overs. Similar examples were given by Brazil where customers visit Pay-per-weight instead of All-you-can-eat restaurants.

Newly established regionally-based short FSCs were recorded by multiple countries as being successful. With the administrative or financial support of local governments, those initiatives can bring different groups together, for example small farmers and school pupil feeding scheme (Brazil) or regional producers and consumers (France). As a side effect, food is re-valued, new marketing options arise and FLW is reduced. Also on the EU level, farmers are supported in order to find new marketing possibilities or get access to improved knowledge (EIP-AGRI initiative). In Brazil, the Campaign “Waste Avoidance”/”Sem Desperdicio” Campaign, and the “Save Food Brazil” Campaign were additionally linked to ZeroHunger goals by linking smallholder producers to schools.

New EU legislation has prohibited the use of certain pesticides since 2008. As a consequence, some cereals which are now more exposed to insects show increased infestation. In Germany, a project introduced horizontal storage containers to avoid the entrance of insects but still allow ventilation. In addition, an expert advisory service on the identification of insects was established. Sometimes farmers are not aware that certain insects are pests, so information for early recognition of insects can help avoid the infestation of cereals. Few EU countries still have research institutes focused on research for stored products protection. Therefore, these type of projects have a high importance at EU level in order to facilitate best proof storage and processing structures (e.g. for lentils, beans, cereals etc.).

In China a farm-level program was established to reduce waste (through *subsidies and trainings*). It was started as a pilot in three provinces in 2007, and was rolled out to cover 8 million grain farmers in 24 provinces in 2016. There are plans to reduce post-harvest losses of vegetables in the time period of 2011 to 2020. The FAO offers *advisory services* targeting small farmers in developing countries. The general public is

unaware of the main effect of food waste on prices and on the whole food chain. In Kenya, Sri Lanka or Cambodia, with appropriate training, a difference can be made at the farm level. These programmes reach 150 million subsistence farmers, who, of course, have a greater interest in reducing food waste. Also research from Spain on Post Harvest (PH)-technologies conducted by private company under financial support by government was recorded. In Australia, the Cooperative Research Centre Programme links researchers with industry and government with a focus towards research application and commercialisation.

Further, *vacuum and pest-proof packaging* is important for the protection of the packaged food products. The quality of packaging can improve the quality of cereals (Germany).

Redistribution systems are widely established and accepted. Support from state-owned stakeholders (e.g., wholesale markets in Brazil, Turkish municipalities which organize food banks by collecting and storing excess or surplus food and then redistributing to people in need) foster positive developments.

New collection scheme for FLW introducing a so called *"Pay-As-You-Throw" (PAYT) system* was successfully established in South Korea with the target groups of households and food services. Depending on the volume of householder´s/company´s FLW, one has to buy waste disposal bags in order to dispose of the FLW. This should decrease the generation of FLW. South Korean people are disciplined enough to separate food waste honestly. Also, the Australian Zero Waste SA organics recycling program was mentioned as success story towards FLW prevention.

b) Barriers

Barriers are manifold and may come from cultural, legal, logistical, individual, methodological and structural perspectives. *Cultural* barriers include hospitality traditions in several countries, leading to a huge generation of FLW, especially at the restaurant level. On the one hand, not offering a surplus and a wide variety of food is in some countries considered as impolite if inviting guests/friends, or is interpreted as sign of insufficient financial resources of the host. On the other hand, eating everything offered may be seen as impolite. Another cultural barrier is that the use of doggy bags (taking surplus food from own plate in restaurants home for later consumption), is not common in some countries (e.g., France).

In general, society shows reluctance to change established practices, traditions and behaviour. Thus, there has to be a strong incentive to introduce new procedures into everyday life/business. An example from Turkey showed that the private sector is very reluctant. Although consumers reduced their bread consumption, bakeries did not adapt their production quantities so that the bread waste reduced at households was shifted to the bakeries. In the past, 51 % was being wasted in the bakeries, and the waste increased to 61 % because the bakeries did not decrease their production. Other participants experienced that in households routines are strong and there is a conflict with other issues such as lack of time, health, etc. Food culture is also a factor as large-sized portions are preferred in some countries (e.g., Germany, US).

In addition, in some countries a *low stakeholder awareness* about the impact of FLW on the environment as well as a "buy-in" for federal goals is experienced (e.g., China, Australia, Brazil, US, Russia) although in countries such as Australia this is rapidly changing.

The term "waste" often has a negative image which may hinder people in responding to assessments in an honest and reliable way – using more agreeable terms like loss, surplus, spoilage, production scraps, shrinkage, when questioning stakeholders may increase the reliability in their answers (for example in Spain), but may in turn make it more difficult to identify sources of food waste. A clear and consensual definition of food waste could help the monitoring and reporting, and avoid misinterpretations. A *barrier*

related to establishment of integrated multi-stakeholder initiatives against FLW is that for stakeholders/countries the benefit of cooperating is not evident.

A barrier coming from *legal* side is that the control of law compliance would not be possible in practice if legal obligations were in force. Also a lack of political will was experienced by participants, which is a barrier for preparing and implementing corresponding legislation within a short time frame. In addition, FLW do not seem to be an urgent topic on the national agenda (e.g., in Brazil). Poor acceptance of taxes among the population is another legal barrier for improvement of better behaviour. In addition, positive incentives would be better than penalties (e.g., US). Other countries are hindered by prevention measures that are not binding enough (no state control, enabling non-compliance).

There is a *logistic* limit of surplus food which can be handled by charities in case of donation law. In developing countries there is often a problem in rolling the information out due to large distances between millions of smallholders (e.g., financing, technology,…). Retailers often try to minimize costs in packaging and thus the products can be infested during the transport from farmer/producer to consumer leading to an increase in FLW (Germany).

There are several *individual* barriers, such as the confusion between “use by” and “best before” dates among consumers. Information campaigns can increase understanding and reduce the confusion, but it may still be there to some degree (e.g., Spain, Germany). While in rural areas less food waste from households can often be monitored (due to a lower income level or additional disposal paths), there is a food waste paradox meaning that also poor people waste a lot of food. Some countries face the problem, that food loss at the primary sector is not recognised and understood by the public and even by the involved stakeholders (e.g., in Australia). Therefore further education, information and awareness is necessary since primary production companies will adopt ideas if they are of economic benefit to them.

From the *methodological* point of view, diversity in business types hinders the finding of a common monitoring and measuring method for FLW. Already available international guidelines (e.g., FAO measurement) do not seem to fit to all countries´ accounting measurements. It is also difficult for small shops to establish an audit system due to financial concerns or a lack of will. Another issue is a mainly industry led research which is not very helpful to overcome FLW data gaps (e.g., Canada). In general, most countries have data gaps related to FLW generation and composition and have to rely on rough estimations rather than reliable data sets. This may hinder the setting of a national base line, the determination of goals with quantification objectives and a proper monitoring of prevention measures (e.g., Russia, Argentina, Germany, Brazil, Spain). The lack of data results in disempowering which is a major barrier as the stakeholders cannot be motivated without numbers. It is also a barrier in monitoring the impact of the implemented FLW prevention measures. Monitoring systems are not implemented on a large scale and are often handicapped by methodological errors which are not easy to overcome.

In developing countries, up to 30 % of crop losses occur at the primary production stage of the FSC due to diseases, insect pests, weeds, etc. If these crop losses in the field could be decreased by only 1 %, millions of currently undernourished people could be lifted out of food insecurity. A lot of research is done aiming to support rural smallholders to decrease crop losses, but many smallholder farmers often do not have access to research-based knowledge as there is a *structural disconnection* between the relevant stakeholders (e.g., research institutions) and rural advisory services (both public and private). Even simple and easy to implement technologies are often not available to farmers. In addition, increases in international trade, climate change and agricultural intensification will further accelerate the spread of new and emerging pests, increasing the vulnerability of millions of smallholder farmers. Development programmes such as Plantwise are trying to overcome this structural disconnection. Other countries face

insufficient research for grain storage in villages (e.g., China) or a lack of technology to reduce post-harvest losses (e.g., Russia).

Another *structural barriers related to policy* include cases where a coordinator or a few responsible persons are lacking (for examples because too many ministries are involved). This hinders the ability of someone to take over leadership or responsibility in order to start new cooperations or initiatives (e.g., Turkey, China). In addition, a lack of policy coherence within a country due to various competences hinders FLW prevention progress. Also mistaken reactions to unexpected events, such as when the EU-Common Agricultural Policy responded to the Russian import ban by offering not-harvesting and green harvesting payments. These were experienced as counterproductive in relation to FLW prevention.

But there is also the problem that alternative options to handle surplus food are not possible as corresponding infrastructure and business partnerships are not yet available. Especially countries with independent states within their nation experienced a need for a national rather than state-based approach (e.g., Australia).

Another *structural barrier* is the market power of oligopolistic companies dominating the market. For example, two retailers in Australia control more than 70 % of the total grocery market and have very high produce cosmetic quality standards as a result. This can lead to the rejection large amounts of fresh produce for cosmetic reasons, with few options for resale. The result is waste being pushed back on to primary producers, along with the responsibility for disposal and the financial burden. Conversely, in Japan, by law businesses have to manage their own waste. A corresponding law could be the requirement for food donation/rescue with associated tax incentives.

Another *structural/cultural barrier* mentioned from several countries was that food is undervalued in terms of financial value (e.g., Australia, Brazil). Reasons also include that supply is higher than demand for specific regions and that external costs for FLW are not included into food prices. Therefore, there is little economic incentive not to waste it. This may be associated with a large state area (especially in relation to the population size), no direct experiences with food shortages, absence of natural disasters and a generally good economic situation. Therefore, waste prevention in general is not a priority and FLW prevention has low priority on social agenda. Additionally, from a broader point of view, there is lack of sense of urgency. There may be many small local programs and initiatives, but at a broader level the problem is not cross-linked enough.

Data sharing within food chain actors is often not possible for security reasons and a *lack of acceptance* of open data sharing (e.g., France, Canada). That approach would be important for better ordering, planning etc. Especially, if only few companies control the market, this is a *structural* problem for establishing a better data base. Also a lack of time resources was mentioned as barrier for participation in innovative processes.

Technical barriers were mentioned related to the agricultural sector. An example from Brazil highlighted the special problem of soybeans, where additional to the loss not harvested by the machine, the harvest machines are driven too fast causing additional losses (educational issue).

Lack of funding for implementation of FLW prevention measures, or investments for new technologies leading to FLW reduction, is also experienced in G20 states. Most decisions are based on general economic facts but there is no incentive to consider social or environmental issues in addition. For example, in Germany the initial costs are important barriers. For example, grain traders are not willing to invest much for such small gains. Furthermore, the price of grains is currently very low. Thus, benefits need to be highlighted in a proper way.

Although *redistribution* activities are already established in most countries, there are several barriers in relation to acceptance, cooperation, legal issues, financing, logistics, etc. (e.g., US). The national laws about food donation in Argentina provide no incentive to donate because the industry has all the responsibility for the donations. For retailers dumping food is cheaper and "safer" than donating to charity.

c) Experiences:

Powerful testimonials could be helpful to facilitate the message of the awareness campaign (UK, Participation of "TV stars" in Brazil). Similar experiences were reported at the business level where well-known and/or big players who participate in FLW prevention programs have a positive impact on participation rate of other companies (e.g., European Potato Processor (EUPPA Potato) leads in transparency about data). P*owerful multipliers* can also be found at the household level. For example, there was a children stories and poster contest for primary schools implemented in Spain. The winners were published and the children responded in a good way, acting as multipliers towards their families. Teachers and school staff get involved too, and they can also involve their families. When the media gets involved, the industry wants to participate (e.g., Argentina).

In addition, you need *both positive incentive and negative incentives* within your awareness building campaign (carrots and sticks) and it is country-specific whether to use incentives (e.g., US) or obligations/fees/penalties (e.g., South Korea, France). Beside economic and environmental issues, the FLW topic can also be highlighted from a religious point of view (e.g., in Turkey a relevant topic). One should try to connect FLW with other topics of national concern (e.g., climate change, water shortage, energy, efficient food production as a strategic sector) in order to show interrelations.

An integrated FLW strategy (along the entire FSC from farm to flush, including all stakeholders and all food products) tailored to the specific country and corresponding sectors with a long-term perspective respecting and considering local cultures without trade-offs between food waste and food safety should be launched. For that approach the leadership/responsibility among national authorities has to be clarified from the very beginning. The involvement of the private sector is key (market access). Complementary extension approvals are required to reach scale and to have impact. Even if language and cultural background of countries are similar (e.g., UK and Australia), the awareness building campaigns may have to be adjusted according to local characteristics in order to work (e.g., for indigenous groups).

Political commitment on a federal basis is essential for success (e.g., Australia). *Legislation* needs the commitment of all stakeholders in advance (e.g., France). There should not be an isolated law without a policy framework. There is a need for a systemic approach because FLW is a system failure – at the moment we are mostly only looking at symptoms or isolated facets of the entire problem.

Voluntary agreements can be successful if companies understand their benefits (economic, CSR, branding, marketing), and a lot of innovative ideas are developed at both the individual and company level. Nevertheless, every sector has different interests (e.g., 4500+ businesses/organisations designed own FLW reduction plans/efforts in the US, 15 companies committed publicly to an FLW reduction goal; currently, more than 50 stakeholders from public sector, private sector, NGO, science and technological community are committed in Argentina). Therefore, the government has to be in contact with each group to hear their interest and concerns. The most difficult sectors are retail and industry, where they want to be part of the communication but are often not involved in implementing effective changes. Also private grass root initiatives dealing with food surplus prevention can grow to a considerable movement such as the German Tafeln or food sharing movement (e.g., Germany).

Education is an important issue for all stakeholders in relation to FLW throughout the countries. In developing countries, strengthening the rural advisory services (public and private) is crucial in order to ensure the establishment of a qualitative, inclusive and gender responsive support service for farmers. In many developing countries, rural advisory services face chronic understaffing, limited reach and limited human capital (e.g., limited knowledge to detect and respond to emerging pest problem). In order to disseminate research-based knowledge and respond to farmers' needs with locally adapted measures, considerable public and private investment is crucial to improve diagnostic performance for pest problems and improve management advice to prevent future crop/food losses. A combination of different extension approaches by making use of modern communication technology such as ICTs (mobile, radio, television, etc.), combined with open/big data initiatives have already demonstrated to have transformative power in the developing world. In developed countries, a change of household members' behaviour and attitudes also requires education and incentives. The FLW issue should be implemented into interdisciplinary training curricula. Due to recent activities, in developing countries there is the general trend that commercially-oriented smallholders achieve higher yields due to decreased losses. Additionally, a lower usage of chemicals can be observed in agriculture due to compliance obligation for market access. It is assumed that these factors might lead to higher income at the farm level but at the moment the established monitoring does not provide reliable long-term data sets.

Although there are several problems with *definitions, measuring and monitoring* easy and simple to implement measures targeting the visibility of FLW can also help to raise awareness and decrease FLW generation (e.g., the separation between the disposal of food waste and the disposal of other waste). If people can see how much they waste, behaviour may change. This approach also works for businesses. Where you have a specific target or aim for a general reduction, you also should implement an on-going monitoring system in order to evaluate effects of implemented measures and be able to adjust policies and actions (e.g., Spain). But the major challenge for the future is to set targets, implement measures and monitor the impact. The basis for that would be a reliable data base which is not available in most cases. Therefore, the FLW issue should be incorporated into interdisciplinary research.

Date marking is a difficult issue in most countries. Food labelling was found to be poor, as in European countries either a quality date (best before) or a safety date (use-by) has to be displayed on packaging which leads consumers to dispose of food which is still safe (e.g., UK, Germany). Risk aversion is assumed to be an underlying reason as perceived food safety is a critical concern for consumers.

Even in industrialised countries there are problems with *household equipment*, as sometimes people do not know how to use it or it is in a bad condition. For example, the fridge in some households is often not large enough to store all food properly. Or it is too old to hold the correct temperature or does not have light in it (you cannot find oldest item).

*Technical improvement*s are possible. For example, Carrefour developed a new system to prolong the date for yogurts and decreased their yogurt waste by 40 %. This should also be implemented by other business stakeholders. ICT/digital technology can help to overcome advisory stall strategies in a country.

Experiences show that there is also an improvement in flexibility of *operating standards* at the industrial – retail level as well as in catering (e.g., schools) related to portion size and organisation of service (match delivery of meals with required numbers).

Redistribution – giving surplus edible food to charities – has been successfully established in many countries and is already socially acceptable (e.g., OzHarvest, food banks).

Financing of FLW may be seen as a barrier but there are examples where a public-private partnership could operate successfully due to shared costs. Public authorities at all levels should help facilitate the start-up of FLW prevention companies. They can provide premises and can offer subsidies, as most start-ups do not have enough own money to start. In the Netherlands, all FLW projects consider the whole supply chain because a holistic approach is really important, e.g., Top institute Food and Nutrition (TiFN). Two programs are in place on FLW - one upstream, one downstream. Creating an Ecosystem for solutions (innovation & scale-up) as a meeting place for entrepreneurs with other stakeholders was a good idea in the Netherlands. There is the need for a person who looks at whether the start-ups are successful or not. Food innovations are made from surplus food that is then marketed to consumers. In the Netherlands, up to 25 different products were developed from surplus food but the challenge is to first identify the market potential in order to be successful and meet the demand. Experiences from the Netherlands show that one has to connect to the highest level (business in the lead). First, financing comes from private businesses because it is an economic benefit for the company and afterwards there is the need to match these funds with public funds. Further positive examples for public-private cooperation are represented by the Norway model/format, called ForMat/Mattvett. There are also two positive experiences with the production of beverages: A brewery in the US uses surplus bread, another one in Australia processes surplus lemons (*Two Dogs Lemonade*). A contradictory issue is the fear that FLW prevention could have negative impact on national economic system or GDP as cost-benefit analyses are not available or details are unknown.

Working in subgroups 2: Screening and discussing presented experiences, factors of success and failure etc. (lessons learnt) with MACS planning in mind

The subgroup discussion was divided into three parallel groups, each with one moderator (Stephane Guilbert/Ulrich Kuhlmann/Morvarid Bagherzadeh) and the same questions to complete. Afterwards the results of each group were presented separately. The following summarises the outcomes.

a) **Looking back to national concepts/strategies discussed in Session 1: Are gathered experiences similar/different/controversial? Which of the already presented or discussed precise FLW prevention measures could be used in a multinational context? Which key factors have to be considered in order to have good impacts?**
   E.g. creating networks for multinational stakeholders for sharing experiences on a regular basis; key factor: financing of meetings

b) **Which food product-related requirements driven by importing G20 states may lead or lead to considerable FLW in producing countries (other G20 countries, emerging and developing countries)?**

Multinational context

Although there are different approaches and framework conditions for G20 member states, the group felt that there are manifold options for multinational cooperation under consideration of local aspects. There was the proposal that (a group of) ambassadors could help with further activities (Blue print for G20).

Educational approaches along the FSC from farm to flush could be rolled out for all countries considering local cultural aspects. Another problem is the domestic migration of youth from rural areas to urban centres connected with a loss of agricultural production and shift of attitudes and lifestyles as well as

challenges for urban infrastructure. While it is important to tackle domestic migration, it is also important to strengthen off-farm income opportunities for rural communities as a holistic system approach needs to be considered. By highlighting benefits of taking over farms from parents/relatives those trends could be decreased and accompanying activities could also be used for education related to FLW reduction (pre- and post-harvest).

Research and innovation for the prevention of food waste (but also for valorisation of surplus food) including research on upcoming trends and their assumed persistence and impact could be done on a common basis. There should be a promotion of innovative FLW-relevant mobile apps.

For China and Brazil a *legal based approach* like in France sounds interesting. Others would prefer voluntary agreements due to better acceptance. In addition, general guidelines to support multi-national companies to comply with national voluntary agreements could be further developed. Key is that policy should monitor development of voluntary approaches and respond correspondingly in case of slow progress.

An integrated, comprehensive approach inspired by existing case studies (e.g., "Love Food Hate Waste" and others) could be used in a multinational context with active role of government, industries and NGOs as well as other stakeholders along the FSC. Key factors are to value the issue with high importance by the government and a high social responsibility within industrial sector, to design an adaptive (think global, act local), transparent and participatory approach, to implement coherent national policies with clear leadership (Target, measure, act: strategy + action plan + evaluation + adaption), a positive image of FLW prevention activities (keep it "sexy"), to offer approved practical alternatives to stakeholders in order to reduce FLW as well as a good in-depth understanding of FSC and underlying drivers for FLW.

In order to enhance *innovation* related to new products from surplus food and the establishment of new *marketing strategies,* national policy makers should encourage the development of innovative products from surpluses including market development as a priority instead of "end-of-life" solutions such as support of composting or anaerobic digestion.

Also with respect to *FLW commitments, database sharing, definitions, consistent measuring and monitoring standards, evidence based business cases* (e.g., icon products/solutions, public-private partnership) and *foodbank networks* a multinational approach seems possible. Perhaps, establishment of a relative system of measurement rather than an absolute compliance value is required. Going to a monitoring and evaluation approach, each country should search for its own goals rather than taking the same targets for all countries. Although there are already set reduction targets - do we have corresponding baselines and how can the targets be met? Experiences already show that it will be difficult to agree on same definitions among different countries. Thus, this would require transparent data and at least a robust framework for FLW (considering already existing ones). That issue should be handled by creating an internet-based platform for sharing economic, ethics and environmentally related best practice as incentives. If we start with multi-national data, we could develop a long-term contribution on regular basis. As key requirement for open access data, political willingness and cooperation on strategic level, sharing of research approaches not only research results, linking to existing communication channels (newsletter, FAO platform) is needed. Comprehensive and reliable data (knowledge gap closure) are necessary to convince all stakeholders for common action and participation and to overcome cultural obstacles which may hamper collaborative initiatives.

Interdisciplinary research, considering international trade agreements, CODEX requirements, introducing a full cost approach of food accounting and pricing considering external costs as well as a consumption based accounting for greenhouse gases (GHG), quantitative Material Flow Analysis or Carbon footprint and similar indicators based not on production but on consumption, already includes global data and could be

enhanced on multinational level. Such approaches would give more value to food. Key could be to identify the critical issues (hot spots) for ranking of priorities. Multinational cooperation could also help with language barriers which may cause misunderstanding or misinterpretation at present.

Foodbank networks would need support with food donation guidelines and general guidelines to increase voluntary standards or legislation.

The establishment of overarching networks for multinational stakeholders (e.g., community of experts) for sharing experiences (exchange of best FLW practices including knowledge innovation systems and "end-of-life" approaches) was highlighted. A key factor is the financing of stakeholder meetings in general, which has to be clarified and requires long-term financial commitments. Another pre-condition is to organise farmers into associations or similar non-governmental bodies.

The idea of a *competition among cities* with partner cities was discussed, however it was deemed to be controversial as competition could, on the one hand, have a positive impact on innovations, but on the other hand, a negative impact on knowledge-sharing and cooperative activities.

Impact of importing G20 on producing countries

Large retailers as well as political unions such as the EU or Russia request the fulfilling of *high level product specifications* (including strict phytosanitary requirements, size and shape of products to fit in the box, uniformity, requirements per piece vs. bulk) for most fresh food products inducing FLW in third countries. An example from Australia shows that the retailer Aldi entered the Australian market and reduced the cosmetic specifications for potatoes. Existing retailers had contributed to FLW problems with their cosmetic standards (a potato should look like a peach instead of a potato). In the case of political bodies (e.g., EU) one could complain to the World Trade Organisation (WTO) but this is time-consuming and results in ambiguous outcomes. Some of the requirements seem to be cosmetic and could/should be adjusted. In Brazil, for example, the misfit small apples are used for child nutrition (smart slogan: "small apples for small people") and there could be similar alternative marketing strategies. The G20 should offer to support developing countries in finding options for misfit produce to market it on own national markets. According to UK experiences, the problem is not the standard itself but that the food price is too low to allow compliance with the standards for a lot of smallholders. The powerful north, with powerful purchasers, should provide safety insurance for producers and also redesign *contract-cancelling clauses* (e.g., late cancellation payments). In addition, retailers are typically only take a part of the crop yield of the farmers, but contract crop-growing should be expanded so that retailers have to snap up the entire yield of a contractually appointed crop area – to shift the risk from weak to powerful actors.

It was also suggested that Internet and social media, along with classic mass media, can have a great influence on how a food product is viewed and, therefore, affect markets and product flows. Some products may become fashionable for a time and lead to an increase in their production. If the trend changes suddenly, or when a product gets a bad reputation and people stop consuming it, it may not be easy to adjust the production, which could lead to excess product and waste. This is a global problem.

Also *politics, changing policy and unfortunate diplomatic relations* (trade boycotts/import tariff) have a considerable impact on food supply chains due to unpredictable and unexpected decisions, such as embargos, which induce huge amounts of FLW. Several examples were mentioned, e.g., several years ago, China had problems with Norway related to salmon. Thus, the import of salmon from Norway was banned. As a consequence, the Norwegian fish market went down. Some years ago China also had problems with another country and banned the import of bananas and mangos – farmers cannot react on that issue in

advance. Although we are not able to influence these reasons, we could help to design the food supply chain to be more resilient.

Experiences show that *cold chain management* is very important and inefficient pre-cooling leads to a considerable reduction of the shelf life of perishable food products. According to a study, even basic cooling facilities could save millions of tons of losses for importing countries. In order to prevent such risks, temperature and time management systems should be provided to developing countries (exporting countries). In addition, a better monitoring of temperature and provision of refrigeration facilities is necessary. There is also a demand for innovative technology such as packaging. In relation to other levels of FSC, *agricultural production* seems to be lacking in most studies about FLW in general. By fostering (existing*) advisory systems* at location of production, importing G20 states could support producing countries.

Another challenge is to more efficiently organize the logistics of *very long FSC*, especially for exotic products which are non-producible in own country and have to be imported, as long transportation times may increase spoilage or lower the shelf life of fresh food products.

G20 countries want to import food produce according to specific production standards which also aim to have low pesticide residue levels or do not accept residues of certain highly hazardous pesticides. However, if farmers in developing countries want to comply with such production standards, low toxicity or "green-products" must be available and affordable. If this is not the case, food produced for export might be rejected and therefore wasted. This is particular true for crops which are *grown in developing countries* only for export markets and do not have *local consumer demand*.

In general, all experience and knowledge-sharing efforts between G20 states should also be provided for non-G20 states in order to help with FLW problems (perhaps also in advance of predictable trends). With respect to an open data base, especially in developing countries, it is important for established supply chains to be able to look on FLW along the chain and the reasons for the losses. Also a transfer of *knowledge and innovations from grass-root level initiatives* from G20 to other states would be preferable. Different aims were identified for developed countries which are searching more for innovation, while emerging countries need to implement basic guidelines.

Summary and conclusions of the workshop

Food Loss and Waste is an *interdisciplinary and very complex issue* and therefore should not be restricted to the "end-of-life" but rather should be interrelated with other important global challenges such as undernourishment, food prices, food value, food quality, nutrition, food safety, food security, global climate change, water scarcity, rural-to-urban migration, etc. This approach can help to make FLW prevention a higher political and social priority. In order to change old-fashioned behavior and existing inefficient structures, we need to establish long term commitments and strategies targeting FLW which are promoted by diplomats. We, as the MACS-G20 FLW initiative, can support those attempts actively with a long-term perspective.

A *common international understanding* of "Food Loss and Waste" is crucial for reliable data bases and monitoring. Standardised definitions as well as measuring and monitoring methodologies related to FLW are a common issue as various attempts for harmonisation show. We, as MACS-G20, should not work on own definitions and methodologies, but should actively support existing initiatives with own experiences and be aware of present developments to be used for own activities. There is a strong need for *mutual assistance* related to standardised definitions, measuring and monitoring methodology, finding baselines,

setting targets and developing national strategies among G20 states. As the implementation level of FLW activities in G20 countries is very different, the need for support varies from basic data to financing models (e.g., public private partnerships) of start-ups. The exchange could be done directly or by providing guidelines for specific issues.

There was interest in establishing an *open data base* for data, best practises (business cases, methodology,…) etc. and an *expert chat room* for quick responses on urgent questions related to all aspects of FLW.

There is a *generic transferability of prevention measures* due to very similar food supply systems in all G20 countries. But considering local (e.g., cultural) specifics may require corresponding adaptations. There is no "one size fits all" solution. *Data sharing and knowledge exchange* (best practices, strategies, innovations, technology, research, cold chain/pre-cooling…) among all stakeholders is important for all countries.

We should enhance *increasing knowledge* (e.g., in-depth details about FSC, full costs accounting, entire system approach, risk assessment for pests, drivers, extension services) and fill gaps, especially in the area of primary production. In this context, it is understood that we must put information, skills and tools in farmer´s hands if we want to make real progress on FLW in developing countries. The structural disconnection between research and extension remains a key barrier not only in developing countries but also remains an issue which requires further improvement in G20 countries. Impact at scale is only possible with considerable private sector involvement, in order to create innovative sustainable information delivery systems and ensure that farmers, who are integral to this process, receive the knowledge and information they need to reduce pre and post-harvest losses.

In particular the reinforced involvement of social sciences at all stages of research and implementation seems to be crucial in order to create real FLW reduction.

Concerning communication and dissemination, the MACS-G20 FLW initiative should prefer the utilisation of already existing platforms as a basis (e.g., the FAO Community of Practice on Food Loss Reduction, Refresh/EC Community of Experts,…) instead of creating new ones.

Regulations (both voluntary and legislative depending on preferences; international trade agreements) and trade practices between different partners have to be modulated. Several issues were mentioned by participants which could be used as basis for further action.

Economical barriers/embargos on which we have no influence are a big problem but we could try to foster resilience of food supply systems to deal with those challenges in a better way (e.g., alternative marketing structures and logistics, start-ups, grass-root initiatives striving for closer consumer-farmer-partnerships …).

Stakeholders along the FSC have different *market power and individual interests*. We should find solutions to sensitize and encourage all stakeholders for the topic of FLW and recognize their individual benefits due to FLW prevention and reduction. Especially the fostering of co-operation and interactions among stakeholders with different market power is a global issue and includes G20 members as well as non-members. We could use the increasing trend towards locally grown and processed food preferences for alternative FSC and to redesign food markets. Although at the moment these initiatives may concern only specific groups of population, they lead to a desired change and should be supported. In addition, we should enhance co-operation overarching different levels of FSC in order to decrease negative impacts from one level to another.

There is also need to provide access to *financial funding* for research and implementation as well as initial financing for start-ups and other businesses. Thus, international and national public and private funding

organisations should correspondingly structure their funding programmes. Already *subscribed commitments* by public and private institutions, such as the Sustainable Development Goals, the Milan protocol, etc., could also be used as initial starting point towards FLW prevention activities. In addition, there are already positive examples of privately-based financing of promising new business innovations. Policy should create the conditions for them to grow further (e.g., eliminate legal barriers).

The final protocol will be used as a basis for developing upcoming cooperation and to prepare input for the MACS-G20 meeting in November 2017 in Potsdam. Thanks for your contribution!

List of abbreviations

CSR	Corporate Social Responsibility
EIP-AGRI	agricultural European Innovation Partnership
EU	European Union
FAO	Food and Agriculture Organisation
FLW	Food Loss and Waste
FSC	Food Supply Chain
GDP	Gross Domestic Product
ICT	Information and Communication Technology
MACS-G20	Meetings of Agricultural Chief Scientists of G20 States
NGO	Non-governmental Organisation
NL	The Netherlands
PHL	post harvest losses
SA	South Australia
UK	United Kingdom
US	United States of America
WTO	World Trade Organisation